

Ladies and Gentlemen, Dear Colleagues,

I welcome you to the XIII International Tinnitus Seminar and the 2nd World Tinnitus Congress on 11–12 September 2023 in Bishkek, Kyrgyzstan.

The World Tinnitus Congress is an initiative grown from many discussions with researchers in tinnitus, participants and faculty members of previous ITS conferences, and candidates looking to organize future meetings. They noted that the scope of the International Tinnitus Seminar has, since its conception in 1979, far outgrown the frames of a seminar meeting. Today, it is a significant intercontinental event on a global map of hearing science. Tinnitus research is of increasing social and clinical interest as number of sufferers grows all over the world. There is a demand for strategies and therapies preventing and alleviating tinnitus. We organize this congress to unite experienced and up-and-coming scientists and clinicians to discuss the latest ideas, results, and challenges. We shall consider it our success when the congress will spark new insights that will be applied in research and clinical work.

I wish you a fascinating and productive meeting.



*Prof. Piotr H. Skarzynski, MD, Ph.D, MSc.
Chairman of the International Scientific and Organizing Committee*

XIII INTERNATIONAL TINNITUS SEMINAR AND 2ND WORLD TINNITUS CONGRESS, BISHKEK, KYRGYZSTAN, 11–12 SEPTEMBER 2023

Keynote Lectures

Association between tinnitus and migraine

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Tinnitus is defined as the perception of sound in the absence of an external source. I propose the hypothesis that tinnitus is a migraine-related phenomenon, given the mechanistic and epidemiological associations between tinnitus and migraine disorder. Studies have reported a high prevalence of cochlear symptoms in patients with migraine headaches and up to 45% of tinnitus patients have been shown to concomitantly suffer from migraine. Both conditions are thought to stem from central nervous system disturbances, specifically involving disruption of the auditory and trigeminal nerve pathways. One proposed mechanism of this association is the modulation of sound sensitivity by trigeminal nerve activation of the auditory cortex during migraine attacks, resulting in tinnitus. Alternative mechanisms involve spontaneous activity of the dorsal cochlear nucleus due to loss of auditory input, and increased brain and inner ear vascular permeability resulting from trigeminal nerve inflammation, which can manifest in the observed headache and auditory symptoms. In addition to the mechanistic links, tinnitus and migraine share a number of symptom triggers including stress, sleep disturbances, and dietary factors. These shared features may also help explain promising results on the use of migraine therapies for the treatment of tinnitus. Lifestyle modification, cognitive behavioral therapy, sound therapy, and traditional migraine medications such as tricyclic antidepressants have demonstrated efficacy in managing both migraine and tinnitus symptoms. However, given the complex association between tinnitus and migraine, further investigation is needed to more clearly identify the underlying mechanisms and determine the optimal treatment strategies for managing patients with fluctuating bothersome tinnitus.

Cognitive Behavioral Therapy (CBT) for the management of tinnitus

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Cognitive Behavioral Therapy (CBT) has emerged as a promising and effective approach for managing tinnitus, a condition characterized by the perception of sound in the absence of external stimuli. While tinnitus is often rooted in physiological factors, its impact on psychological and emotional well-being is profound. CBT, a psychotherapeutic modality, addresses this holistic spectrum by targeting the interplay between cognitive processes, emotional responses, and auditory sensations. Central to CBT's effectiveness is its focus on identifying and altering maladaptive thought patterns and behaviors that contribute to tinnitus-related distress. Negative cognitive patterns, such as catastrophic thinking or rumination about the condition, can amplify the perceived loudness and annoyance of tinnitus. CBT techniques, like cognitive restructuring, empower individuals to challenge and reframe these thoughts, thereby reducing their emotional impact. Additionally, relaxation techniques and mindfulness practices integrated within CBT can help individuals develop coping skills to manage the emotional reactions triggered by tinnitus.

A noteworthy aspect of CBT's applicability to tinnitus management is its adaptability to individual experiences. Therapy sessions are tailored to each patient's specific needs, allowing for a personalized approach that resonates with their unique challenges and goals. Moreover, the skills acquired through CBT empower individuals to take an active role in their treatment, fostering a sense of agency and control over their tinnitus-related experiences. Advancements in technology have expanded the reach of CBT for tinnitus management. Virtual platforms and digital resources facilitate remote access to therapy, making it more accessible to a broader population. This democratization of care encourages individuals to engage in self-guided interventions, enhancing their ability to cope with tinnitus and improving their overall well-being.

In summary, Cognitive Behavioral Therapy offers a comprehensive approach to tinnitus management by addressing the intricate connections between cognitive processes, emotional responses, and auditory perceptions. Through cognitive restructuring, exposure therapy, and personalized strategies, CBT equips individuals with the tools to navigate the challenges posed by tinnitus, fostering emotional resilience and restoring a sense of control over their lives.

Round Table

Understanding tinnitus from different perspectives

Moderator: Sanfins M.D.

1. Bezerra Rocha C., *Clinical guidelines for somatosensory tinnitus diagnosis*

Somatosensory or somatic tinnitus is affected by alterations in the afference of the cranio-cervical-mandibular region and shoulder girdle. Remaining very poorly diagnosed by health-care professionals, despite its identification criteria, this subtype of tinnitus can be treated successfully in many patients. I propose an evaluation protocol based on the latest published studies and more than 20 years of clinical experience in this tinnitus subtype towards facilitating its treatment.

2. Holdefer L., *The role of psychology in the treatment of tinnitus*

The role of psychology in the treatment of tinnitus is crucial in addressing the emotional, cognitive, and behavioral aspects associated with this condition. Psychologists help patients develop coping strategies to manage negative emotions such as anxiety and depression related to tinnitus. Additionally, they work to modify dysfunctional thought patterns, such as negative beliefs and catastrophizing about tinnitus, through therapeutic approaches such as cognitive-behavioral therapy (CBT). Psychology also plays a role in educating patients about tinnitus, helping to reduce fear and uncertainty associated with the symptom. In summary, psychology plays a vital role in tinnitus treatment, assisting patients in improving their quality of life and developing effective coping skills.

Oral Presentations

Autosomal dominant hearing loss and tinnitus – literature review

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Introduction: Autosomal dominant hearing loss (ADHL) is the second most common type of hereditary HL. It is usually postlingual and progressive. While extensive genetic and clinical studies are conducted in patients with the recessive form of HL, there are still not much data on the genetic landscape of the dominant form of HL and little is known about its audiological characteristics.

Aim: The aim of our work was to thoroughly analyze the available literature on ADHL and to summarize different clinical aspects important for the standard patients' care including the experience of tinnitus.

Material and methods: Selected literature was retrieved from the PubMed database and searching was performed with the names of genes and loci involved in the development of ADHL listed in the Hereditary Hearing Loss Homepage. Additionally, following search terms were used: 'genetic hearing loss', 'ADHL', 'autosomal dominant hearing loss', 'hearing loss dominant' and 'deafness dominant'. Only data from the original articles with accessible full texts were analyzed and all papers had to contain both genetic and clinical characteristics of the presented patients. Finally, 335 scientific papers were analyzed for the age at ADHL onset, its characteristics and degree, audiological profile, presence of tinnitus and/or vestibular dysfunction.

Results: Up to now 70 loci and 54 genes causally involved in the development of ADHL were identified. Tinnitus experience was evaluated only in patients with pathogenic variants located in 70% (38/54) of ADHL genes. HL caused by 37% (14/38) of analyzed genes is frequently accompanied with tinnitus (reported in >75% of articles) and this group of genes includes *KCNQ4*, *IFNL3*, *MYH14*, *GSDME*, *COCH*, *MYO7A*, *COL11A2*, *POU4F3*, *TMC1*, *DSPP*, *DIABLO*, *TBC1D24*, *OSBPL2* and *PTPRQ*. On the opposite side there are patients with pathogenic variants in *MYH9*, *COL11A1*, *CCDC50*, *TNC*, *CD164*, *TRRAP*, *PLS1*, *SLC12A2* and *SCD5* genes, who haven't complained of tinnitus. These genes account for 24% (9/38) of the analyzed ADHL genes.

Conclusions: Tinnitus is an important medical condition reported by patients with ADHL and there is a relationship between the genetic cause of HL and tinnitus appearance. Genetic testing should be always complemented by detailed clinical data to fully understand the etiology, characteristics and progression of the disease as well as to provide accurate diagnosis and prognosis to the patient.

Supported by the National Science Center, Poland grant: 2016/22/E/NZ5/00470.

Binaural benefit after cochlear implantation in SSD patients with tinnitus

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Introduction: Single-sided deafness is associated with a lack of binaural hearing, which produces deficits in speech discrimination in noise and sound localization and leads to difficulties in performing activities related to communicating in complex acoustic surroundings. The binaural hearing may also be restored after cochlear implantation of the deaf ear. The question remains, how does the tinnitus in the implanted ear affect the binaural benefit.

Aim: This study aims to evaluate binaural benefits after cochlear implantation in individuals with single-sided deafness associated with tinnitus.

Material and methods: A group of 54 with preoperative tinnitus with single-sided deafness implanted in their deaf ear at the Institute of Physiology and Pathology of Hearing, Poland, was included in the study. The age at CI ranged from 18 to 77 years. Subjects were evaluated with a monosyllabic word test under different conditions to evaluate binaural effects: redundancy in quiet, redundancy in noise, head shadow, and squelch.

Results: All subjects used their cochlear implant more than 8 hours a day, 7 days a week. The mean benefit of cochlear implantation was, respectively: 21 p.p. for redundancy in quiet, 14 p.p. for redundancy in noise, 22 p.p. for head shadow, and 9 p.p. for squelch. The benefit for each binaural effect was found significant.

Conclusions: For patients with single-sided deafness and tinnitus, the addition of the cochlear implant enables binaural hearing with positive and significant effects of binaural summation, head shadow, and squelch.

BPPV vertigo observes the prism of pathogenetic mechanisms of otolithiasis at the women of fertility age in the Republic of Uzbekistan

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Introduction: Benign paroxysmal positional vertigo (BPPV) occupies a leading position among all types of vertigo, determining its statistical index up to 35–37% of cases. Despite the data on the frequency of this dizziness in the elderly, BPPV has become quite younger, which indicates a number of other pathogenetic factors, except for degenerative processes in the structures of the inner ear.

Material and methods: During for the period of January–March 2023, there are 94 patients with complaints of dizziness were examined at the Vertigo Laboratory at the U clinic Medical Center and the Republican Center of Sports Medicine. All underwent a comprehensive vestibulometric study using computerized video nystagmography (VNG).

Results: We examined a total of 94 patients, including 33 men and 61 women. Female patients in terms of age were divided: 20–35 years old – 6 patients, 35–55 years old – 30, 55–75 years old – 25. The main complaints of these women was positional dizziness, namely, an attack of dizziness occurred either when changing the body, or when turning, tilting the head. Also, women had complaints of hair loss – 27 people (44%), sweating – 20 (33%), causeless tachycardia – 23 (38%), pain and crunching in the joints – 20 (33%). VNG confirmed BPPV in the active phase in 42 women, of which otolithiasis of PSC – 29 (48%) people, HSC – 9 (21%), and the combined form of BPPV – 4. However, the focus of our attention was the debut of BPPV in young women of middle age (20–55 years), where out of 36 women in 18 the onset of BPPV occurred for the first time, was pronounced and was accompanied by autonomic reactions (nausea, vomiting, increased blood pressure). At the same time, among 18 women, 8 were women in labor. All these women had accompanying complaints: hair loss, causeless heartbeat, brittle nails, dry skin. Of these, 21 women were registered with an endocrinologist with thyroid pathology, with susceptible laboratory data indicating hypocalcemia. Moreover, from the anamnesis, it was revealed that 41 women suffered COVID-confirmed by ELISA study. So, for example, from the study group, a confirmed decrease in vitamin D – in 37 women, and blood calcium – in 21 women.

Conclusions: Analyzing the data obtained and analyzing the literature over the past 10 years, where the main pathogenetic mechanism is a violation of calcium metabolism and association with other pathological conditions, we found scientific research in this direction interesting and justified. It is well known that Uzbekistan is a region with a low content of iodine in the water and high rates of regional pathology – hypofunction of the thyroid gland among the population. The combination of the above factors became a help and the beginning of scientific research in this direction. Subsequent results of the study will be published in future articles.

CI fitting in patients with SSD according to the perceptual characteristic of tinnitus

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Introduction: The primary reason for implantation in SSD was the accompanied incapacitating tinnitus. Major consideration was given to programming the speech processor for a decrease of tinnitus annoyances. Several innovative mapping methods were developed. In one of them, electrodes approximating the pitch of the tinnitus were stimulated to identify which one reportedly was most similar in perception compared to the tinnitus. When the electrode was identified, the four neighboring electrodes were given the same T-levels. For C-levels, the stimulation were increased to match the perceived intensity of the tinnitus. This C-levels was applied to the neighboring four electrodes (Ramos A. et al., 2011). Lately, the programming of speech processor in SSD patients with tinnitus was more focus on restoration of binaural hearing. The most important stage in this fitting was the identification of the dynamic range of electrically evoked hearing sensation for a particular electrode. This is achieved by determining the upper and lower limits of the stimulation current, which are typically described in terms of the threshold level and most comfortable loudness level (MCL). These values are entered into the patient's map using programming software. The study objective was to evaluate MCLs of SSD patients with tinnitus.

Material and methods: Forty adult SSD patients with tinnitus and 40 SSD patients who were not reporting tinnitus were enrolled in the study. MCLs (in charge per phase) were compare between these two groups.

Results: There were no significant differences in MCLs between maps of CI users with SSD and with and without tinnitus. While using CI, patients reported significant relief of tinnitus annoyance. Restoration of binaural hearing was observed in both groups.

Conclusions: The fitting of speech processor in SSD patients with tinnitus is similar to the fitting in SSD patients without tinnitus.

CI fitting in patients with tinnitus

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Subjective tinnitus, or abnormal central nervous system activity, can present as ringing, rumbling, whistling, buzzing, swishing or hissing. They occur with almost all ear disorders and can occur after head trauma or trauma associated with loud noise. The most common cause is damage to the auditory nerve endings in the inner ear, but noise can also be caused by other factors. Abnormal activity of hearing-related neurons in patients with tinnitus can be inhibited by electrical stimulation. In recent years, the use of electrical stimulation in the treatment of tinnitus has been an important research topic; however, its treatment is still in the discussion stage and no optimal regimen suitable for clinical practice has been developed. Nevertheless, on the basis of the Institute of Physiology and Pathology of Hearing's own experience as well as reports from other centres, the effect of electrostimulation on the tinnitus level of patients who have received a cochlear implant has been confirmed. In many cases, the intensity of the tinnitus decreased after the procedure, and in some cases it disappeared completely. Particularly significant effects in reducing tinnitus have been observed in patients with unilateral deafness, where traditional methods of habituating noise in the deaf ear using available techniques have had no effect. For such patients, but also for patients with bilateral deafness, a tinnitus habituation effect can be achieved through the appropriate selection of stimulation parameters.

Cochlear implantation for tinnitus relief in SSD patients

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Introduction: Single sided deafness, a condition where there is a severe to profound hearing loss in one ear and normal or mild hearing loss in the other ear. This condition is frequently associated with tinnitus. For several years, cochlear implants (CI) have been successfully applied in patients with single sided deafness for suppressing tinnitus. Studies indicate that a cochlear implantation of the deaf ear has a positive effect on both tinnitus distress, tinnitus loudness, and reduces complaints, demonstrating a reduction in perceived tinnitus disability.

Aim: The aim of this study is to evaluate the effect of cochlear implant use on tinnitus loudness and annoyance.

Material and methods: A group of 40 patients with single sided deafness associated with tinnitus, implanted in their deaf ear at the Institute of Physiology and Pathology of Hearing, Poland, were included in the study. The mean age at CI was 51 years (range: 28–68). Subjects were evaluated preoperatively and at 14 months of CI use with Visual Analogue Scale to assess perceived tinnitus loudness and tinnitus annoyance.

Results: Mean preoperative perceived tinnitus loudness was 69.4% while after 14 months of CI use it was 23.0%. The reduction of tinnitus loudness was found significant ($t(39) = 10.1, p < 0.001$). Similar results were observed for tinnitus annoyance. Mean preoperative score was 67.5% and 14 months after surgery it was 18.7%. The reduction of tinnitus annoyance was also found significant ($t(39) = 9.4, p < 0.001$).

Conclusions: Cochlear implantation can be considered an effective method for tinnitus annoyance relief

Cochlear implantation in adults in the experience of the Clinical Hospital no. 5 in the city of Almaty

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Introduction: The treatment of profound hearing impairment in adult postlingual (late-deafened) patients by cochlear implantation has been used in world practice for about 40 years. During this period, the high efficiency of this method and the constant, gradual expansion of indications for this operation were proven. Late-deafening adults are highly promising candidates for this treatment. Despite this, in the Republic of Kazakhstan, from 2019 to 2022, a moratorium was introduced on this type of medical care for the adult population due to low efficiency.

Material and methods: From 2007 to 2022, 379 cochlear implantations were performed in the country's adult population: 163 female patients and 216 male patients. This study presents current indications and patient inclusion rules based on 15 experiences.

Results: Medical indications for cochlear implantation in the adult population in the Republic of Kazakhstan are:

- a) bilateral postlingual deafness (more than 10 years);
- b) bilateral sensorineural hearing loss IV degree;

- c) low effectiveness of hearing aids (hearing thresholds in hearing aids in a free sound field in the range of 500–4000 Hz are 55 dB or more, intelligibility of polysyllabic words is less than 40%, monosyllabic – less than 20%, the presence of positive dynamics in the development of auditory reactions only to non-speech sounds after 6 months of constant use of the hearing aid, the lack of dynamics of speech development, subject to its constant wearing);
- d) unilateral sensorineural hearing loss with severe tinnitus in the deaf ear, not compensated by other hearing aids or bone implants.

Hearing function was restored up to 1 degree in one ear (monoaural cochlear implantation) in 371 patients, in two ears (binaural) in 8 patients.

Conclusions: Cochlear implantation is not only a surgical stage; it is a complex of long-term, sometimes costly, postoperative follow-up and auditory rehabilitation. Health-related quality of life indicators have distinctive features in any age group. Against the backdrop of declining healthcare resources, cost-effective analysis is quickly becoming an important tool. There is still a strong need for health-related quality-of-life assessment tools that can truly reflect the benefits of cochlear implantation, in which the assessment of utility is of fundamental importance.

Кохлеарная имплантация взрослым пациентам, опыт ГКП на ПХВ «Городская клиническая больница #5», г. Алматы

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Введение: Лечение глубокого нарушения функции слуха у взрослых постлингвальных (позднооглохших) пациентов методом кохлеарной имплантации применяется в мировой практике около 40 лет. За этот период была доказана высокая эффективность данного метода и постоянное, постепенное расширение показаний к этой операции. Позднооглохшие пациенты из категории взрослое население являются высокоперспективными кандидатами для проведения данного метода лечения. Несмотря на это в Республике Казахстан с 2019 по 2022 года был введен мораторий на проведение данного вида медицинской помощи взрослому населению по причине низкой эффективности.

Материал и методы: В ГКП на ПХВ «Городская клиническая больница №5» г. Алматы с 2007 по 2022 год было выполнено 379 кохлеарных имплантаций взрослому населению страны: 163 пациенту женского пола и 216 пациенту мужского пола. В этом исследовании представлены текущие показания и правила включения пациентов, основанные на 15 опыте.

Результаты: Медицинскими показаниями для проведения кохлеарной имплантации взрослому населению в Республике Казахстан являются:

- a) двусторонняя постлингвальная глухота (более 10 лет);

- б) двусторонняя сенсоневральная тугоухость IV степени;
 в) низкая эффективность слухопротезирования (пороги слуха в слуховых аппаратах в свободном звуковом поле в диапазоне 500–4000 Герц составляют 55 децибел и более, разборчивость многосложных слов менее 40%, односложных – менее 20%, наличие положительной динамики развития слуховых реакций только на речевые звуки после 6 месяцев постоянного использования слухового аппарата, отсутствие динамики речевого развития при условии его постоянного ношения);
 г) односторонняя сенсоневральная тугоухость с выраженным тиннитусом в глухом ухе, не компенсируемом другими слуховыми аппаратами или костным имплантом.

Восстановлена функция слуха до 1 степени на одном ухе (моноуральная кохлеарная имплантация) у 371 пациента, на двух ушах (бинауральное) у 8 пациентов.

Выводы: Кохлеарная имплантация – это не только хирургический этап, это комплекс длительных порой дорогостоящих мероприятий послеоперационное сопровождение и слухоречевой реабилитации. Показатели качества жизни связанные со здоровьем имеют отличительные черты в любой возрастной группе. На фоне сокращения ресурсов здравоохранения экономически эффективный анализ быстро становится важным инструментом. По-прежнему существует острая потребность в инструментах для оценки качества жизни, связанных со здоровьем, которые действительно могут отражать пользу от кохлеарной имплантации, в которой оценка полезности имеет фундаментальное значение.

Determination of factors influencing the prevalence of exudative otitis media

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Introduction: Otitis media with effusion (OME) reduces the quality of life of children, causes speech delay, and problems in cognitive, behavioral, and neurophysiological development. Despite healthcare and the medical care system changes, OME remains a major problem worldwide. Some data show a range of factors, such as population growth, low socioeconomic status, living in an industrial area, exposure to secondhand smoke, frequent upper respiratory infections, craniofacial defects, palate or lip defects, allergies, duration of breastfeeding, and vaccinations that may affect the origin of the OME. The presence of these factors doubles the risk of OME, but the relationships between these factors are complex and controversial. In addition, the results obtained are not comparable due to age differences, seasonal differences, and differences in screening protocols.

Aim: Our study aims to explore all possible risk factors and the effect of changes in height and width between screening sites in a wide geographical area from the Balkans to the Caspian Basin using an otoscope and tympanometry.

Material and methods: The study was conducted in 16 countries in 18 cities. Prior permission to conduct the study was obtained from the administrative authorities of each country. A study was conducted of 4768 children aged 4 to 7 attending childcare facilities. A questionnaire was developed that parents filled out before the child's examination. The questionnaire included factors that affect: the age of the child (4–7 years old), the education of the mother (higher, secondary, or lower), the fact that at least once in the last year, according to the doctor interview, the child had an acute respiratory infection, smoking of the father and/or mother at home, allergic history.

Conclusions: The review showed that exposure to secondhand smoke, low level of mother's education, a history of acute respiratory infection, and the child's age under 7 years were significant risk factors for developing OME, so public health should be involved in facing these problems and reducing their prevalence.

Определение факторов, влияющих на распространенность экссудативного среднего отита

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Введение: ЭСО снижает качество жизни детей, приводит к задержке речи, проблемам в когнитивном, поведенческом и нейрофизиологическом развитии. Несмотря на изменения в здравоохранении и системе медицинского обслуживания, ЭСО по-прежнему остаются серьезной проблемой во всем мире. В некоторых данных приводится ряд факторов, таких как рост населения, низкий социально-экономический статус, проживание в промышленной зоне, пассивное курение, частые инфекционные воспаления верхних дыхательных путей, черепно-фасциальные дефекты, наличие дефектов неба или губ, аллергии, продолжительность грудного вскармливания и прививки, которые могут повлиять на происхождение ЭСО. Наличие этих факторов удваивает риск возникновения ЭСО, но связи между этими факторами сложны и противоречивы. Кроме того, полученные результаты несопоставимы из-за возрастных различий, сезонных различий и различий в протоколах скрининга.

Цель: Изучить все возможные факторы риска и, кроме того, влияние изменений высоты и ширины между участками скрининга в широком географическом районе от Балкан до Каспийского бассейна с использованием отоскопа и тимпанометра.

Материал и методы: Исследование проводилось в 16 странах в 18 городах, предварительно были получены разрешения на проведение исследования от административных органов каждой отдельной страны. Было проведено исследование 4768 в возрасте от 4 до 7 лет, посещающих детские учреждения. Была разработана анкета, которую заполняли родители перед проведением обследования ребенка. В анкету были включены факторы, которые влияют: возраст обследуемого ребенка (4–7 лет), образование матери (высшее, среднее или низшее), тот факт, что по крайней мере один раз за последний год

согласно анамнезу ребенком было перенесена острая респираторная вирусная инфекция (ОРВИ), курение отца и/или матери дома, аллергический анамнез.

Выводы: Обзор показал, что значимыми факторами риска развития ЭСО были пассивное курение, низкий уровень образования матери, перенесённое ОРВИ в анамнезе, возраст ребенка до 7 лет, таким образом общественное здравоохранение должно быть вовлечено в борьбу с этими проблемами и сокращение их распространения.

Distortion product otoacoustic emissions in extended high frequency range in tinnitus patients with different degrees of hearing loss

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Introduction: Distortion product otoacoustic emissions (DPOAEs) are usually measured up to 8 kHz. However, some equipment provides the possibility of measuring DPOAEs up to 16 kHz.

Aim: The study aimed to investigate high-frequency DPOAEs (at frequencies 10, 12, and 16 kHz) in subjects with tinnitus. The DPOAEs were compared with hearing thresholds in search of some preclinical hearing loss.

Material and methods: DPOAEs were measured in tinnitus patients and a control group without reported tinnitus. DPOAEs were measured at frequencies of 1, 2, 4, 6, 8, 10, 12, and 16 kHz. The main focus was on the 10–16 kHz range, while 1–8 kHz served as a comparison.

Results: The subjects were divided into subgroups based on the degree of hearing loss. When the tinnitus subjects were compared with the control group with similar hearing thresholds, there were no statistically significant differences between DPOAEs.

Conclusions: DPOAEs in both standard and high frequencies does not seem to provide information on preclinical hearing loss in tinnitus subjects compared to subjects without tinnitus.

Epidemiologic study of 5 thousand patients, understanding the predisposing factors

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Tinnitus (ringing in the ears) is a symptom with a high prevalence rate. It is estimated that around 15–31% of the world population experience it, in many different intensities. It can

come from any part of the auditory system, being able to vary in amplitude, type and level of discomfort from patient to patient. Currently there are countless studies that can identify its primary causes. However, there hasn't been yet a study analyzing an expressive number of patients suffering from this symptom in order to identify which factors are the most frequent and prevalent in the population in the most realistic way, which is our objective. This will be a linear retrospective research about the most common causes worldwide. Data regarding sex, age, poly pharmaceuticals, smoking, level of physical activity, stress, previous hearing disorders, hypercholesterolemia, thyroid alterations, cervical spine alterations, ATM alterations, sleeping disorders, systemic arterial hypertension, daily intake of sugar, caffeine and alcoholic drinks, were all collected. Some factors such as vitamin D deficiency or hypozincemia, were not included in the research, for not being studied factors in 2005 – year that the author initiated this study. Therefore, we would have a research bias if we included the data collected later on. Such subjects may be individually evaluated in a posterior research. Later on, the percentage of the most common tinnitus causes will be analyzed. For being an epidemiological study, we will not compare the data with controlled groups for a statistical analysis, the prevalence of each item will be identified in percentage among the total number of studied patients. 15,546 medical records of the author's patients will be analyzed, including the ones who have tinnitus as their main problem, until complete 5 thousand cases. Those who do not show tinnitus as their main symptom or who have not had all their data collected will not be included. **Conclusions:** We conclude that many factors may cause suffering in the auditory pathway, causing tinnitus as a symptom, and all of those that were researched have an importance. We conclude that among the direct causes, meaning pre-existent diseases considered causes for tinnitus, stress, sleep disorders, metabolic sugar disorders and hypercholesterolemia are the ones with highest prevalence in the studied group. Somatosensorial alterations, as temporomandibular or cervicogenic alterations, also show a high incidence, but are not among the most prevalent. We conclude that the average age for patients to initially have tinnitus is 54 years old. We conclude that the symptom is more prevalent on females, representing 57,5% of the cases. We conclude that the symptom is more common in its bilateral form (60%), being slightly more prevalent, when unilateral, on the left side (23,9%). We conclude that all items studied in this research are important when studying the tinnitus origin. We conclude that in all patients many items untreated and concomitant causing tinnitus were found, therefore, the multicausal research is the most adequate when evaluating patients with such alteration.

Genetic background of inner ear malformations and frequency of tinnitus in Polish patients

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Introduction: Enlarged vestibular aqueduct (EVA) is the most frequently observed inner ear malformation (IEM) often accompanied with incomplete partition type 2 (IP2) or cochlea hypoplasia. According to literature approx. 50–70% of patients with EVA/IP2 experience tinnitus. While genetic background of EVA/IP2 has been strongly associated with *SLC26A4* variants, the genetics of tinnitus is still poorly understood. Based on literature data, only 25% of EVA/IP2 patients carry two pathogenic *SLC26A4* variants therefore, about 75% of EVA/IP2 cases require further extensive genetic testing. The frequency of tinnitus in Polish EVA/IP2 patients has not been assessed before.

Aim: The aim of the study was to identify the genetic background of hearing loss (HL) and estimate the frequency of tinnitus in Polish IEMs patients.

Material and methods: A retrospective analysis was conducted on medical records of 23 patients with bilateral IEMs. Collected data included results of audiological evaluation, radiological imaging, and subjective reports of tinnitus. The genetic landscape was analyzed by next generation sequencing (NGS) using custom HL-related multigene (Roche) or TruSight One sequencing (Illumina) panels. Presence and segregation of selected variants as well as CEVA haplotype (CEVA) were verified by Sanger sequencing.

Results: The genetic testing identified the cause of IEMs in 16/23 patients (70%). Two pathogenic variants in the *SLC26A4* gene were identified in 8 out of 23 (35%) patients. CEVA haplotype was considered as the cause of IEMs in 6 probands with only one *SLC26A4* variant. In two individuals with a phenotype consistent with branchio-oto-renal (BOR) spectrum disorder, cochlear hypoplasia resulted from pathogenic variants in the *EYA1* gene. Among 23 individuals with IEMs, 9 (39%) suffered from tinnitus. Out of 9 patients with tinnitus, 4 are carriers of two *SLC26A4* variants, 2 probands have one *SLC26A4* variant *in trans* with CEVA haplotype and no causative variant were identified in 3 individuals.

Conclusions: In our study the majority of IEMs patients (70%) were found to carry variants in *SLC26A4*, further supporting the important role of this gene in IEMs development. *SLC26A4* variants together with CEVA haplotype explain IEMs in a large group of tested patients with only one pathogenic variant found in the *SLC26A4* gene. To better understand the pathogenesis of IEMs, it is necessary to investigate pathogenic variants in noncoding regions of known HL genes

or look for them in novel HL candidate genes. In opposite to the literature, in our study only 39% patients with EVA/IP2 have tinnitus. However, this can be explained by the fact that every tested patient use hearing aids or cochlear implants. Furthermore, medical data has been collected in the early years of patients' lives and tinnitus seems to be correlated with advancing age.

Founding: National Science Centre, Poland, grant number: 2021/41/B/NZ5/04390.

Hearing aids fitting for tinnitus patients using TSG and the ReSound Relief app

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Introduction: Tinnitus is the perception of unpleasant sounds in the absence of an external acoustic stimulus. They are experienced by about 15–20% of people worldwide; in Poland, about 20% of adults have ever experienced tinnitus. In the case of hearing loss – as many as 80% of people suffer from this condition. People with tinnitus seek help from a variety of specialists, and hearing aid specialists are one of them. The cause of tinnitus is still insufficiently understood, and no single method quickly brings decisive improvement in the experience of tinnitus. Hearing aid specialists have at least one tool for tinnitus therapy, and that is the tinnitus sound generator (TSG), a feature available on most hearing aids to generate noises that can serve in the habituation of a patient's tinnitus. Often this tool is modifiable, allowing both the intensity of the stimulus and its modulation in frequency. Tinnitus habituation originated from Tinnitus Retraining Therapy (TRT) and remains today one of the most widely used approaches for tinnitus patients.

Aim: The main purpose of this study is to present the tinnitus therapy tools available to hearing aid specialists in their offices. It introduces how to fit and use TSG in hearing aids using the ReSound SmartFit software as an example. Also presented is the ReSound Relief app, which allows patients to obtain or expand tinnitus awareness on their own and generate sounds that can provide relief in daily functioning. The presentation will also include the results of a survey on the awareness of Polish hearing aid specialists regarding the tools and management of tinnitus therapy.

Material and methods: 32 hearing aid specialists from all over the country, working in different institutions and with different years of experience, participated in the study. A proprietary 25-question questionnaire was used to assess attitudes toward tinnitus treatment, knowledge of treatment tools, and causes of tinnitus. In the presentation were also

used screenshots of the ReSound SmartFit 1.16 software and the ReSound Relief app.

Results: Most respondents reported that patients with tinnitus and hearing loss accounted for approximately 61–70% of their patients, with tinnitus without hearing loss most commonly reported in the 21–30% range. Difficulty falling asleep (reported by 50% of hearing aid specialists) and difficulty concentrating (reported by 47% of hearing aid specialists) were cited as the most common consequences of tinnitus in patients. 59% of the respondents indicated that they provide therapy to people with tinnitus – TRT was reported as the most common form of therapy (47% of respondents), while 13% also indicated that wearing hearing aids alone provides patients with an improvement in their perception of tinnitus. Only 53% of respondents said they felt competent to provide tinnitus therapy.

Conclusions: For Polish hearing aid specialists, the topic of tinnitus continues to be an area in need of expanding knowledge. A multimedia application with comprehensive knowledge about the causes and ways to deal with tinnitus can be a helpful tool in this regard. One such solution is ReSound Relief. The ability to modify the operation of the noise generator on one's own using various apps can also deepen the patient's involvement in the auditory rehabilitation process or also contact with the hearing aid specialist.

Hearing status in the early stages of light skull and brain trauma

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Introduction: Rapid technological progress, the growth of emergencies, urbanization, and increased population mobility have led to an increasing number of injuries.

Aim: This study aims to study the state of the hearing organ in patients in the early period of mild closed skull and brain trauma.

Material and methods: Clinical material was collected in 2020–2022 in the Neurosurgical Department of the XopMIII. The study included patients with no ear or hearing problems before the head injury. A total of 56 patients with mild closed head trauma were examined (aged between 16 to 69 years; mean age 43 ± 1.27 years). All patients were under the constant supervision of a neurosurgeon. They underwent a clinical examination, including blood and urine tests and consultations with a general practitioner, neuropathologist, ophthalmologist, and other specialists if necessary. A general otorhinolaryngological examination was performed, including otoscopy, anterior and posterior rhinoscopy, oropharyngoscopy, and indirect laryngoscopy. The audiological examination was performed starting from the third day after the injury when the patients were able to communicate. In the patients included in the study, diseases of the outer and

middle ear were excluded, which could distort the true picture of the state of the auditory organ during the examination.

Results: 12 (21%) complained of tinnitus at the time of the examination. In 43% of these patients, tinnitus was the only manifestation; in 39% of cases was combined with hearing loss, and in 18% was combined with impaired speech intelligibility. In 24%, the tinnitus was localized in one ear, and in 76%, it was bilateral. In 57%, tinnitus was only high-frequency; in 22%, mixed, and only 21% had low-frequency tinnitus. 7 (12%) patients complained of hearing loss. Although unilateral hearing loss was more common (54%) than bilateral (46%), the difference between these two types was not significant. In 9 (16%) cases, the average indicator of recognition of whispered speech in both ears was 2.4 ± 0.3 m ($Pk < 0.05$). This had a significant impact on the rate of recognition of whispered speech in all examined patients, which amounted to 3.7 ± 0.4 m ($Pk < 0.1$), on the left ear – 3.5 ± 0.3 m ($Pk < 0.1$). The recognition rate of spoken language on both sides exceeded 6 m ($Pk > 0.1$).

The mean result of the tuning fork test C_{128} by air conduction was 54.7 ± 1.6 sec ($Pc > 0.1$) in the right ear, 52.5 ± 1.8 sec ($Pc > 0.1$) in the left ear, and 52.5 ± 1.8 sec ($Pc > 0.1$) in the bone conduction – on the right ear 22.7 ± 1.3 sec; on the left ear – 22.5 ± 1.5 sec ($Pc < 0.1$). Only 8 (15%) of the examined patients had a significant deterioration of the tuning fork test result for both conduction types ($Pk < 0.1$). Due to these patients, there was also an overall worsening of the tuning fork test results in air and bone conduction, although they did not differ significantly from the control group ($Pk < 0.1$). Rinne's test results were positive in 48 (86%) and 'small' positive in 8 (14%). Schwabach test results were worse in one ear in 7 (12%) and both ears in 9 (16%) of the examined patients.

The average level of hearing threshold for air conduction at the speech frequencies of the examined patients ($N = 56$) was 14.3 ± 1.4 dB ($Pk > 0.1$). According to the pure-tone audiometry, in 14 (25%) patients, a deviation of the indicators relative to the age norm was revealed as an increase in air and bone conduction thresholds. The audiogram curves had different configurations. In 52%, the rise in air and bone conduction thresholds had the form of steeply descending, 29% – gently descending, 16% – horizontal, and 4% – gently ascending curves. A decrease in the steepness of the slope in the first two cases was observed at frequencies of 4000, 6000, and 8000 Hz. In 6 patients, hearing loss of the first degree was established, 2 – of the second degree. In 6 cases, there was an increase in the threshold of audibility of air conduction at speech frequencies, but their value did not reach the level of 26 dB, i.e., to the value of hearing loss of the first degree.

Conclusions:

1. In patients suffering from mild closed traumatic brain injury, in the early period, hearing impairment caused by a lesion of the auditory pathway occurs, often manifesting as mild hearing loss.
2. Pure-tone audiometry is a method of choice in diagnosing hearing loss in the early period of mild closed traumatic brain injury.

Состояние слуха в раннем периоде легкой черепно-мозговой травмы

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Введение: Бурный расцвет технического прогресса, рост чрезвычайных ситуаций, урбанизация и увеличением скорости передвижения населения привели к увеличению травматизма населения.

Цель: Целью настоящей работы явилось изучение состояния органа слуха у больных в раннем периоде легкой закрытой черепно-мозговой травмы (ЗЧМТ).

Материал и методы: Сбор клинического материала проводился за период 2020–2022 гг. в нейрохирургическом отделении ХорМППЦ. В разработку были включены больные до момента получения ЧМТ не имеющие патологию уха и головного мозга. Всего были обследованы 56 больных легкой формой ЗЧМТ. Возраст больных был от 16 до 69 лет (средний возраст $43 \pm 1,27$ лет). Все больные находились под постоянным контролем нейрохирурга, им проведено клиническое обследование: общий анализ крови и мочи, при необходимости – консультация терапевта, невропатолога, окулиста, и других специалистов. Производился общий оториноларингологический осмотр, включающий отоскопию, переднюю и заднюю риноскопию, мезофарингоскопию и непрямую ларингоскопию. Аудиологическое обследование производили, начиная с третьей сутки после травмы, когда больные становились контактными и критичными. У больных, включённых в разработку, были исключены заболевания наружного и среднего уха, которые могли исказить истинную картину состояния слухового анализатора в момент обследования.

Результаты: 12 (21%) обследованных больных от общего количества предъявляли в момент обследования жалобу на шум в ушах. Из них у 43% больных шум был единственным проявлением, 39% он сочетался со снижением слуха и лишь 18% нарушением разборчивости речи. Шум в 24% был односторонний и 76% двухсторонний. 57% он имел только высокочастотный, 22% – смешанный и лишь 21% – только низкочастотный характер. Жалобу на снижение слуха предъявляли 7 (12%) больных. Хотя одностороннее снижение слуха встречалось чаще (54%), чем двухстороннее (46%), разница между ними была не существенной. В 9 (16%) случаях средний показатель восприятия шепотной речи составил на оба уха $2,4 \pm 0,3$ м ($P < 0,05$). Это оказало существенное влияние на показатель восприятия шепотной речи всех обследованных больных, которое составило на правое ухо $3,7 \pm 0,4$ м ($P < 0,1$), на левое ухо – $3,5 \pm 0,3$ м ($P < 0,1$). Показатель восприятия разговорной речи с обеих сторон превышал 6 м ($P > 0,1$). Средний показатель звучания камертона C_{128} по воздушной проводимости составило на правое ухо $54,7 \pm 1,6$ сек ($P > 0,1$), на левое ухо – $52,5 \pm 1,8$ сек ($P > 0,1$), по костной – на правое ухо $22,7 \pm 1,3$ сек на левое ухо – $22,5 \pm 1,5$ сек ($P < 0,1$). Лишь у 8 (15%) обследованных больных имело место достоверное укорочение

абсолютного времени звучания камертонов по обоим типам проводимости звука ($P < 0,1$). За счет этих больных в целом также имело место укорочение звучания камертонов по воздушной и костной проводимости, хотя они не имели достоверное отличие по отношению к контрольной группе ($P < 0,1$). Результат опыта Ринне в 48 (86%) был положительный и 8 (14%) – «малый» положительный. Установлено укорочение опыта Швабаха на одно ухо в 7 (12%) и на оба уха 9 (16%) обследованных больных. Средний уровень порога слышимости по воздушной проводимости на речевых частотах обследованных больных ($N = 56$) составил $14,3 \pm 1,4$ дБ ($P > 0,1$). По данным тональной пороговой аудиометрии у 14 (25%) обследованных больных выявлено отклонение показателей относительно возрастной нормы в виде повышения порогов воздушного и костного проведения. Кривые аудиограмм имели различную конфигурацию. В 52% повышение порогов воздушного и костного проведения имели вид в виде крутонисходящих, 29% – пологонисходящих, 16% – горизонтальных и 4% – пологовосходящих кривых. Выраженное снижение крутизны наклона при первых двух вариантах наблюдалось на частотах 4000, 6000 и 8000 Гц. У 6 больных установлена тугоухость первой, 2 – второй степени. В 6 случаях имело место повышение порога слышимости воздушного проведения на речевых частотах, но их значение не доходило до уровня 26 дБ, т.е., до значения тугоухости первой степени.

Выводы:

1. У больных легкой формой ЗЧМТ в раннем периоде встречается нарушение слуха, обусловленной поражением звуковоспринимающего отдела органа слуха и часто проявляется легкой степенью тугоухости.
2. Тональная пороговая аудиометрия является методом выбора в диагностике нарушения слуха в раннем периоде легкой формой ЗЧМТ.

Hyperacusis questionnaire – a new tool for assessment of hyperacusis in tinnitus patients

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Introduction: Hyperacusis is a kind of decreased tolerance to sound and is difficult to measure objectively. It often co-occurs with tinnitus. There is a need for valid and reliable patient-reported outcome measures to capture this subjective phenomenon.

Aim: The aim of the study to create a questionnaire capturing hyperacusis in terms of loudness, fear, and pain and then to evaluate its psychometric properties.

Material and methods: The study group consisted of 106 patients, made up of 51 men and 55 women. They were aged between 19 and 72 years, mean 45.2 years (SD = 12.4).

An initial pool of 33 questions capturing hyperacusis was subjected to expert evaluation and pilot testing. Then, a shortened 19-item version of the tool was checked out. Medical interview, audiological examination and a set of questionnaires: Tinnitus Handicap Inventory, Hyperacusis Questionnaire, State-Trait Anxiety Inventory, and Visual Analogue Scale was completed by all subjects.

Results: The final 14-item Hyperacusis Assessment Questionnaire showed an appropriate three-factor structure that explained 70.5% of the variance. Convergent validity and divergent validity were confirmed by correlations with other measures of hyperacusis, anxiety, tinnitus severity, misophonia, and hearing thresholds. Internal consistency as assessed with Cronbach's alpha, was excellent ($\alpha = 0.91$) as was reproducibility (intra-class correlation, ICC = 0.96).

Conclusions: The new Hyperacusis Assessment Questionnaire is a psychometrically sound and brief tool that can assess the severity of hyperacusis in terms of loudness, fear, and pain. It can be used in clinical practice and scientific research for patients with hyperacusis and tinnitus.

New approaches in the construction and validation of tinnitus-related questionnaires

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Aim: Tinnitus is sometimes called a scientific and clinical enigma. Still tinnitus assessment relies on self-report questionnaires and subjective psychoacoustic measures. The objective of the work is to present current advances in measurement of tinnitus severity using questionnaires.

Material and methods: Studies conducted in the Institute of Physiology and Pathology of Hearing in the field of tinnitus questionnaires included a group of more than 1000 patients with various clinical manifestations. Results of own research concerning psychometric properties of the existing tinnitus questionnaire will be presented as well as own original tools created for Polish-speaking patients. Additionally, other current advances in measurement of tinnitus will be discussed.

Results: In addition to Classical Test Theory, more modern methods began to be used to assess psychometric properties of the existing questionnaires (Item Response Theory, Differential Item Functioning analysis). Validations are carried out on online versions of tinnitus questionnaires. Ecological momentary assessment is up-to-date approach to capture real-time data concerning perceived tinnitus severity.

Conclusions: Methods of construction and validation of tinnitus-related questionnaires continue to improve. They allow more precise evaluation of factor structure, reliability, and the quality of individual items. Ecological momentary assessment provides deeper insight into how people perceive tinnitus in their natural setting and fluctuations of tinnitus symptoms over time.

Prevalence and characteristics of tinnitus and other auditory manifestations in patients with vestibular migraine

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Aim: To examine the prevalence and characteristics of tinnitus and other auditory symptoms in patients with vestibular migraine (VM).

Material and methods: A retrospective review of 253 patients (ages 18–75 years) with consensus diagnose of VM, collected from ambulatory tertiary dizziness clinic (2016–2021). The prevalence of tinnitus, its type (pulsatile or constant) and severity (using visual analog scale) as well as phonophobia, aural fullness and hearing loss and its association to migraine attacks were analysed.

Results: After ruling out patients with hearing loss and tinnitus due to alternate diagnosis (e.g genetic, inflammation, vascular, trauma, otosclerosis, concomitant Meniere's disease) the prevalence of tinnitus among all patients with VM was 15,6%. Thirteen percent had tinnitus associated with attack (appearance or increase in intensity), in 15 patients concurrent with hearing loss. Among those, 26 patients had tinnitus as aura of migraine attack. Pulsatile type of tinnitus was found in 55% of patients. The intensity of tinnitus was estimated subjectively using VAS and the points range from 0 to 5. Otalgia as the only pain symptom temporarily associated with a migraine attack was present in 21% of people. Hearing loss manifested as a low-frequency deficits and was reversible. Aural fullness was permanent (17%) or associated with attacks (33%). Phonophobia affected 33% of patients.

Conclusions: The prevalence of tinnitus in patients with VM is comparable with that in general population (10–15%). The overlap of tinnitus and hearing loss associated with vestibular symptoms make the differential diagnosis with Ménière's disease difficult. Pulsatile tinnitus occurring in more than 1/3 of patients require, particularly in the context of dizziness, detailed diagnostic procedures to exclude serious pathology. The perception of the intensity of tinnitus by patients with VM as a light to moderate can be explained by a greater focus on dizziness and sensory hypersensitivity annoyance.

Sensorineural hearing loss and vestibular disorders in patients with long COVID-19

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Introduction: The COVID-19 clinical symptoms are primarily related to the respiratory system but may also be involved in many others, including the nervous system. Recently, sensorineural hearing loss, vertigo, or dizziness has been described as one of the clinical manifestations and possible complications of COVID-19.

Material and methods: The study aimed to describe the otorhinolaryngological evaluation and assess hearing and videonystagmographic (VNG) findings in patients after COVID-19 infection. All patients underwent anamnesis, otorhinolaryngological evaluation, complete audiological and otoneurological diagnostics, including threshold tonal audiometry, tympanometry, otoacoustic emissions, and auditory brainstem evoked potentials (ABR) tests, and VNG as well. The study group included 58 patients aged 23 to 75 years diagnosed with COVID-19 infection six months before inclusion in the present study and reported post-COVID-19 hearing impairment or vertigo.

Results: There were statistically significant differences between the control and study groups. Sensorineural hearing loss was found in 65.5% of the tonal audiometry test. The stapes reflex was absent in almost 20% of post-COVID-19 patients. The analysis of ABRs demonstrated longer latencies of wave III, V, and time intervals I–III, I–V in post-COVID-19 patients. Spontaneous nystagmus with closed eyes was reported in 8 patients (13.8%). Positional nystagmus was observed in 15 patients (24.1%). Asymmetrical optokinetic nystagmus was observed in 18 patients (31%). A distorted record in the tracking pendulum test was present in 23 patients (39.7%). Square waves were observed in 34 COVID-19 patients (58.6%). Unilateral weakness (UW) was observed in 23 subjects (39.7%); among those with UW, 22 patients (95.7%) also demonstrated directional preponderance contralateral to the UW. Another 16 patients (27.6%) presented only a directional advantage. The post-caloric recruitment was present in 38% of patients.

Conclusions: COVID-19 can damage the inner ear and the auditory pathway. Hearing loss and/or vestibular dysfunction may be the only symptom of COVID-19 or be a late complication of the disease due to postinfectious nerve tissue inflammation as a symptom of long COVID-19. Therefore, it is advisable to perform hearing and balance diagnostics in patients after COVID-19 and provide them with specialist care.

Speech discrimination in cochlear implanted ear in patients with single sided deafness associated with tinnitus

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Introduction: Individuals suffering from tinnitus often complain about difficulties understanding speech even in the absence of a hearing loss. Patients with single sided deafness (SSD), suffering from tinnitus in the deaf ear, often report some reduction of tinnitus annoyance after cochlear implantation (CI). It is not clear, how the remaining tinnitus in the implanted ear affects the speech perception in this ear.

Aim: The aim of this study is to evaluate speech discrimination in the implanted ear in individuals with SSD associated with tinnitus.

Material and methods: A group of 43 with patients with SSD associated with tinnitus, implanted in their deaf ear, were included in the study. The mean age at CI was 51 years (range: 28–76). The reference group constitutes of 37 SSD patients with no tinnitus also CI users. Subjects were evaluated with a monosyllabic word test in quiet and in noise (10 dB SNR). The test was performed using speech processor direct input at 14 months of CI use. The presentation level was set individually, to obtain comfortable loudness of presented speech material. In the group with tinnitus also the tinnitus loudness and tinnitus annoyance were evaluated with Visual Analogue Scale.

Results: Mean speech discrimination in the group of patients with tinnitus was 45.1% in quiet and 31.5% in noise. For the reference group, without tinnitus, the mean speech scores were 49.5% in quiet and 28.8% in noise. There was no significant difference between the groups in terms of speech scores in quiet ($t(79) = 0.74$, $p = 0.46$) as well as in noise ($t(79) = -0.55$, $p = 0.58$). There was no correlation between speech discrimination scores and tinnitus loudness or tinnitus annoyance.

Conclusions: Tinnitus is not the main factor affecting speech discrimination in the implanted ear in patients with SSD associated with tinnitus.

Subjective hearing benefit after cochlear implantation in unilateral hearing loss patients with tinnitus

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Introduction: Patients with unilateral hearing loss (UHL) – severe to profound hearing loss in one ear and normal or near-normal hearing in the other – besides the difficulties in sound localization and speech discrimination in noise, also perceived the emotional and social consequences of UHL. UHL's emotional and social impact seems even more severe in patients with tinnitus. Cochlear implants (CIs) have been successfully applied in UHL situations for suppressing tinnitus for several years. 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.

Aim: The aim of this study was to evaluate subjective benefits after cochlear implantation in patients with unilateral hearing loss and tinnitus and compare them to those obtained in a similar group who had no tinnitus.

Material and methods: A group of 249 adult patients with UHL was divided into two groups: patients with preoperative tinnitus (178 patients) and those without experience tinnitus before their operation (71 patients). All patients were implanted in the Institute of Physiology and Pathology of Hearing, Poland. Those who achieved 14 months of CI follow-up were included in the study. Subjective benefits in the study groups were evaluated with an APHAB (Abbreviated Profile of Hearing Aid Benefit) questionnaire.

Results: All subjects used their cochlear implant more than 10 hours a day, 7 days a week. The analysis of the questionnaire results shows that patients with UHL and tinnitus had benefited from using a CI to the same extent as patients with UHL who had no tinnitus.

Conclusions: Patients with unilateral hearing loss and tinnitus can benefit from using a CI.

Symptoms of auditory processing disorders in children with tinnitus

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Introduction: Tinnitus is the experience of sound in the ears or head in the absence of an acoustic stimulus in the environment. Study results in adults indicate that speech comprehension in people with tinnitus is worse compared to people without tinnitus. Children self-report rarely having tinnitus hence limited understanding of the problems they face and how tinnitus affects their daily lives. Worse speech comprehension in people with hearing loss and tinnitus is understandable and is due to a limited supply of acoustic information to the CNS. In situations where peripheral hearing is normal and the patient reports difficulty understanding speech, one may consider the co-occurrence of other causes, such as auditory processing disorder (C)APD, which involves difficulties in perceptual processing of auditory information in the central nervous system.

Aim: The aim of the study was to assess the presence of symptoms of auditory processing disorders in children with tinnitus.

Material and methods: The study group consisted of 169 children aged 10 to 14 years (92 girls and 77 boys) with normal hearing threshold on tonal audiometry reporting the presence of tinnitus. In 63 children, tinnitus occurred rarely, in 76 – sometimes, in 30 – often or all the time. The study material consisted of the results of the Scale of Auditory Behaviors (SAB) in the Polish adaptation, used to assess complaints that may indicate the presence of auditory processing disorders. The study was conducted during the implementation of the program among students in grades I and VIII of elementary schools in the capital city of Warsaw implemented in 2021–2022 by the Institute of Physiology and Pathology of Hearing.

Results: In children with tinnitus, symptoms that may indicate auditory processing disorders were observed. The most common symptoms were difficulty hearing or understanding speech in noise – in 16% of children, easy distraction – in 27% of children, difficulty focusing attention – in 19% of children, distractibility, inattention – in 18% of children, difficulty organizing and planning activities – in 18% of children. A SAB total score of less than 46, an indication for an extended diagnosis, was obtained by 30% of children with tinnitus occurring infrequently, 35% of children with tinnitus occurring sometimes, and 53% of children with tinnitus occurring often or all the time.

Conclusions: Children reporting tinnitus should receive additional diagnostics for auditory processing disorders. This diagnosis should be multispecialty and, in addition to hearing tests, include an in-depth interview, psychological and pedagogical evaluation, and the performance of psychoacoustic tests.

The effect of guided imagery technique applied to individuals with tinnitus on TENS treatment, anxiety, and sleep levels: preliminary results

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Aim: The aim of this study is to examine the effects of guided imagery on tinnitus, transcutaneous electrical nerve stimulation (TENS) treatment, anxiety, and sleep levels in individuals with tinnitus.

Material and methods: Six individuals aged 18 years and older, diagnosed with chronic subjective tinnitus and receiving TENS treatment with guided imagery technique were included in the study. During TENS, which was applied to individuals for 20 minutes every day for 3 weeks, audio recordings made by a psychiatric nurse (5th Researcher) were listened to in order to perform guided imagery. Expert opinion for the guided imagery technique was obtained from a psychologist and a psychiatric nurse. Before starting the treatment and at the end of the treatment Tinnitus Handicap Inventory (THI), State Trait Anxiety Inventory (STAI), and Pittsburgh Sleep Quality Index (PSQI) were administered. $p < 0.05$ was considered significant.

Results: According to THI, a statistically significant decrease was found in tinnitus severity after treatment ($p < 0.05$). In these individuals, a decrease in anxiety scores and an improvement in sleep scores were observed after treatment compared to before treatment.

Conclusions: Improvements were observed both in terms of psychoacoustics and in terms of discomfort due to tinnitus in individuals who underwent TENS with the guided imagery technique. It is predicted that the creation of treatment programs with a multidisciplinary approach is more beneficial for tinnitus patients in terms of general health.

The effect of TENS therapy on tinnitus annoyance in individuals with tinnitus with bruxism: case series

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Introduction: Bruxism is generally accepted as non-functional and continuous, strong contact between the occlusal surfaces of the teeth. As a result of bruxism, problems such as temporomandibular disorders, tinnitus, headache, tooth wear, sensitivity and mobility can be seen. Tinnitus due to bruxism negatively affects the quality of life of individuals.

Aim: The aim of this study is to present the effect of transcutaneous electrical nerve stimulation (TENS) therapy on tinnitus annoyance, sleep quality and quality of life in 3 cases of tinnitus with bruxism.

Material: The cases consisted of three adult individuals who were referred to Ankara University Faculty of Medicine İbni Sina Hospital Audiology, Balance and Speech Disorders Diagnosis and Rehabilitation Unit with complaints of tinnitus. Each of the cases underwent audiologic evaluation (pure tone audiometry, speech audiometry, immittance examination, speech tests) and tinnitus assessment (psychoacoustic measurements, use of scales and questionnaires). Tinnitus Handicap Inventory (THI), Quality of Life SF-36 short form, GAD-7 anxiety level questionnaire, visual analog scale were used for subjective assessment. Mandibular range of motion and oral parafunctional habits were also evaluated in 3 individuals diagnosed with bruxism by a dentist.

Methods: TENS frequency was set as 70–110 Hz and current duration as 40–100 microseconds. The electrodes were placed in a way to include the trigger point or points and applied five days a week for 30 minutes for a total of four weeks. Pencil electrode was used as the electrode. Algometric trigger point measurement was performed with the patients sitting in a chair in an upright position with the teeth adjacent to each other. All evaluations were repeated after 20 sessions.

Results: In all three cases, THI score decreased after TENS sessions. Quality of Life SF-36 short form score increased. GAD-7 anxiety level questionnaire score decreased. Mandibular range of motion increased and improvements were also seen in oral parafunctional habits assessment.

Conclusions: TENS therapy applied to the masseter muscle with a pen electrode can be beneficial in reducing annoyance and anxiety from tinnitus and improving quality of life. Future studies should be planned to confirm the benefit of this method.

The importance of REM in hearing aids fitting

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Introduction: Real ear measurements (REM) is a testing method performed with a special probe in the outer ear canal near the eardrum. This allows for the consideration of parameters such as the length and shape of the ear canal, its characteristic resonance frequency and the type of earmold ventilation used when fitting hearing aids. It also enables the verification of functions such as noise reduction, wind noise reduction, and microphone directionality. AutoREM is a feature that automatically adjust the gain to closely match the expected outcomes of the chosen fitting method. Today, AutoREM is a standard feature in the software of nearly every hearing aid manufacturer. In many countries REM is a compulsory tool for verifying the appropriate fit of hearing aids. In Poland, however, only a small percentage of hearing aid specialists currently incorporate this method into their practice.

Aim: The primary objective of this study is to summarize the differences in amplification in hearing aids before and after the implementation of AutoREM. Additionally, the researcher aims to highlight variations in the REUG results obtained from patients.

Material and methods: 48 patients ranging in age from 5 years to 86 years old were included in the study. A total of 74 ears were evaluated. Measurements were made using ReSound brand hearing aids and AuditData's PrimusPro REM instrument.

Results: After AutoREM, changes in hearing aid gain are apparent – usually fluctuating within ± 5 dB, but there are cases where differences amount to 15 dB (such large differences are observed for single frequencies). The researcher suspects that this is related to the resonance frequency, which varies between almost 2 kHz and 4 kHz in patients. In the future, it will be necessary to check whether the influence on the obtained results is not due to the non-standard capacity of the ear canal.

Conclusions: Failure to consider differences in the structure and resonant properties of patients' ear canals when fitting hearing instruments will result in front of the eardrum will not achieve the expected gain, which can lead to poorer speech understanding or less natural sound perception. REM should be an integral part of the hearing aid fitting process.

The problem of moderate hearing loss in children with delayed speech development

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Introduction: The problem of hearing loss in children from the point of view of early diagnosis is still relevant, especially in the absence of universal auditory screening. The main problem is the incorrect or absent care algorithm, the so-called 'diagnostic route', for children showing symptoms of delayed psycho-speech development. As a rule, at the first signs of delayed psycho-speech development, the first step is consultation with a pediatric neurologist or speech pathologist, not an audiologist. Only the awareness and professionalism of these specialists can help in early diagnosis and therapy. It is particularly important for these children to diagnose potential mild-to-moderate hearing loss because if speech is present, even defective and unintelligible, no concerns appear regarding the auditory functioning, which delays the speech therapist's consultation.

Aim: The aim of the study is to assess the functional state of the hearing organ in children with various forms of delayed speech development.

Material and methods: Based on the Tashkent Medical Academy and the Republican Scientific Research Center for Sports Medicine, 128 children were examined with referral diagnoses of delayed psycho-speech development. All children underwent a comprehensive audiological examination using subjective and objective methods (noise-induced otoacoustic emissions, ABR (air and bone conduction), multi ASSR, pure-tone play audiometry YДP3 registration). All children were examined by a speech therapist – a teacher for the deaf.

Results: Of the 78 children who were admitted to the center, 24 (30.7%) were referred by a speech therapist, 40 (51.3%) – by a pediatric neurologist, and 14 (17.9%) children were directed for hearing diagnostics after examination by an otorhinolaryngologist. At the same time, parents of 55 children complained about a lack of speech; in the rest of the children, parents complained about defective speech – 7 children, incomprehensible speech – 4 children, and in 11 children, parents observed special difficulties in school. Complex audiometry in 33 children revealed hearing thresholds corresponding to the age norm; in 18 children, bilateral sensorineural hearing loss of the IV degree, and in 7 children, sensorineural deafness. In 10 children, a hearing threshold level corresponded to bilateral sensorineural hearing loss of the III degree, 4 children of the II degree, 6 children of the II–III degrees, and 2 children of the I degree. At the same time, the latest detection rate of hearing loss was in the group of children with moderate hearing loss – among 22 children (11 children aged 5–7 years, 2 children aged 10 years, and 1 child aged 16 years).

Conclusions: 45 (57.7%) of 78 children with speech development problems had hearing impairment. This fact indicates

that in the absence of universal hearing screening and insufficient awareness, children in this group are treated and monitored by related specialists, which is the reason for delayed diagnosis and rehabilitation. The mild and moderate hearing loss remains neglected for a long time and manifests in older children. Thus, an examination by an audiologist and a comprehensive hearing assessment should be mandatory and paramount in the management algorithm for children with delayed psycho-speech development.

Проблема средних потерь слуха у детей в аспекте задержки речевого развития

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Введение: Проблема детской тугоухости с позиции ранней диагностики остается актуальной, особенно в условиях отсутствия универсального слухового скрининга. Основной проблемой является не совсем корректного, а зачастую отсутствие алгоритма ведения или так называемого «маршрута» ребенка с симптомами как задержка психо-речевого развития (ЗПРР). Как правило, при первых признаках ЗПРР первой инстанцией обращения бывают детские неврологи или дефектологи, но никак не сурдологи. Лишь осведомленность и профессионализм этих специалистов может стать подспорьем своевременной диагностики и коррекции. Особую актуальность при этом представляют легкие и средние потери слуха, потому как, наличие речи, пусть и дефектной, малоразборчивой, не вызывает опасения касательно слуховой функции, что ведет к долгим скитаниям по дефектологам

Цель: провести оценку функционального состояния органа слуха у детей с различными формами задержки речи.

Материал и методы: На базе Ташкентской Медицинской Академии и РНИЦСМ было обследовано 128 детей с направительными диагнозами ЗПРР. Всем детям было проведено комплексное аудиологическое обследование с применением субъективных и объективных методов (ЗВОАЭ, КСПВ воздушная и костная мульты АССР, игровая тональная аудиометрия с выработкой УДРЗ), а также все дети осмотрены дефектологом – сурдопедагогом.

Результаты: Из 78 детей, обратившихся в центр 24 (30,7%) были направлены дефектологом, 40 (51,3%) детей направлены детским неврологом и 14 (17,9%) детей пришли на диагностику слуха после осмотра оториноларгологом. При этом на отсутствие речи предъявляли жалобы родители 55 детей, у остальных детей родители жаловались на дефектную речь – 7 детей, «непонятную речь» – 4 детей, у 11 детей родители наблюдали отставание в школе. Комплексная аудиометрия у 33 детей выявила слуховые пороги, соответствующие возрастной норме, у 18 детей двустороннюю сенсоневральную тугоухость IV степени, у 7 детей сенсоневральную глухоту.

У 10 детей СП соответствовали двусторонней сенсоневральной тугоухости III степени, у 4 детей II степени, у 6 детей II–III степени, и у 2 детей I степени. При этом самый поздний показатель выявляемости тугоухости составил в группе детей с средними потерями слуха, а именно среди 22 детей, 11 детей в возрасте от 5–7 лет, 2 детей в возрасте 10 лет и 1 ребенок в возрасте 16 лет.

Выводы: Из 78 детей с проблемами развития речи, у 45 (57,7%) выявили те или иные нарушения слуха. Данный факт указывает, что в условиях отсутствия универсального слухового скрининга и недостаточной осведомленности дети данной группы проходят лечение и наблюдение у смежных специалистов, что является причиной запоздалой диагностики и реабилитации. Легкие и средние степени потери слуха долго остаются без внимания и проявляют себя в более в старшем детском возрасте. Таким образом, осмотр сурдолога и комплексная оценка слуха должны быть обязательными и первостепенными в алгоритме ведения детей с ЗПРР.

The psychological intervention on coping with tinnitus – assessment in an extended study

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Introduction: In The Institute of Physiology and Pathology of Hearing, a team of Psychologists conducts weekly group therapy in which patients learn to cope with the emotional effects of tinnitus and stress. Therapy is a unique project consisting of three thematic blocks: (1) psychoeducation, (2) relaxation therapy with the use of music therapy and bodywork, and (3) activating exercises to improve concentration.

Aim: Evaluation of the effectiveness of psychological group therapy to cope with tinnitus in an extended study.

Material: The study included 66 patients in the testing just after the intervention, an average age of 56.3 years (32–79), including women (68,2%) and men (31,8%) and 45 patients that completed all tests during 2 years after the intervention, the average age of 57.4 (32–79); including women (62.2%) and men (37.8%).

Methods: The therapy effect was evaluated based on the results of questionnaires in the following diagram: Beck Depression Inventory filled at the start of the therapy, after a month of the therapy and after 2 years of the therapy, and Tinnitus Functional Index (TFI) questionnaire completed, before, immediately after completion of the course, a month after- and 2 years after intervention. 2 years after the patients completed a short survey about how the level of perceived noise had changed and what factors were associated with this change in their opinion.

Results: In the study group, 54.5% of people received results indicating the presence of depressive symptoms from mild

to moderate levels of depression. Patients with more symptoms of depression much worse cope with tinnitus, mainly in emotional reactions to tinnitus, a sense of control over the problem and the quality of sleep. After treatment, there was a significant improvement in all subscales tested in TFI except for the subscale associated with hearing problems. The improvement was independent of age, depression level and duration of tinnitus. The research performed a month and 2 years after the intervention proved that the improvement has maintained. The intervention did not significantly change the level of depression in the subjects. After two years, in 40% of the subjects, the perceived loudness of tinnitus decreased, 33,3% remained at the same level, and 26,7% increased. 89% linked reducing tinnitus volume with a change in mental attitude. In this group, 68% referred in their statements directly to the importance of psychological intervention.

Conclusions: The results confirm the positive effect of psychological intervention on the patient's functioning, sleep, concentration, relaxation and emotional reaction to the perceived tinnitus. The observed improvement is stable and persists long after the intervention. Patients with diagnosed depression should be monitored and given additional targeted treatment.

The role of auditory stimulation by the means of hearing prostheses (hearing aids/implants) in tinnitus treatment

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The “European Tinnitus Guideline: Diagnosis, Assessment, and Treatment” from 2019 specifies hearing aid training and implant surgery as possible treatments for tinnitus in patients with concurrent hearing loss. The presentation outlines the mechanism of tinnitus and explains how using a hearing aid or implant reduces tinnitus sensation.

Tinnitus in patients with hearing loss caused by pathogenic variants of the GJB2 gene

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Introduction: Tinnitus is perception of phantom sounds which may resemble squeaking, buzzing, ringing or wind noise. They appear in the ears, in the head, or in the ears and head simultaneously, without an external source. Tinnitus is a scientific and clinical conundrum that affects 10–15% of the total population. Tinnitus is a complex problem due to its heterogeneity, ability to fluctuate, lack of objective measurement methods, and many possible causes in the absence of a precise molecular mechanism. Studies show that hearing loss plays an important role in the occurrence of this phenomenon.

Aim: The aim of the research was to characterize tinnitus in patients with non-syndromic hearing loss caused by *GJB2* pathogenic variants.

Material and methods: The research included a group of 100 respondents who were patients of the Institute of Physiology and Pathology of Hearing, diagnosed with non-syndromic hearing loss caused by pathogenic variants in the *GJB2* gene (c.[35delG];[35delG] vs c.[35delG];[101T>C] and c.[35delG];[109G>A]). Clinical data analyzed in the study included: *GJB2* genotype, age, sex and pure tone audiometry results. Patients' tinnitus was characterized with the THI questionnaire.

Results: Tinnitus was reported by 35% of the analyzed patients. The results indicated that particular *GJB2* genotypes are not associated with a higher incidence of tinnitus in the tested group, as well as gender, age and overall level of hearing loss. Characterization of tinnitus onerousness revealed that the more often tinnitus appears, the more annoying it is. There are no statistically significant differences in tinnitus onerousness between genotypes, sexes, age, hearing loss severity, duration of tinnitus and the overall time patients have suffered from tinnitus.

Conclusions: The study confirms the complexity of the tinnitus problem and implicates the need for an individual approach to each patient experiencing phantom sounds.

Tinnitus in patients with hereditary low frequency sensorineural hearing loss

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Introduction: Low frequency sensorineural hearing loss (LFSNHL) is a rare form of hearing loss, which affects mostly low frequencies (<2000 Hz). It has postlingual and progressive character, resulting in hearing loss at all frequencies, sometimes accompanied by tinnitus. LFSNHL might be hereditary and displays autosomal dominant pattern of inheritance. Most well-known genetic cause of LFSNHL are variants in exon 8 of *WFS1* gene, but the sporadic reports on involvement of other genes exist, such as *DIAPH1*, *MYO7A*, *TNC*, *CCDC50* and *CENPP*.

Aim: The study aims to explore the genetic background of LFSNHL and its coincidence with tinnitus in Polish patients.

Material: The group consisted of 43 patients (36 female, 7 male) of Genetic Outpatient Clinic of the Institute of Physiology and Pathology of Hearing. Criteria of inclusion were as follows: (1) diagnosed with LFSNHL, (2) no environmental hearing loss risk factors, (3) no pathogenic variants in *DFNB1* locus. The patients gave their written informed

consent. Material used for the genetic analyses was DNA isolated from whole blood.

Methods: The amplicon sequencing of exon 8 of *WFS1* gene was performed using Nextera XT DNA Library Preparation Kit and Miseq Illumina sequencing platform. Variants discovered in *WFS1* exon 8 underwent the pathogenicity assessment and segregation analysis in patients families. Patients without variants in *WFS1* exon 8 were qualified for targeted next generation sequencing (NGS) with our custom multi-gene panel (237 HL genes).

Results: Variants in exon 8 of *WFS1* were found in almost one third of patients (32.5%, 14/43). The analysis of segregation in the patients families was performed for 6 variants, revealing clear autosomal dominant mode of inheritance for 5 variants and 1 sporadic case. In patients without pathogenic variants in exon 8 of *WFS1*, the possible genetic cause was found for 6 out of 29 patients (21%), mostly within genes associated with autosomal dominant HL, like *TECTA* and *MYO6*. Tinnitus was reported by 19 out of 43 patients (44%). Proportions change when patients are divided in two groups based on their genetic status – 50% of patients with *WFS1* variant (7/14) and 41% of patients qualified for NGS multi-gene panel (12/29) reported tinnitus.

Conclusions: Our results confirm *WFS1* variants as common cause of LFSNHL. Probably causative variants detected with targeted multigene panel testing are localized mainly in genes involved in the development of hearing loss inherited in an autosomal dominant manner. Interestingly, while results point to heterogeneity of this type of HL, 2 variants were found in *TECTA*, that is usually associated with post-lingual, progressive HL. Tinnitus was reported by almost half of the recruited patients (44%) and exactly half of patients with *WFS1* variants. These results are consistent with data published so far. Presence of tinnitus might correlate with LFSNHL, especially since some of identified variants (i.e variants in *TECTA* and *MYO7A* genes) have been suggested recently as implicated in familial Ménière's disease, which main clinical features are HL, vertigo and tinnitus.

This research was supported by the National Science Centre, Poland (grant number 2016/22/E/NZ5/00470) and the Institute of Physiology and Pathology of Hearing.

Tinnitus in Polish patients with autosomal dominant hearing loss

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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 one of the most common type of hereditary HL and has an

onset usually after the first decade of life. Based on the literature data, ADHL is frequently accompanied with tinnitus.

Aim: The aim of the study was to unravel the genetic background of ADHL in a group of Polish patients and to estimate the prevalence of tinnitus.

Material and methods: In this study, 105 families with a vertical inheritance pattern of hearing impairment underwent targeted next-generation sequencing (NGS) using a HL multi-gene panel (237 genes). Genomic DNA was isolated from peripheral blood samples or buccal swabs of the available family members. Prior to NGS, environmental HL risk factors and *DFNB1* locus (*GJB2* and *GJB6*) related hearing impairment had been excluded in all probands. Presence of the selected probably pathogenic variants and their segregation with HL within the family were confirmed by a standard Sanger sequencing. Different audiological and clinical data, including the experience of tinnitus, were analyzed.

Results: Genetic cause of ADHL was identified in 43,8% (46/105) of the examined families. Among the 46 identified HL variants only 26% (12/46) have been previously reported and the remaining 74% are novel (34/46). Among the most common causative genes were *MYO6* ($n = 8$), *TBC1D24* ($n = 5$), *KCNQ4* ($n = 4$), *GSDME* ($n = 4$), *POU4F3* ($n = 4$) and *WFS1* ($n = 4$). Pathogenic variants causative of HL in the *SLC44A4*, *NLRP3*, *LMX1A*, *FGFR3*, *CD164*, *GRHL2*, *TMCI*, *COCH*, *ATP2B2* and *CEACAM16* genes were detected in single families. Tinnitus was reported in 43,5% (20/46) of patients with genetically determined HL. It was most frequently identified in patients with pathogenic variants located in *TBC1D24* ($n = 5$), *MYO6* ($n = 3$), *WFS1* ($n = 2$) and *POU4F3* ($n = 2$) genes.

Conclusions: Our custom panel has demonstrated a good diagnostic performance. Considering frequent identification of novel genetic variants it is necessary to perform thorough clinical examination and variant segregation analysis with ADHL in all available family members. Tinnitus may be reported in almost half of the genetically determined ADHL cases.

Supported by the National Science Center, Poland grant: 2016/22/E/NZ5/00470.

Tinnitus treatment as integrated method of rehabilitation in patients with Ménière's disease

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Aim: The aim of the study was to evaluate different otoneurological and audiological rehabilitation methods that can be used in Ménière's disease treatment.

Material and methods: A group of 800 patients with Ménière's disease was evaluated. The diagnosis was established after

clinical examination using audiological and otoneurological tests. The patients were subsequently referred to pharmacological treatment or surgery, if needed, and to rehabilitation. The authors focused on the latter method which included: vestibular training, balance exercises on Equitest – dynamic posturography, repositioning maneuvers, Brandt–Daroff exercises, tinnitus retraining therapy and hearing rehabilitation.

Results: Different methods of otoneurological and audiological rehabilitation were applied. Tinnitus therapy and vestibular training are crucial for patients with long term symptoms.

Conclusions: The role of integrated rehabilitation is critical in treating patients with Ménière's disease.

Tinnitus treatment with multicausal focus in 5 thousand patients

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Tinnitus (ringing in the ears) is a symptom with a high prevalence rate. It is estimated that around 15–31% of the world population experience it, in many different intensities. It can come from any part of the auditory system, being able to vary in amplitude, type and level of discomfort from patient to patient. We previously conducted a study of epidemiological evaluation on factors documented as causes for tinnitus, and its objective was to prove that tinnitus has a multifactorial origin, and, therefore, properly treating these factors, we would obtain results abolishing or reducing the symptom in most of the cases. It was asked in the initial anamnesis about poly pharmaceuticals, smoking, regular physical activities, stress, previous auditory diseases, hypercholesterolemia, thyroid alterations, cervical spine alterations, ATM alterations, sleep disorders, systemic arterial hypertension, daily consumption of candy and excess in carbohydrates and diseases correlated to sugar metabolism, daily intake of caffeine and alcoholic drinks, constant exposition to loud noises and neurological diseases. Some factors such as Vitamin D deficiency or hypozincemia, vitamin B12 deficiency were not included in the research, for not being studied factors in 2005 – year that the author initiated this study. Therefore, we would have a research bias if we included the data collected later on. Each of the factors above were studied individually, associated with treatment of secondary lesion in the auditory pathway, for example, of hydrops or vascular hypoacusis. 15,546 medical records were analyzed, of patients attended by the author, including only those who have tinnitus as their

main complain, and that had all the necessary data for the research collected, gathering 5 thousand records, for further study. Only those who did not have tinnitus as their main complaint or all data collected properly were excluded. We also gathered data regarding age, sex, time since the symptom was first noticed and time of monitoring and treatment. Every patient started treatment after the second appointment, after receiving the subsidiary exams results, having evaluated the control or lack of it over diseases already diagnosed, or necessity for primary treatment of newly shown diseases. The author's focus, from that point on, is to control all and any alteration able to cause suffering in the auditory pathway, and properly treat it. For such reason, the author is surrounded by a multidisciplinary team that act in its fields accordingly to the medications chosen by the author, when necessary. Then, the patients are monitored during the necessary time, and having the alterations in medication when necessary, following the data collected through Tinnitus Handicap Inventory (THI). A parallel protocol was created, in which the patient was monitored and the level of his/her recovery was analyzed and registered, varying from 0 to 100%, from 10 to 10%. Recovery of 40% or above was accepted for the research. Anything below was considered 0%. A cut-line was created regarding the end of treatment or monitoring for 2018, so that patients still undergoing treatment wouldn't interfere with the final results. From there, an index was created with the treatment's results, for later statistical analysis. Patients that had begun treatment and stopped before the second appointment, or gave up in the middle of the treatment were also included, in order to have an idea of the level of their accession to this type of approach. By the end of collection, the data was distributed in an Excel index, and later subjected to statistical analysis to obtain the study's limits of reliability. All patients were attended by the same doctor (author), always following the same protocol, which creates less chance for research bias. In conclusion we found: The parallel multidisciplinary treatment's efficiency is high, being positive in 91.7% of the cases, with interval and reliability of 95% in the percentual that showed improvement, varying from 90,6% to 92,8%. The adherence among the patients to such type of treatment is of 48,6%. Studies or ways to improve this percentage will be important in the future. 38% of the cases showed improvement of 100%. Global improvement was seen in 91.7% of the patients, being considered appropriate results to the study that of 40% of positive response. The results increased from 10 to 10% until 100%, starting from 40%, they were 9,7%, 11,5%, 6,2%, 11,2%, 17,4% and 38% respectively. Positive results with 70% or more of efficiency were seen in 72,5% of the cases. The average time of initiating treatment was 12 months. The average time of patient follow-up for treatment was 90 months.

Posters

An ABR study of central gain in individuals with chronic tinnitus

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Introduction: Chronic tinnitus is a symptom that can be present in subjects with or without changes in auditory thresholds. A hypothesis of neural deafferentation, in which changes in the auditory pathway cause alterations in multiple areas of the auditory and cerebral nervous system, explains why tinnitus is associated with central gain. Such changes would lead to neuroplastic reorganization, increased neural responsiveness, and, due to increased spontaneous neural activity, be experienced as unpleasant. The aim of this work was to check whether the presence of chronic tinnitus was associated with changes in click-ABR responses, which would support the neural deafferentation hypothesis.

Material and methods: This was an analytical, cross-sectional, and quantitative study approved by the Ethics Committee of the University, opinion number 56038322100005346. There were 51 ears in our study, which were divided into two homogeneous groups regarding sex and age: (a) A study group (EG), consisting of 25 ears with chronic tinnitus and mean age of 23.7 years; (b) A control group (CG) of 26 ears without tinnitus and the same mean age. Exclusion criteria were pharmacological treatment, noise exposure, dizziness, objective tinnitus of a pulsatile type, and diagnosed or evident neurological, psychiatric, or cognitive impairment. All subjects had previously submitted to an ABR with a click stimulus. They also underwent an anamnesis, basic audiological assessment, transient otoacoustic emission test, and behavioral assessment of central auditory processing. A Mann–Whitney *U*-test was used for data analysis, adopting a *p*-value ≤ 0.05 .

Results: There was a statistically significant difference between the groups in terms of the amplitude of wave I, with the EG presenting higher values.

Conclusions: Chronic tinnitus appears to cause a change in the amplitude of wave I of the ABR, a finding which suggests that chronic tinnitus may be associated with neural changes in the distal part of the auditory nerve. To confirm these findings, electrocochleographic studies should be carried out.

Assessment of subjective tinnitus treatment results using a prototype device for electrical and magnetic stimulation of the ear—preliminary study

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Aim: The aim of the study was to evaluate the effectiveness of subjective tinnitus treatment in patients with cochlear sensorineural hearing loss with magnetic ear stimulation using a prototype device. Since the 1970s, studies have been conducted on the use of electrical stimulation of the ear in the treatment of tinnitus. The available literature contains various hypotheses about the influence of electrical stimulation of the ear on tinnitus

Material and methods: Preclinical studies were performed for 100 patients, 40 women and 60 men (124 ears in total), aged 38–72 years, treated for tinnitus. A subjective assessment of the loudness of tinnitus was performed, and the frequency and intensity as well as hearing threshold were determined using a prototype device for electro-magnetic stimulation of the ear. The treatment cycle consisted of 10 five-minute stimulations performed daily 5 times a week.

Results: Before treatment, persistent tinnitus was found in 100 ears (80.6%) and periodic tinnitus in 24 ears (19.4%). Immediately after treatment, persistent tinnitus was present only in 50 ears (40.3%) and periodic tinnitus in 40 ears (32.3%). Complete resolution of tinnitus was noted in 34 ears (27.4%). On the other hand, the examination performed 3 months after the treatment showed persistent tinnitus in 40 ears (32.3%) and periodic tinnitus in 50 ears (40.3%), and complete resolution of tinnitus was recorded in 34 ears (27.4%). Based on the VAS analog scale, there was an improvement in tinnitus in 98 ears (79.0%) immediately after treatment and no improvement in 26 ears (20.0%). The mean VAS scale before treatment was 4.9 points, after treatment it was 2.1 points and 3 months after treatment it was 1.9 points.

Conclusions: As already mentioned, further research on the effectiveness of the prototype device for electrostimulation of the ear in patients with tinnitus is necessary. The results of the initial studies are encouraging. Preliminary research results show the high effectiveness of magnetic stimulation in the treatment of tinnitus with the use of a prototype device for electromagnetic stimulation of the ear. In addition to evaluating the effectiveness of therapy with this device, it is also very important to assess the safety of its use. The safety tests that have been carried out have shown that there was no negative effect of the stimulation on hearing or tinnitus, and no serious adverse events were observed.

Chronic disseminated coagulation syndrome and its role in the accelerated development of age-related hearing loss

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Introduction: The purpose of the study is the prevention and complex treatment of age-related hearing loss, taking into account the etiology, pathogenesis, and possible mechanisms for the development of hearing loss.

Material and methods: The data of the study of hearing with the help of pure-tone audiometry in older people are presented. The results of clinical significance in the prevention of age-related hearing loss are given on the example of the use of aspirin (acetylsalicylic acid). These results were obtained during an audiological study of two groups of patients. One group was made up of persons taking aspirin 50–75 mg daily as prescribed by cardiologists in the form of Thromboass 50 mg, or aspirin cardio, Cardiomagnyl 75 mg or Thrombopol 75 mg, while the other group did not take this drug. All these persons were examined at the age of 60–80 years.

Results: Those who regularly took aspirin had better hearing, those with severe hearing loss did not, while those who violated this recommendation or refused and did not take aspirin, had worse hearing.

Conclusions: To prevent an accelerated increase in age-related hearing loss associated with the indicated change in the state of the hemostasis system, it is advisable to recommend a daily intake of anticoagulants that have a de-aggregating therapeutic effect. With prolonged use of omega-3, an effect on lipid metabolism is manifested, which prevents the appearance of atherosclerotic changes in the vessels, i.e., neutralizes circulatory disorders that increase with age.

Хронический синдром диссеминированного свертывания и его роль в ускоренном развитии возрастной тугоухости

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Введение: Целью исследования является Профилактика и комплексное лечение возрастной тугоухости с учетом этиологии, патогенеза и возможных механизмах развития тугоухости.

Материал и методы: Приведены данные исследования слуха с помощью тональной пороговой аудиометрии у лиц старшего возраста. Даны результаты клинического значения в профилактике возрастной тугоухости на примере использования аспирина (ацетилсалициловой кислоты). Эти результаты получены при аудиологическом исследовании 2-ух групп больных. Одна группа была составлена из лиц, принимающих по назначению

кардиологов аспирина по 50–75 мг ежедневно в виде Тромбоасс 50 мг, или аспирина кардио, Кардиомагнил 75 мг или Тромбопол 75 мг, то другая группа не принимала этот препарат. Все эти лица были обследованы в возрасте 60–80 лет.

Результаты: Слух у тех, кто регулярно принимал аспирин, слышали лучше, среди пациентов с выраженными проявлениями тугоухости не было, в то время как у лиц, которые нарушили эту рекомендацию, или отказывались и не принимали аспирин, слух был хуже.

Выводы: Для предупреждения ускоренного нарастания возрастной тугоухости, связанный с указанным изменением состоянием системы гемостаза желательнее рекомендовать ежедневный прием антикоагулянтов, которые обладают дезагрегационным терапевтическим эффектом. При длительном приеме омега-3 проявляется влияние на липидный обмен, что препятствует появлению атеросклеротических изменений в сосудах, т.е. нейтрализует возрастающее с возрастом нарушение кровообращения.

Creating and using mobile applications for tinnitus assessment and therapy: a scientific literature review

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Introduction: Tinnitus is the conscious hearing of a tonal or complex sound for which an appropriate acoustic source cannot be identified in the environment. About 10–15% of the general population is affected by tinnitus. Tinnitus requires multidisciplinary care because of various causative factors and a wide range of consequences in daily life. Access to reference centers with specialized and multidisciplinary staff is limited for many people due to distance and long waiting times. To circumvent these barriers, specialists are looking for solutions in increasingly common access to the Internet and increasingly widespread use of mobile devices. Furthermore, smartphones have an application ecosystem that can be extended by new apps programmed for a particular health problem.

Aim: Assessment of the scale and direction of creating and using mobile applications to diagnose and treat tinnitus.

Material and methods: Google Scholar and PubMed were searched for the 13 years 2010–2023. The search strategy used the following keywords: ‘tinnitus mobile applications’, ‘smartphone-based treatment tinnitus’, ‘smartphone-based diagnostic tinnitus’, ‘CBT apps’, ‘sound and relaxation therapy apps’, ‘tinnitus therapy smart’, ‘artificial intelligence tinnitus’. In the next stage, the search strategy included reviewing interesting articles in references. The results of the review were catalogued and organized into themes.

Results: Results were organized into the following themes: (1) ranking evaluation and analysis of applications supporting tinnitus therapy existing in the Internet space; (2) applications supporting the diagnosis of tinnitus, with particular emphasis on the EMAs program (Ecological Momentary Assessment) and the TruckYourTinnitus application; (3) applications supporting the therapy of tinnitus, especially CBT (Cognitive Behavioral Therapy) apps, sound and relaxation therapy apps which effectiveness has been scientifically tested, development and testing of prototypes, in particular, based on the Tinnitus Coach application; (4) a look into the future – the use of sensors built-in or connected with mobile devices, the use of artificial intelligence (AI), the development of systems for collecting and processing data from applications.

Conclusions: Tinnitus diagnostic applications supplement the diagnosis with the fluctuation of tinnitus in real-time and the natural environment of the examined person, enabling the correlation of these fluctuations with other factors in the user's environment or in his body. Combining the application with a central database that collects and analyzes anonymized user data is a valuable source for developing scientific research. There is a need for an application for tinnitus therapy that includes a varied psychological program. The more intuitive and step-by-step psychological tasks in the application are, the more attractive they will be. Applications increase the availability of therapy, and, at the same time, their frequent use daily does not increase the tinnitus over time. Personalized AI modelling should result in the development of smart therapy platforms for tinnitus in future.

Factors influencing psychological evaluation of tinnitus patients

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The study was carried out to determine the impact of some co-morbid otological symptoms and demographic factors on the emotional distress and cognitive functioning in patients with tinnitus. One hundred consecutive patients, complaining of constant idiopathic tinnitus, were enrolled into the study. Four tests were administered: Beck Depression Inventory (BDI), Hospital Anxiety Depression Scale (HADS, A – anxiety, D – depression), Mini-Mental State Examination (MMSE) and Trail Making Test (TMT). A multivariate stepwise linear regression analysis was performed to estimate the relationship between the results of each of the tests and following co-morbid factors: age, sex, tinnitus duration, tinnitus laterality, hearing status (normal hearing, unilateral hearing loss, bilateral hearing loss) and vertigo/dizziness. It was found that the scores of MMSE and TMT were negatively correlated with age and with hearing status and the scores of HADS-A were slightly correlated with sex. In regression analysis, in HADS-A, sex and to a lesser extent tinnitus duration, in MMSE and TMT, age and to a lesser extent tinnitus laterality were the variables that were comprised in the final model. Demographic factors had contributed more than overlapping otological symptoms to the psychological outcome in tinnitus patients.

Hearing loss and tinnitus after ultrasonic scaling: a case report

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Introduction: An acoustic injury may cause sudden hearing loss. The severity of the symptoms depends on individual sensitivity to noise, its intensity, nature, and duration of exposure. Tinnitus is one of the early predictors of noise-induced hearing loss. Using a dental ultrasonic scaler may be a potential hazard to the patient's hearing.

Case study: We report a 39-year-old man who presented to World Hearing Center with unilateral hearing loss and tinnitus. Symptoms occurred immediately after ultrasonic scaling. Pure tone audiometry showed normal hearing. High-frequency audiometry revealed right-sided high-frequency hearing loss. The patient was admitted to WHC, and appropriate treatment was initiated. After treatment, hearing returned to normal.

Conclusions: Ultrasonic noise exposure may be related to high-frequency hearing loss. Damage to the operator's hearing can occur through airborne subharmonics of the ultrasonic scaler. Damage to a patient's hearing can occur through ultrasound transmission to the inner ear by the bones of the skull. In the case of acute hearing impairment, it is necessary to introduce treatment according to the guidelines for the treatment of sudden deafness.

Hearing, speech, and voice disorders as a result of post-COVID-19 condition

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Aim: The pandemic has affected the lives of millions of people around the world, causing extraordinary disruptions in healthcare delivery, economic activity, and social interaction. As many as one-third of those recovering are struggling with symptoms of post-COVID-19 condition. The term, defined by the WHO, is a condition of long-term persistent symptoms. It is diagnosed when the following conditions are met. First, it follows probable/ confirmed infection with SARS-CoV-2; second, symptoms occur within 3 months of infection and persist for min. 2 months; thirdly, they cannot be explained by an alternative diagnosis.

Material and methods: The material of the study consisted of patients presenting to the Audiology and Phoniatrics Policlinic of the IFPS for post-COVID-19 condition. Out of 6674 patients under the outpatient care of doctors, the study's authors, nearly 20 people presented post-covid condition causing hearing, voice, or speech disorders. All patients

underwent standard otolaryngology-phoniatric diagnostics depending on the complaints reported. Uncharacteristic and often very inconvenient complaints sometimes required highly specialized diagnostics. In situations where the standard diagnostic package did not allow the cause of the complaint to be determined, we used supportive tests with lesser availability and innovations in medicine to exclude other conditions. In addition, patient care often requires close cooperation with physicians of other specialties.

Results: Patients with hearing, voice, and speech disorders due to post-COVID-19 disease are 90% professionally active. The average age in this group is 50 years. Half of the patients are in an occupation that requires a higher level of vocal function. The vast majority of these individuals have gone through COVID-19 mildly. The most common health problems reported by patients were fatigue, hindered breathing, and cognitive impairment. The most common auditory, voice, and speech symptoms were cough, breathing difficulties, neuralgias, tinnitus, cognitive impairment, and a number of less common long-term complications such as voice or hearing impairment.

Conclusions: Post-COVID-19 condition presents with uncharacteristic symptoms, often underestimated by patients and those close to them. Patients' persistence in seeking help is due, among other things, to the increasing importance of good hearing and voice performance in society. In addition, the inconvenience of the symptoms and the serious impact on functioning may be associated with a long diagnostic process related to minor deviations in additional tests and prolonged treatment.

Is it up there? An MR spectroscopy study of frontal lobes and non-primary-auditory temporal areas in subjective bilateral and unilateral tinnitus

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Aim: Subjective tinnitus is a prevalent, though heterogeneous, condition whose pathophysiological mechanisms are still under investigation. Based on animal models, changes in neurotransmission along the auditory pathway have been suggested as co-occurring with tinnitus. It has not, however, been studied whether such effects can also be found in other sites beyond the auditory cortex. Our MR spectroscopy study was therefore aimed to measure composite levels

of glutamate and glutamine (Glx) in bilateral medial frontal and non-primary auditory temporal brain areas in tinnitus.

Material: We studied two groups of participants with unilateral and bilateral tinnitus ($n = 24$ and 28 respectively) and a control group without tinnitus ($n = 25$), all three with a similar hearing profile.

Methods: All participants were scanned in a 3T Siemens Prisma FIT scanner with a 20-channel receiver head-coil. A single voxel spectroscopy (SVS) PRESS (Point-Resolved Spectroscopy Sequence) sequence was applied for collection of MRS data from four locations in the brain: left temporal lobe, right temporal lobe, left frontal lobe, right frontal lobe. The parameters were: voxel volume = $1.5 \text{ cm} \times 1.5 \text{ cm} \times 1.5 \text{ cm}$ (3.75 cm^3), TR (time of repetition) = 2000 ms, TE (time of echo) = 40 ms, TA (time of acquisition) = 4 min 16 s, 128 averages with 1024 time points and 1200 Hz bandwidth. Raw data from each voxel in each participant was analyzed with LCModel version 6.3-1R, which resulted in estimates of brain metabolite levels, including Glx, represented as ratios to tCr (total creatine).

Results: We found no metabolite level changes as related to tinnitus status in neither region of interest, except for a tendency of an increased concentration of Glx in the left frontal lobe in people with bilateral vs unilateral tinnitus.

Conclusions: In conclusion, we show no relationship between tinnitus status and levels of Glx levels in the non-primary auditory temporal, and frontal brain regions. Nevertheless, our results indicate that glutamate concentration in the left frontal lobe may play a different role in the development and maintenance of bilateral, as compared to unilateral subjective tinnitus. The potential mechanisms may be related to the functioning of the frontal-limbic-auditory noise canceling/inhibition system, attention control as well as psychological aspects of tinnitus. Further research is still necessary to explore the relationship between the tinnitus percept and the neurotransmitter systems in the brain. Emerging methodological advances in MRS may facilitate the process.

Long-latency auditory evoked potentials and cortical gain in patients with tinnitus disorder: a preliminary study

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Introduction: Previous research has pointed to evidence of changes in the central auditory nervous system (CANS) in

individuals with tinnitus disorder, reflected as an increase in central gain in the brainstem. The long latency auditory evoked potential (LLAEP) plays an important role in the analysis of patients with tinnitus disorders; however, little is known about corresponding changes in the cortex.

Aim: To measure in subjects with tinnitus disorder the amplitude of the LLAEP components and the cortical gain in terms of the ratio between the P2/P1 waves.

Material and methods: This was an analytical, cross-sectional, and quantitative study approved by the Research Ethics Committee (nr 56038322.10000.5346). The sample comprised 20 individuals divided into two groups, which were homogeneous in terms of gender, age, and education. The first was a study group (SG): 7 women and 5 men aged 19–35 years (mean = 24 years); evaluations were done on 11 right ears (RE) and 12 left ears (LE); 10 individuals had bilateral tinnitus and 2 had unilateral tinnitus in the LE. The second was a control group (CG): 5 women and 3 men aged 19–35 years (mean = 25 years); 16 right ears (RE) and 16 left ears (LE) were evaluated. Inclusion criteria for both groups were: educated, right-handed, Brazilian Portuguese speakers, hearing thresholds within normal ranges, normal mobility of the tympanic–ossicular system, normal contralateral stapedial acoustic reflexes, integrity in cochlear functioning, and normal brainstem responses. Exclusion criteria were: pharmacological treatment for tinnitus, noise exposure, dizziness, objective tinnitus of a pulsatile type, and diagnosed or evident neurological, psychiatric, or cognitive impairment. Testing: All individuals were submitted to anamnesis, basic audiological evaluation, evaluation of transient otoacoustic emissions, click ABR, and LLAEP.

Results: Data analysis involved a Mann–Whitney *U*-test, adopting a *p*-value ≤ 0.05 . Statistically significant differences between the groups were observed only for the amplitude of the P2 component ($p = 0.017$) in the left ear.

Conclusions: These preliminary results corroborate the hypothesis that the presence of tinnitus can cause changes in the lower regions of the CNS, such as in the brainstem; however, in the cortex, there are few alterations and the LLAEP may not be a good predictor of central gain in such cases. Our studies need to be performed on a larger number of patients to confirm these initial findings.

Neurovascular conflict occurrence among tinnitus patients

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Aim: Neurovascular conflict (NVC) is diagnosed using magnetic resonance imaging. In spite of known guidelines in NVC diagnosis, determining the degree and probability of

occurrence is problematic. NVC is often diagnosed among tinnitus patients of the Institute of Physiology and Pathology of Hearing (IPPH). The purpose of this study is to determine the exact frequency of NVC among patients with tinnitus and control individuals without tinnitus.

Material: In a retrospective study design, we included 8353 patients with available MRI head scans acquired using CISS sequence. All of the data has been acquired between 2017 and 2021.

Methods: All participants were scanned in a 3T Siemens Prisma FIT scanner with a 20-channel receiver head-coil. The CISS sequence used for image acquisition had the following parameters: repetition time (TR) = 8.76 ms, echo time (TE) = 4.38 ms, flip angle = 51°, voxel size = 0.5 mm × 0.5 mm × 0.5 mm. The MRI interpretations have been prepared by five experienced radiologists and included determination of the existence (or risk of existence) of NVC among the patients. In addition to information about NVC, extracted from MRI reports, information about occurrence of tinnitus has been extracted from patient history. Frequency of NVC among patients with and without tinnitus was then calculated.

Results: Out of 8353 patients from the whole database, 904 (10.8%) had varying degrees of probable NVC described by a radiologist (18.36% of which were bilateral) and 2540 (30.4%) had tinnitus. Out of patients with tinnitus 369 (14.5%) had some form of NVC risk diagnosed, while out of patients without tinnitus 535 (9.2%) had probable NVC.

Conclusions: A large group of patients treated at IPPH was selected for the study. Elevated frequency of probable NVC was observed for tinnitus patients, however the sole risk of NVC remains non-specific to tinnitus. We hypothesize that one of the reasons may be the relative difficulty of assessing NVC with exact determination of clinical relevance of radiological observation in this aspect. Due to the problem of NVC evaluation, it would be recommended to evaluate NVC risk by several independent physicians and determine the exact degree of probability of NVC. It would also be advisable to assess the degree of annoyance of tinnitus among the people with NVC.

Preliminary results on auditory and vestibular complaints in post-COVID-19 patients

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Introduction: Studies of patients after COVID-19 virus infection point to various auditory and vestibular impairments.

To confirm such complaints, tests of the auditory and vestibular systems can be done, but an alternative way to obtain data on a large number of individuals is through a self-assessment questionnaire done online. The hypothesis of this study is that most online subjects will report a change in auditory and vestibular perception after infection.

Material and methods: Participants were 20 to 54 years of age, of both sexes, had completed elementary school education, had been positive on a PCR test for COVID-19, and resided in São Paulo. They were volunteers recruited by verbal invitation from the researcher or by advertisements on social networks and websites. After giving informed consent, the participants answered an online questionnaire containing 52 questions about personal information, diagnosis and treatment of COVID-19, health conditions, and hearing history. Questions were also asked about conditions, pre and post-diagnosis of COVID-19, of hearing, tinnitus, and dizziness. A visual analog scale was also used for these items.

Results: Some 100 responses were obtained from the online questionnaire from 8 March 2022 to 17 April 2022. Of these, 69 met all the inclusion criteria for the study and were analyzed (16 males and 53 females). We found there was increased difficulty in communication after COVID-19, especially for males, with a greater incidence of bilateral and sudden hearing loss. Some subjects reported the appearance of tinnitus, and for those who already had the condition, 75% said it had worsened. There was an increase in the number of subjects who reported non-rotational dizziness and associated symptoms. Visual analogue scale scores for hearing, tinnitus, and dizziness were worse post-COVID-19.

Conclusions: Preliminary results indicate that our volunteers reported a worse quality of life due to persistent symptoms triggered by COVID-19. They reported auditory and vestibular alterations, such as dizziness and tinnitus, either triggered or worsened by COVID-19. However, the reported changes cannot be directly attributed to COVID-19 infection without undertaking further clinical studies.

Prevalence and severity of tinnitus in otosclerosis

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Aim: To assess the prevalence and severity of tinnitus among a group of patients with otosclerosis who qualified for stapes surgery

Material and methods: 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. The Tinnitus Functional Index (TFI) was used to assess tinnitus severity. Preoperative pure-tone audiometry was conducted in every patient. The mean hearing thresholds for air conduction and bone conduction were determined to be 500, 1000, 2000 and 4000 Hz.

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.

Conclusions: The basic criterion for qualification for stapes surgery is the degree of the hearing impairment. Tinnitus is not considered in the qualification process. Meanwhile, tinnitus is a common complaint among patients with otosclerosis, being a significant or severe problem for more than half of them.

Prevalence of CAPD in children with tinnitus

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Introduction: Tinnitus, defined as the perception of sound in the absence of external auditory stimulation, is a prevalent audiological condition affecting various age groups, including pediatric patients. The perception of tinnitus may influence a child's emotional well-being, insomnia, social relationships, and auditory and cognitive processing. It can easily become overwhelming. These, in turn, may affect their school performance. This study investigates the prevalence of central auditory processing disorders (CAPD) in children with tinnitus.

Material and methods: The study group consisted of 2046 students with normal hearing and reported tinnitus. Of these, 85 children (4.1%) experienced tinnitus always and often; 601 (29.4%) experienced tinnitus sometimes; and 1360 (66.5%) reported tinnitus rarely. All parents completed the Scale of Auditory Behaviors.

Results: On the SAB questionnaire, a pass score (60–46 points) was obtained by 1086 students (53.1% of the study group). Nine hundred sixty children (46.9%) had a reduced score (45–12 points). Many participants experiencing tinnitus

and reduced questionnaire scores reported learning difficulties, mainly related to concentration disorders and listening difficulties.

Conclusions: The study confirms that tinnitus affects central auditory processing, particularly children's ability to maintain concentration, while also affecting their emotional well-being through feelings of annoyance, anxiety, or misunderstanding. The implications extend to tinnitus's wider impact on the overall quality of life and sense of isolation which are also relevant when managing a child with tinnitus. Considering that tinnitus in children may provoke serious consequences, even in the absence of ear pathology, it is necessary to investigate and understand this symptom in pediatric patients to develop holistic strategies.

Prevalence of tinnitus in a sample of 43,064 children in Warsaw, Poland

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Introduction: Children rarely complain spontaneously of tinnitus, and their parents are not aware of the condition. The prevalence of tinnitus in children differs considerably between studies, and large studies are needed to reliably estimate how many children experience tinnitus symptoms. The goal of the study was to estimate the prevalence of tinnitus in a large sample of schoolchildren.

Material and methods: This study was population-based, epidemiological research, conducted in the general, pediatric population of school-age children in Warsaw, Poland. Results from 43,064 children aged 11 to 13 years old, as well as their parents, were collected. Pure-tone audiometric testing was done, and hearing thresholds were determined from 0.5 to 8 kHz. Both the children and parents answered questions about the presence of tinnitus in the child.

Results: The study showed that tinnitus affected 3.1% of the children, but it was significantly more frequent (9%) in children with hearing loss. We found that 1.4% of the parents were aware of the presence of tinnitus in their children.

Conclusions: Results of the study show that there is a need to introduce a routine question about experiencing tinnitus during pediatric check-ups. Particular attention should be paid in cases of children with hearing impairment because of the higher risk of comorbid tinnitus. Further management, if needed, should be conducted in appropriate pediatric settings

by health care professionals who have the skills and knowledge to work with children.

Simultaneous adenoidectomy with adenoid hypertrophy and subsequent uranoplasty with congenital cleft palate

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Introduction: Nowadays, congenital cleft lip and palate is the most common congenital malformation of the maxillofacial region. According to different authors, this defect occurs among newborns with a frequency of 1 to 500–1000 in different regions. 30% of patients with congenital cleft palate also have concomitant ENT diseases. The aim of the study is to facilitate simultaneous adenoidectomy and uranoplasty to improve treatment results in children with congenital cleft palate and prevent facial deformity.

Material and methods: The material included 130 patients with congenital cleft lip and palate and hypertrophied adenoids of the 3rd degree under our supervision. All patients were operated on under general intubation anesthesia. During surgery, adenoidectomy was performed by an ENT specialist, and next, uranoplasty by a maxillofacial surgeon.

Results: Immediate treatment results after the surgery show the general condition of the patients is satisfactory, and the procedure is well tolerated. On the first day after the surgery, pediatric patients are capricious, complain of pain in the postoperative area, and have difficulty eating due to the pain when swallowing. The above complaints are noted on the first day after surgery in the operated children with congenital cleft palate, pain in the postoperative period is observed in 100% of children. On the first day after the surgery, almost 100% of children had hyperemia and edema of the soft tissues of the hard and soft palate and the nasopharynx. The niche is hyperemic and edematous on both sides, but there is no bleeding from the wound.

An increase in body temperature after surgery on the 1st day is observed: up to 38.5°C in 98.2% of children. 1.8% of children after surgery had a body temperature of 37.8°C. On the third day after surgery, 89.2% of children expressed moderate pain, and 11.8% mild, intermittently present pain. Edema and hyperemia gradually decreased in 85.6% of children, and 14.4% still had edema. The body temperature returned to normal in 98.1%, and 1.9% had 37.1°C.

The pain stopped on the fifth day after the surgery of simultaneous adenoidectomy and uranoplasty. Edema and hyperemia of the postoperative wound subsided, and the niche of the two sides and the nasopharynx was epithelialized. Children became more active, started eating full meals, and hemodynamic parameters normalized. It is noted that after surgery, children started breathing through the nose, there was no snoring, and excretion from the nasal cavity stopped. Thus, the simultaneous surgery to remove pathological growths of the adenoids and plastic surgery of the congenital cleft of the hard and soft palate allows for achieving positive long-term treatment results, which cannot be achieved when treating with two separate operations.

There were no serious complications in patients treated by this method ($n = 130$). The wound healed by primary intention without suture divergence. The risk of adenoid growths lies in the fact that under the pressure of the adenoid mass on nearby tissues and its congestive hyperemia, the process of phonation and articulation of the palatal curtain is disrupted, but after the above method of surgery, all processes are normalized. At the same time, breathing improves significantly in children with this pathology in the postoperative period, and the voice normalizes, thereby improving speech development. When examining 130 children with congenital cleft palate with concomitant diseases of hypertrophy of the adenoids, we revealed a violation of the patency of the Eustachian tubes in 86.2% of children before surgery. We used the best research methods, such as anterior rhinoscopy, mesopharyngoscopy, otoscopy, examination of the tympanic cavity (tympanometry), and audiometry to identify hearing impairment, evaluate dynamic performance before and after surgery in a given area (upper lip, nose, palate).

Tympanometry was performed for all children in the study group. Tympanometry type A (normally functioning auditory tube) was established in 58 (44.6%) patients before and after surgery. Of 29 (22.3%) children, 20 had type B before the surgery (presence of accumulation of exudate in the middle ear), and 9 had type B and C. In 43 (33.0%) children out of 130 had type C (impaired ventilation function of the auditory tube) before surgery. Early surgical treatment of uranoplasty restores the function of the ear canal.

Conclusions: Based on the presented results of the study, it is necessary to develop a unified algorithm for examining and treating pediatric patients with congenital cleft hard and soft palate and pathology of the adenoids. Early diagnosis and performing a complex surgery – uranoplasty and simultaneous adenoidectomy will allow us to contribute to the growth of a healthier generation and also shortens one stage of the surgery. The advantage of the presented method lies in the fact that the ENT specialists manage to determine the full extent of the boundaries of adenoid growths, which makes it possible to perform the surgery more efficiently and reduce potential complications. Long-term dynamic monitoring of children with congenital cleft lip and palate is necessary for an ENT specialist. We found that the middle ear problem persists in this contingent of children. Early surgical treatment of simultaneous adenoidectomy and uranoplasty repairs the palate's defect and restores the auditory canal's function.

Одномоментно аденоидтомия при гипертрофированной глоточной миндалине и последующем уранопластике при врожденной расщелина неба

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Введение: На сегодняшний день врожденная расщелина верхней губы и неба является наиболее распространенной среди всех врожденных пороков развития челюстно-лицевой области. По данным разных авторов, этот

порок встречается среди новорожденных с частотой 1 к 500–1000 в разных регионах. У 30% больных с врожденной расщелиной неба встречается сопутствующие ЛОР заболевания.

Цель: Способствующие одномоментной аденоидтомии и уранопластики улучшению результатов лечения у детей с врожденными расщелинами неба и профилактике деформации лица.

Материал и методы: Под нашим наблюдением находилось 130 больных с врожденной расщелина верхней губы и неба, а также гипертрофированной глоточной миндалины 3 степени все пациенты были прооперированы под общим интубационным наркозом одномоментно произведена операция ЛОР-врачом аденоидтомия и последующем челюстно-лицевым хирургом уранопластика.

Результаты: Ближайшие результаты лечения после операции общее состояние пациентов, в динамике удовлетворительное, операцию перенесли хорошо. Первые сутки пациенты детского возраста капризничают, имеют жалобы на болевые ощущения сильно выражен в послеоперационной области, затрудненный прием пищи из-за боли при глотании. Из оперированных детей врожденной расщелина неба отмечается выше указанные жалобы на первой сутки, боли в послеоперационном периоде отмечается у 100% детей.

Детей первый сутки после операции отмечались гиперемия и отёк мягких тканей твердого и мягкого неба, а также носоглотки почти 100% детей. Нища с двух стороны гиперемированно отечное, но кровотечение из раны не отмечается. Повышение температуры тела после операции на 1-е сутки до 38,5°C у 98,2% детей; 1,8% детей после операции температура тела было 37,8°C.

После третьей суток в стационаре боли постепенно в динамике интенсивность боли умеренно выражен – 89,2% детей, 11,8% детей динамика боли держались по-прежнему слабо выражено, частично присутствуют. Отеки и гиперемия постепенно уменьшается у 85,6% детей, 14,4% детей отеки держится. Температура тела детей на третьи сутки 98,1% нормализовалось 1,9% субфебрильная 37,1°C.

На пятые сутки после операции одномоментной аденоидтомии и уранопластика боли прекращались. Отеки и гиперемия послеоперационной раны спал, нища двух стороны, а также носоглотки эпителизируется. Дети становится бодрым начинается полноценный прием пищи, нормализуется гемодинамические показатели. У детей отмечается что после оперативного вмешательства происходит восстановление активного дыхания через нос, храп отсутствует, выделения из носовой полости прекращаются. Таким образом, проведенная одномоментно операция по удалению патологических разрастаний миндалин и пластика врожденной расщелины твердого и мягкого неба, позволяет добиться положительных отдаленных результатов проведенного лечения, чего нельзя добиться при лечении двумя разными операциями.

У прооперированных данным методом пациентов ($n = 130$) серьезных осложнений не отмечалось. Рана

зажила первичными натяжением без расхождения швов. Опасность аденоидных разрастаний заключается в том, что под давлением аденоидной массы на близлежащие ткани и ее застойной гиперемии нарушается процесс фонации и артикуляции небной занавески, но после вышеуказанного метода операции все процессы нормализуются. При этом у детей с данной патологией в послеоперационном периоде значительно улучшается дыхание и нормализуется голос, тем самым улучшается речеобразование. Нами при обследовании 130 детей с врожденной расщелиной неба с сопутствующими заболеваниями гипертрофии глоточной миндалины было выявлено нарушение проходимости евстахиевых труб у 86,2% детей до операции. Мы использовали оптимальные методы исследования, такие как передняя риноскопия, мезофарингоскопия, отоскопия, исследование состояния барабанной полости (тимпанометрию) и аудиометрию дабы выявить отклонения слуховых качеств, оценить динамические показатели до и после операции в заданной области (верхняя губа, нос, небо).

Проведено обследования у 130 детей тимпанометрии врожденных расщелиной верхней губы и неба, установлено преобладание типа тимпанометрии «А» (нормально функционирующая слуховая труба) у 58 (44,6%) пациентов до и после операции. У 29 (22,3%) детей, из них до операции у 20 детей отмечено тип «В» (наличие скопления экссудата в среднем ухе), у 9 детей отмечено тип «В и С». У 43 (33,0%) детей из 130 врожденной расщелина неба имелась Тип «С» (нарушение вентиляционной функции слуховой трубы) до операции. Ранняя оперативное лечение уранопластика восстанавливается функции слухового прохода.

Исходя из представленных результатов исследования необходимо выстраивание единого алгоритма обследования и лечения пациентов детского возраста с врожденной расщелиной твердого и мягкого неба и с патологией глоточной миндалины. Ранняя диагностика и проведение сложносоставной операции пластики дефекта (уранопластика) и одновременно аденоидтомии позволит нам способствовать подрастанию более здорового поколения, а также сокращает один этапы операции.

Выводы: Таким образом, преимущество при данном методе заключается в том, что ЛОР-врачу удается определить в полном объеме границы аденоидных разрастаний, что позволяет эффективнее провести операцию, повысить результативность, уменьшить возможные осложнения. Динамическое наблюдение за детьми ВРВГиН необходимо оториноларинголога в течение длительного времени. Нами выявлено, что проблема со стороны среднего уха сохраняется у данного контингента детей. Раннее оперативное лечение одновременно аденоидтомии и уранопластики восстанавливается дефект неба и функции слухового прохода.

The effectiveness of mindfulness-based cognitive therapy in the management of tinnitus

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Introduction: Tinnitus is defined as the perception of sound in the absence of an external sound source. Approximately 10–15% of the population suffer from chronic tinnitus and have significant psychological problem. The pathogenesis of tinnitus remains unknown. Maladaptation of the central auditory system to compensation associated with a prior peripheral injury is one of the most frequently discussed reason. Several treatment modalities are used for management of the tinnitus, no consensus regarding effective modalities has emerged. Many present study suggested that the Mindfulness-Based Cognitive Therapy (MBCT) is one of the modality that is effective in the treatment of tinnitus in terms of reduce the effect of tinnitus and improve quality of life of the patients.

Aim: To evaluate the effectiveness of Mindfulness-Based Cognitive Therapy in the management of tinnitus.

Material and methods: This study is designed as an quasi-experimental study. Study was conducted in patients who were diagnosed as tinnitus. 45 patients were enrolled in this study. The mindfulness group consisted of 24 patients and the control group consisted of 21 patients. The evaluation of the effect was made by using Tinnitus Handicap Inventory (THI), Hospital Anxiety and Depression Scale (HADS) and measuring the intensity of tinnitus.

Results: Statistically significant improvement was seen in all outcome measures except the intensity of tinnitus in both treatment groups. The change in THI and HADS was greater in the mindfulness group than control group after 4 week-course and at 3 months follow up.

Conclusions: This study suggested that Mindfulness-Based Cognitive Therapy shows some effective in the management of tinnitus in terms of the improvement of THI and HADS, overall quality of life.

The use of VR in tinnitus therapy: a literature review

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Introduction: Tinnitus is the perception of tonal or complex sounds for which no external acoustic source can be identified. It becomes a disorder (tinnitus disorder) when accompanied by emotional stress, cognitive impairment and/or autonomic nervous system arousal, leading to changes in behaviour and functional disability. Tinnitus is associated with

varying levels of discomfort and/or suffering. Available treatment methods, in most cases, are unsatisfactory as they do not lead to a total elimination of this condition. Therefore, this means there is a need to manage tinnitus to have the least possible impact on the daily functioning of people experiencing it. Virtual reality (VR) is a rapidly developing technology that is increasingly being used in psychology and medicine, among others, in the psychotherapy of anxiety disorders and neurological rehabilitation.

Aim: This paper aims to review the scientific literature on the use of VR in tinnitus therapy.

Results: This paper collects current data on using VR technology in tinnitus therapy. Scientific reports on the prevalence of VR in tinnitus therapy, possible benefits and limitations resulting from its use were analyzed. The subject of interest also includes the assessment of the effectiveness and safety of therapy using VR and the types of methods used.

Conclusions: Technology may be helpful in tinnitus therapy, but further randomized studies are necessary.

Tinnitus assessment by THI in patients with idiopathic sudden sensorineural hearing loss

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Introduction: Idiopathic sensorineural hearing loss (ISSNHL) is characterized by a loss of at least 30 dB in three contiguous frequencies on pure tone audiometry over 72-hour period. ISSNHL is very often accompanied by tinnitus. The Tinnitus Handicap Inventory (THI) is a self-report measure to determine perceived tinnitus handicap severity. The THI comprises 25 items grouped into three subscales: functional (role limitations in the areas of mental, social/occupational, and physical functioning), emotional (affective reactions to tinnitus), and catastrophic (catastrophic thinking about the symptoms of tinnitus, including a sense of lack of control).

Aim: The aim of this study was the assessment of the quality of life of patients suffering from idiopathic SSNHL and to evaluate the influence of parameters, i.e., the time elapsed since the episode of sudden deafness, hearing level, and speech discrimination on the level of tinnitus.

Material and methods: A total of 14 patients (6 male, 8 female) ranging in age from 31 to 75 years (mean age = 52 years) with unilateral ISSNHL at various times in the past participated in this study. The subject sample was drawn from outpatients and patients diagnosed for implantation at Institute of Physiology and Pathology of Hearing, from December 2022 to May 2023. The affected side was the right in 6 (43%)

and the left in 8 patients (57%). The time of occurrence of ISSNHL episode from 3 months to 15 years back, average 5 years. The cochlear implant was implanted in 4 patients, 6 patients awaiting cochlear implants surgery. All patients performed pure tone and speech audiometry and completed the questionnaires for THI.

Results: The average THI total score for the study group was 39.3 ± 48.7 , corresponding to grade 3 (moderate), this means tinnitus is perceived even in the presence of environmental sound; however, daily activities are not impaired; it is perceived less under concentration but interference with sleep and relaxing activities is not infrequent. The tinnitus severity distributions of the subjects were 43% with slight handicap ($n = 6$), 14% with mild handicap ($n = 2$), 7% with moderate handicap ($n = 1$), 7% with severe handicap ($n = 1$), and 29% with catastrophic handicap ($n = 4$). The THI subdomain mean scores show that the functional (40.18%), emotional (43.75%) and catastrophic (42.21%) subdomains are comparable. The most common positive response ('yes' or 'sometimes') was for the questions: 6. 'Do you complain a great deal about your tinnitus?', 8. 'Do you feel as though you cannot escape your tinnitus?' and 19. 'Do you feel that you have no control over your tinnitus?'. In the study group, profound sensorineural hearing loss was found in 57.14%, severe in 21.43%, moderate in 14.29%, and mild in 1 case (with a catastrophic degree of THI in this patient). In 2 implant users the tinnitus decreased and in 1 it intensified subjectively (no data available in 1 case).

Conclusions: The degree of tinnitus severity as measured by THI was not proportional to the hearing loss, the degree of speech discrimination and the time since the episode of idiopathic sudden sensorineural hearing loss occurred.

Tinnitus in the patient with neuroendocrine adenoma of middle ear (NAME): case study

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Introduction: 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.

Case study: A 23-years old patient was admitted to World Hearing Center due to right-sided hearing loss and tinnitus. Physical examination suggested a tumor of the middle ear. The patient underwent surgical treatment (atticoantromastoidectomy) with pathological tissue excision and myringoplasty. For tinnitus evaluation, several questionnaires were applied (TFI, THI, THS).

Results: Postoperative period was uneventful. The patient reported hearing improvement and tinnitus reduction. Histological examination revealed a neuroendocrine adenoma of the middle ear.

Tinnitus perception in children with normal hearing thresholds

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Introduction: Tinnitus is an annoying and irritating auditory sensation unrelated to the presence of a sound source. Tinnitus involves hearing ringing or other sounds from one or both ears, such as roaring or buzzing. Many studies indicate that adults and children suffer from the problem, although the condition often goes unnoticed. Children who experience tinnitus report emotional and anxiety disorders and are more likely to experience depression. Tinnitus causes irritability and negatively affects life activities such as playing sports, and tinnitus in children can also cause poorer academic performance. This study aimed to assess the prevalence of tinnitus in 13-year-old children.

Material and methods: The study group consisted of 10,582 13-year-old children who underwent screening audiometric hearing tests using the Sense Examination Platform. Only air conduction thresholds for 0.5, 1, 2, 4, and 8 kHz were measured. Outcomes were regarded as abnormal if the threshold in either ear was worse than 20 dB at any frequency. The children were asked about the presence of tinnitus. They were asked if they heard humming, squeaking, buzzing, ringing, or other sounds in their ears when the room was quiet, and their answers were scored as 1 – never, 2 – rarely, 3 – sometimes, 4 – often, or 5 – always.

Results: Analysis showed that 12.2% of the children tested (1289 subjects) had abnormal audiometry, and these were excluded from further analysis. The remaining sample consisted of 9293 children (4891 girls and 4402 boys). Of this number, 2046 students (22% of children who passed screening). Of these, 85 children (4.1%) experienced tinnitus always and often; 601 (29.4%) experienced tinnitus sometimes; and 1360 (66.5%) reported tinnitus rarely.

Conclusions: Our study has shown that tinnitus is common among 13 years old children. Proper diagnosis is important, so screening tests among school-age children should be introduced permanently as a preventive measure. Early identification of a hearing disorder in routine clinical practice could

lead to appropriate diagnosis, early initiation of therapy, and minimization of delays and developmental issues. Therefore, it has the potential to improve children's quality of life.

Tinnitus severity change following stapes surgery

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Aim: 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.

Material and methods: According to the inclusion criteria, a group of 162 otosclerosis patients and diagnosed with tinnitus were included in the study. The average age at the time of surgery was 48.6 years (SD = 11.5). Stapedotomy was performed in all patients. 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 weak correlation was found between the pre- and postoperative difference of TFI total score and air-conduction thresholds as well as between the TFI Total score and the size of the air-bone gap.

Conclusions: Stapedotomy not only improves hearing but also reduces tinnitus, especially in patients reporting moderate or severe tinnitus. The current results extend our knowledge of how stapedotomy affects tinnitus severity, and might be of benefit to patients undergoing counselling. They might also be useful in making decisions about qualification criteria.

Widex Zen and tinnitus retraining therapies on auditory performance and psychological well-being of persons with tinnitus

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Tinnitus has become a hydra-headed monster, enigmatic to the scientific and clinical community and in impeding on the quality of life, auditory performances, and psychological

well-being of PWT. Although studies have previously established the psychosocial effects of tinnitus on an individual and thus projected the need for evidence-based strategies and management modalities in the conditions of PWT. Therefore, this study determined the effects of Widex Zen and Tinnitus Retraining Therapies on the auditory performance (AP) and psychological well-being (PWB) of PWT in Lagos State, Nigeria.

The health belief model and social learning theories served as the theoretical framework while the pretest-posttest control group quasi-experimental design with 3×2×2 factorial matrix was adopted. A purposive sampling technique was used to select PWT with discounting otological reasons for over six months from three healthcare institutions in Lagos State. The participants were randomly assigned to two treatment groups: Widex Zen Therapy (9) and Tinnitus Retraining Therapy (8), and the control group (5). Treatments lasted nine weeks. Audiometer (ANSI S3.6: 2010 Type 2A HF), Ryff's Psychological Well-Being Scale ($\alpha = 0.65$), Self-Efficacy for Tinnitus Management Questionnaire ($\alpha = 0.76$) and Tinnitus Handicap Inventory ($\alpha = 0.80$) were used for data collection. Data were analyzed using descriptive statistics and Analysis of covariance and scheffe post-hoc test at 0.05 level of significance.

The average age of participants was ± 57.2 . There was a significant main effect of treatments on auditory performance ($F_{2,12} = 11.33$, partial $\eta^2 = 0.65$) and on psychological well-being ($F_{2,12} = 239.96$, partial $\eta^2 = 0.98$) of PWT. The participants exposed to WZT for AP obtained the highest mean score (63.89) while at PWB had a mean score of (111.20); followed by TRT for AP with a mean score of (48.13) while at PWB had a mean score of (65.63) and control group for AP (35.00) and at PWB for (63.22). There were significant main effects of age on auditory performance ($F_{2,12} = 3.35$, partial $\eta^2 = 0.29$) and psychological well-being ($F_{1,12} = 3.50$, partial $\eta^2 = 0.23$) of PWT. There were significant 3-way interaction effects on AP ($F_{1,12} = 0.04$, partial $\eta^2 = 0.01$) of PWT.

Widex Zen Therapy was more effective in enhancing the auditory performance and psychological well-being of PWT than Tinnitus Retraining Therapy. Therefore, hearing health practitioners should adopt this strategy to improve the hearing health and quality of life of PWT. Counseling session must be effectively incorporated during the management protocols of tinnitus.