

***Occupational injuries of the
auditory sensorineural
system***



DEFINITION

The occupational diseases of the ear are nosologic units that develop as a consequence of long-term, and in some cases, of acute impact of factors from the working environment that are over the accepted sanitary-hygienic levels.



ETIOLOGY

Risk factors:

1. Physical:

- Head traumas (for instance commotion of the labyrinth, fractures of the skull base with damage of the cochleo-vestibular nerve), falls, explosions, burns.
- Noise – intensive singular (explosion), leading to acute acoustic trauma; persistent or intermittent noise.
- Vibrations – local or with whole body impact.



PATHOGENESIS

- The physical traumatic injuries usually manifest with trauma of the inner ear, often with rupture of the round and oval membranes, leading to effusion of fluids to the middle ear with formation of perilymphatic fistula.
- After acute acoustic trauma, mechanical impact upon the inner ear is characteristic. Due to the acoustic action of the intensive sound, the elements of the middle ear can be displaced, there are haemorrhages, trophic changes, and later – degenerative atrophy of the Corti`s organ, the ganglion cells and the nerve fibers.



ETIOLOGY

- Ultrasound – mechanical oscillations in gases, liquids or solid bodies, that exceed the upper limit of hearing – 20 000 Hz
 - Infrasound – low frequency mechanical oscillations (1 до 20 Hz) caused by machine operation or of aerodynamic origin – turbulent flows of gases, liquids, etc.
 - Sharp changes of the barometric pressure
2. Chemical:
- Toxic substances – lead, mercury, manganese and their compounds, arsene, phosphorus; carbon monoxide, benzene, aniline dyes, etc.



PATHOGENESIS

- In chronic acoustic trauma the permeability of the membranous structures increases, with subsequent hydrops of the labyrinth, there are degenerative changes in the sensory cells.
- The role of the CNS cannot be excluded. The acoustic signal acting on the receptive apparatus of the ear causes reflect actions of over-excitement of the CNS, and subsequently - to protective "hold on", through efferent neural tracts. The "hold on" repeats for a long time at the work place with intensive noise, becomes chronic and specific pathologic changes appear – the sensory cells degenerate and die, resulting in definite hearing loss.



PATHOGENESIS

- The ultrasound oscillations exert mechanical, thermic and physio-chemical effects upon all tissues, organs, and systems. Most susceptible are the central and periphereal nervous system – the cortex, hypothalamus, reticular formation, vegetative nervous system and the periphereal nerves. The mechanism of ultrasound polyneuropathy at first is determined by reflectory interactions strating from the vegetative nuclei of the hypothalamus, and later from structural changes in the nerves themselves.



PATHOGENESIS

The injuries, caused by infrasound are still not investigated thoroughly. The scientific researches had proven that the low-frequent acoustic energy with sufficient intensity is an adequate stimulus for the ear and the mechano-receptors of the skin, as a result of which appear changes in the functional state of the ear, vestibular analyzer, CNS, cardiovascular and respiratory systems.




PATHOGENESIS

- Severe changes in the atmospheric pressure are related with haemodynamical disturbances in stria vascularis and development of gas embolisation in the labyrinthine vessels, with consequent hydrops (Deep diving disease).
- After exposition to toxic substances, harmful for the cochlea, the specific sensory cells are directly injured, causing dystrophic changes and loss of function.



ENDANGERED PROFESSIONS

- Risk industries are: metallurgy, mining, machine-building, textile industry, construction, transportation, ship-building, maintenance of aviation, super-sound planes, ultrasound defectoscopy, work with piezoelectric emitters, etc.



CLINICAL CHARACTERISTICS

- The most significant clinical characteristic of the occupational acoustic neuropathy is the hear loss by type of cochlear neuronitis. The hear loss is usually bilateral and symmetrical. The definite hear loss develop slowly between the forth and the tenth year of the working period.



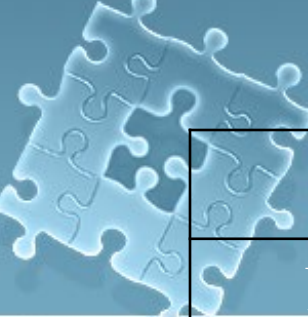
Main characteristics of the occupational acoustic neuropathy

- Injury of the sensoryneural cells of the inner ear of the two analyzers.
- The early sensoryneural hearing loss is in most significant degree at 4000Hz. With the growth of the working period over 10 years, the zone of maximal hearing loss is widening from 3000 to 8000 Hz.
- Persistent noise action is more harmful than those with intervals, during which turn on the adaptive mechanisms and the ears rest. After the stop of the noise exspostion the hearing loss does not progress, or progress very slowly.




Degreees of hearing loss

- **I degree** – up to 35 dB
(socially adequate hearing)
- **II degree** – 35 – 65 dB
(difficult hearing)
- **III degree** – 65 – 90 dB
(deafness)
- **IV degree** – over 91 dB
(practical deafness)



<i>DEGREE</i>		<i>Loss in dB</i>	<i>%</i>
Normal /socially adequate hearing/	From 0 to 35 dB	-	0%
Difficult hearing	From 35 to 65 dB	35-45 dB	15%
		45-55 dB	35%
		55-65 dB	50%
Deafness	From 65 to 90 dB		60%
Practical deafness	Over 91 dB	Without speech impairment	70%
		With speech impairment	80%



CLINICAL CHARACTERISTICS

- Hearing loss is bilateral, sensoryneural type with early positivitation of the overtreshold tests
- An important symptom is the subjective noise in the ears, which often continues even after the practical deafness and causes significant discomfort to the patient.



DIAGNOSIS

- The occupational character of the hearing loss is defined at the basis of the clinical characteristics: acute or progressive course of the disease by type of cochlear neuronitis with predominant elevation of the treshold of perception in the zone of high frequencies (4000 – 8000 Hz).



DIAGNOSIS

- There are no visible changes of the tympanal membrane, no signs for inflammations. It is essential to consider the working period in noisy environment, as well as the possibility for development of acoustic neuropathy after infection diseases, contusions, administration of ototoxic medications.



The diagnosis is placed after complex evaluation of the data from: detailed anamnesis, ORL-status, degree of hear loss from the pure tone threshold audiometry, overthreshold tests and speech audiometry; if necessary objective audiometry (BERA) is performed.



Differential diagnosis

- Age-related hearing loss (presbycusis)
- Hereditary hearing loss
- Cochlear otosclerosis
- Meniere`s disease
- Metabolic diseases
- Vascular diseases
- Diseases of the CNS (acoustic neurinoma, MS, neurasthenic neurosis, etc.)



PROGNOSIS

At first the damages are functional and reversible, later they become definite. If the worker is removed from the noisy environment, the hearing ability may stabilize, if not – continues to progress to different stages of deafness. The presbycusis aggravates the hear loss with the progression of age, and the presence of hear loss makes the patient more vulnerable to ototoxic medications (aminogluco-side antibiotics, chinine, etc.)




EXPERTISE

For the needs of the expertise, in Bulgaria an easy and exact scheme for the estimation of the hear loss is accepted. We take the air-conduction values for the basic frequencies that form the normal hearing field – 500, 1000, 2000, 4000 Hz. The sum in dB is divided to 4, producing the hear loss in dB. The better hearing ear is taken into consideration, as well as age correction is made.




The correct evaluation of the working ability of people with hear loss is based on the exact definition of the type, degree and stage of the disease, as well as the characteristics of the working environment!



EXPERTISE OF WORKING ABILITY

- Temporary unable are patients with acute acoustic trauma, and the length of inability is from 20-40 days, after which if a definite hearing loss is present, an evaluation from an Expert Medical Labour Commission is necessary.
- All persons with hear loss up to 35 dB (after age correction) are able to work.
- Patients with loss from 35 to 45 dB of the better hearing ear, if work in a noisy environment or are in verbal contact with other people are moved to different work by Medical Consultative Commission, without loss of qualification, for dynamic monitoring and treatment by an ORL specialist. The term is individual and depends on the results of the treatment.



EXPERTISE OF WORKING ABILITY

- Persons with hearing loss from 45 to 65dB are with difficult social contact, and if their occupation demands such, or work in noisy environment are with limited working ability for their profession.
- For young persons (up to 45 years) Expert Medical Labour Commission may define loss of working ability for certain period for acquiring new occupation or prequalification.
- For elder persons or deafness (over 65dB) and impossibility for use of a hearing aid, 70% of lost working ability is defined.



TREATMENT

It is administered regarding the etiopathogenesis of the occupational hearing loss, aiming to protect and restore the hearing ability, as well as of the organism as a whole.



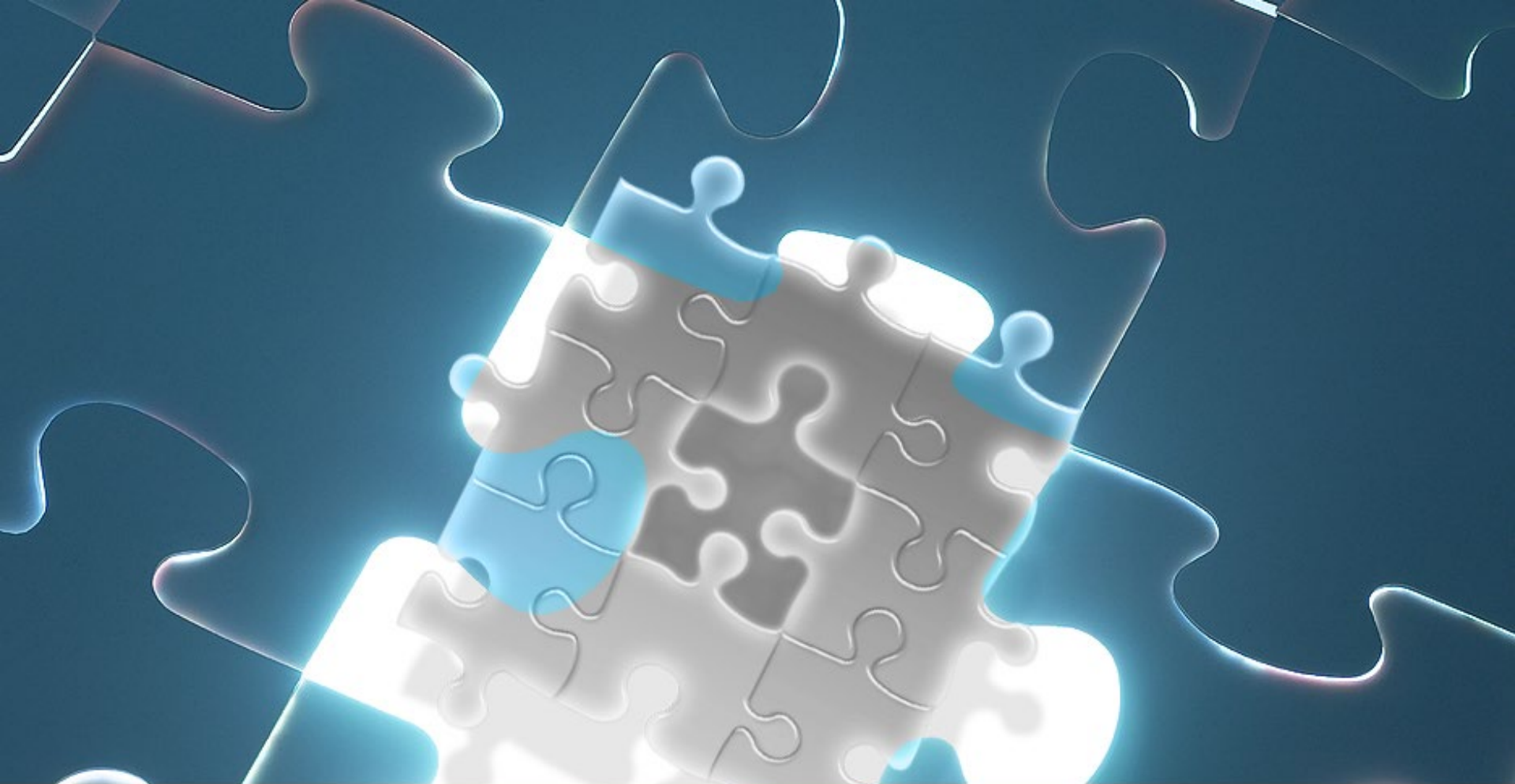
TREATMENT

- In acute forms, a hospital treatment is necessary with dehydrating and vasodilatative medications, corticosteroids, vitamins, antivertiginous medicaments, etc.
- In chronic forms, **the injuries are definite** and the treatment is with medications with protective and symptomatic effect – vasodilators, nootropic and other medicaments.



PROPHYLACTICS

- Proper medical advice for choice of profession.
- Personal protection (antifones)
- Rooms for rest (restauration of the hearing sensitivity)
- Modernisation of the industry



**THANK YOU FOR THE
ATTENTION!**