



## Organization of Multi-specialist Medical Care and Physiotherapy for Patients with Tinnitus

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## Abstract

*Tinnitus is a medical problem for MD and Health Specialists like: otorhinolaryngologists, neurologists, dentists, internists, cardiologists, nephrologists, psychiatrists, psychologists and physiotherapists. Symptoms of tinnitus significantly worsen patients' quality of life. Organization of treatment and treatment raise many challenges. No universally accepted therapeutic method has been developed for patients suffering from tinnitus. The variety of methods could be taken into account. It is also important to look for effective organizational solutions that allow for efficient care of these patients. The effectiveness of the mentioned diagnostic and therapeutic methods is diverse and is a challenge for health care organizations. Patients who have tinnitus are most often older people struggling with concomitant diseases. The interdisciplinary approach is the key to successful treatment of this ailment, and its multifactorial etiology indicates the need for combined treatment, which should take place in centers offering the possibility of consultation, diagnosis and therapy in the field of various medical specialties.*

**Key words:** organization of tinnitus treatment, tinnitus, therapy

*And if I hear what I hear*

*It's just tinnitus*

*Blank noise*

Kazimierz Wierzyński, "I hear time" [1]

## Introduction

Tinnitus (tinnitus auris) is a great diagnostic and therapeutic problem for doctors of many medical specialties. Their prevalence, symptoms that significantly worsen patients' quality of life, cause anxiety, cause insomnia, as well as difficulties in achieving therapeutic success, require an interdisciplinary approach involving the cooperation of doctors of many specialties: otorhinolaryngologists, neurologists, dentists, internists, cardiologists, nephrologists, psychiatrists, psychologists and physiotherapists. Leading patients in coordinated care, involving the cooperation of many specialists, results from a holistic approach to patients and is the only right way to achieve success, which is to improve the quality of life and functioning of patients [2]. This is a huge challenge for the healthcare system with extremely important interaction between medical science and practice. An example of such action is the foundation supporting the development of research on the treatment of tinnitus – Tinnitus Research Initiative, whose mission is to support scientists in interdisciplinary research and to educate and develop clinicians in the field of diagnosis and treatment. To date, no universally accepted algorithm for diagnostic and therapeutic management has been developed for patients suffering from tinnitus. It is also important to look for effective organizational solutions that allow for efficient care of these patients.

## Literature Review

Tinnitus as a condition that worsens the quality of life has been known for centuries. The first notes about the treatment of tinnitus appeared in

Ancient Egypt. In the Ebers papyrus from 1550 B.C.E. there is a mention of „tinnitus singing, whispered and spoken”. More than 20 ways to treat tinnitus come from Babylon. Numerous reports on its occurrence and treatment can be found in manuscripts from Persia, India, ancient Greece and Rome. A broad chapter on this ailment is contained in Du Verney’s first otology textbook published in 1683, “Traite de L’organ de L’ouie”. Famous people suffering from tinnitus included: German religious reformer Martin Luther, writer Jean-Jacques Rousseau, composer of the European anthem Ludvig van Beethoven, actress and singer Barbara Streisand, Rossalyn Carter, wife of former US president who was treated by P.J. Jastreboff using the TRT method, Zbigniew Hołdys, Jan Borysewicz, and English rock guitarist Pete Townshend, Chris Martin, leader of the British rock band Coldplay [3].

Tinnitus is defined as sound sensations appearing in one or both ears at the same time, in the absence of an acoustic stimulus in the environment that would generate sound. This ailment can be divided into two main groups: subjective and objective. Objective tinnitus: vascular and mechanical, are diagnosed less often. They are caused by vascular pathologies, arteriovenous fistulas, haemangiomas, intracranial glomeruli, intraocular muscle spasms, soft palate, trumpetopharynx, sphincter muscle [4]. Subjective tinnitus is only heard by the patient. It is estimated that in Poland the occurrence of this ailment affects 5-10% of patients, and among people over 75 this percentage increases to 30% of patients [5]. The incidence of tinnitus in children with good hearing reported in the literature ranges from 13% to 37.7% [6]. Due to the incidence of complaints, the International Week of Tinnitus Knowledge Week was established, which falls on February 5-11 [7]. Its cause may be in different parts of the hearing organ. It can be conductive, caused by diseases of the outer or middle ear. Sensory and nervous ones have a different etiology. There are 4 types of noise depending on the location of damage in the inner ear (I – in external hair cells, II – in internal hair cells, III – irregularities in the signal from internal hair cells to the auditory nerve fibers, IV – arising in extra-neural structures of the cochlear duct) [8]. A large percentage of

causes are of central origin, and chronic exposure to noise generates this disease in 50% of patients. They can also be the result of ototoxic drugs, the aging process or chronic systemic diseases (diabetes, hypertension, lipid disorders, kidney diseases). Tinnitus can also be a consequence of head injury, as well as degenerative changes of the spine, mainly its cervical segment [9]. Paweł J. Jastreboff, neuroscientist, professor at the Department of Otolaryngology, Emory University School of Medicine, creator of the first Center for Tinnitus Rehabilitation and Auditory Hypersensitivity and TRT (Tinnitus Retraining Therapy) established in the USA, defined multifactorial etiology of tinnitus as arising in all sections of the auditory pathway, centers of the central nervous system, including subcortical centers, cerebral cortex, limbic and autonomic system [10]. Symptoms that accompany tinnitus are: hearing impairment, feeling of fullness in the ear, balance disorder, dizziness, headache, anxiety, depressed mood, difficulty falling asleep, insomnia.

Tinnitus is described by patients as reminiscent of the sound of the waves of the sea or wind, playing crickets, but also penetrating clicks or squeaks [11]. The diverse etiology of tinnitus obliges doctors of various specialties to thorough diagnostic procedures of a multidisciplinary nature. Research in the field of ENT is particularly important, including a comprehensive medical history, full otolaryngological examination with otoscopy complemented by comprehensive audiological diagnostics: threshold and threshold threshold audiometry (SISI recruitment test), impedance audiometry, verbal audiometry, auditory brainstem evoked potentials (ABR), measurements of sound emission (TEOAE, DPOAE and SOAE), subjective assessment of tinnitus loudness. It is also advisable to perform nystagmographic tests (ENG and VNG) [12]. After diagnostics of the scope of otorhinolaryngology, patients undergo imaging tests: computed tomography of the head, magnetic resonance imaging of the head and bridge-cerebellar angles, review and functional x-ray of the cervical spine, Doppler ultrasound of the cervical vessels and numerous laboratory tests, including: morphology with smear, full lipidogram, glucose level, hormonal tests [13].

To date, no universally accepted therapeutic path has been developed for patients suffering from tinnitus. Pharmacological, surgical, acupuncture, diet and spa treatments, psychotherapy, music therapy, electrostimulation, hyperbaric oxygen chambers, laser therapy, noise masking with the use of Tinnitus Masker devices, hypnosis and physical therapy are used [14].

In pharmacological therapy of acute (lasting up to 3 months) and chronic (lasting over 1 year) tinnitus, drugs from various therapeutic groups are used: betahistine [15], vasodilators, improving brain metabolism, vitamins, sedatives, topical anesthetics, hypnotics, steroids, melatonin, homeopathic remedies [16]. Acamprosate, a homotaurin derivative with GABAergic properties, has also been found to be effective in reducing abstinence symptoms in patients with alcohol dependence [17]. In surgical therapy, vascular decompression of the vestibulocochlear nerve, or removal of neuroma VIII, otosclerosis, tympanosclerosis, and treatments for chronic otitis media are used [18]. Dietitians recommend a low-fat diet with a reduced supply of sodium chloride with the recommendation of limiting strong tea, coffee, cigarettes and alcohol. The electrostimulation group of the hearing organ is another therapeutic method [19]. The best results are obtained by therapeutic management based on neurophysiological theory of tinnitus treatment by Jastreboff's TRT habituation method. The patient learns to live with tinnitus by minimizing its negative impact on the quality of life. Another method is psychological therapy involving learning to deal with your own problems and understanding your body [20]. Numerous studies have confirmed that chronic tinnitus can lead to disturbances in the emotional and functional sphere of patients [21]. Neuromonics, or acoustic desensitization, is a similar method. This concept of therapy was developed by Dr. Paul Davis from Australia. Neuromonics uses therapy specially prepared in terms of amplitude and tempo with music filtered to higher frequencies (above 10,000 Hz). The recordings are intended for listening in headphones for 2 to 4 hours a day, for a period of not shorter than 6 months [22]. Music therapy including a block of sound therapy exercises focuses on ple-

asant sounds. This puts the patient in a state of relaxation, reducing his irritability and anxiety. Responsible for this phenomenon is the effect of nitric oxide, which produced in the auditory system under the influence of appropriately selected music improves the blood supply to the cochlea [23]. Physiotherapeutic treatment complements other therapeutic techniques. Treatments in this field that improve the quality of life of patients include: laser biostimulation, acupuncture, hyperbaric oxygen therapy, kinesitherapy, and electrostimulation. The effectiveness of acupuncture in tinnitus has been confirmed by tests carried out by Cai W, Chen AW, Ding L, Shen WD. Patients with tinnitus were treated with this method in TE3 and TE5. The infrared thermography (IRT) test of the bilateral auditory areas of each participant and the results of a visual analogue scale performed before and after the first session of acupuncture treatment showed that the temperature differences on both sides were significantly reduced, but the maximum, minimum and average temperature of the bilateral auditory areas did not have any significant difference before and after the acupuncture session. Thus, an improvement in cochlear blood flow was obtained [24].

Laser therapy as a therapeutic method is used in the treatment of tinnitus, in which the etiological factor is temporomandibular joint dysfunction (TMJ, TMD) and Costen's syndrome. Both Nd: YAG (low-level yttrium-aluminum - 1064 nm (LLLT) diode lasers with neodymium-doped aluminum yttrium are used) as well as LLLT with an 810 nm diode laser [25]. In manual therapy, the indications relate to procedures involving the mobilization of the cervical spine and chest, as well as muscle strengthening, stretching and instructing on correct posture [26]. The usefulness of hyperbaric oxygen therapy (HBOT) has been proven in the acute phase of acoustic trauma. In the studies of Japan Maritime Self-Defense Force Undersea Medical Center researchers conducted in 1997-2017 among persons treated with HBOT, 70.2% showed improved hearing and 83.9% reduced subjective symptoms [27].

Yoga is also a supportive method in the treatment of tinnitus. In one study patients complaining of chronic tinnitus underwent a 12-week

yoga training. All participants were assessed using the Tinnitus Functional Index and described a sense of better tinnitus control, improved sleep quality and quality of life [28]. Clinical studies have shown that the use of manual cervical-mandibular therapies in combination with exercise and education have yielded better results than the use of exercise/education alone in people with TMD-associated tinnitus [29].

Researchers-inventors from the Modern Audiology Center of the Warsaw Kinetic clinic are also looking for a remedy for the described ailment. They developed headphones connected to a device resembling an mp3 player. It is a neuroprocessor that instead of music gives to the ear a signal individually selected for a given patient, reducing his perception of noise. The invention received Focus Lens award in a plebiscite of important scientific discoveries of the editors of the Focus monthly for 2018 [30].

### **Organizational Innovations in Tinnitus Treatment**

The European Union is currently funding an international research project on „UNITI” tinnitus treatment methods. The project is chaired by Dr. Winfried Schlee, of the Tinnitus Center and Center for Neuromodulation of the University of Regensburg at Bezirksklinikum. The program combines genetic, medical, audiological research, etc. The end of the three-year project is to be a computer model recommending the best possible therapy dedicated to a patient with tinnitus. UNITI (EU Action no. 848261) will start at the beginning of 2021, currently recruiting patients for the program. Several leading European centers will take part in them: Regensburg (Germany), Berlin (Germany), Leuven (Belgium), Granada (Spain) and Athens (Greece) [31].

### **Summary**

The effectiveness of the mentioned diagnostic and therapeutic methods is diverse and is a challenge for health care organizations. Patients who



have tinnitus are most often older people struggling with concomitant diseases. The interdisciplinary approach is key to successful treatment of this ailment, and its multifactorial etiology indicates the need for combined treatment, which should take place in centers offering the possibility of consultation, diagnosis and therapy in the field of various medical specialties.

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