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Results of a Subjective Hearing Study in Patients with Meniere's Disease

S.S. Arifov, M.B. Tukhtaev

Center for the Development of Professional Qualificationsmedical workers of the Ministry of Health of the Republic of Uzbekistan, Tashkent

Abstract: The aim of the study was to evaluate the results of a subjective study of hearing in patients with Meniere's disease. A total of 518 patients with a reliable or confirmed diagnosis of Meniere's disease were under observation, which made up the main group. The results of the study showed that patients with Meniere's disease have reduced hearing, and therefore require a more detailed study of hearing.

Key words: *Meniere's disease, seizures, hearing test, subjective method, diagnostics.*

1. Introduction

The problem for otorhinolaryngologists, and often doctors of other specialties - neuropathologists and therapists, has been the treatment of Meniere's disease (MD) for 140 years - one of the common causes of cochleovestibular dysfunction caused by an inner ear disease characterized by bouts of dizziness accompanied by vegetative disorders, noise in the ears and hearing loss, balance disorder [2, 7, 9, 11].

According to the latest data announced at the 4th International Symposium on MD, which was held in Paris, the prevalence of the disease ranges from 8.2 per 100,000 population in Italy to 157 people in the UK [1, 5, 8]. The disease is more often observed in people of working age, often it leads to permanent disability, which determines the socio-economic significance of MD.

The treatment of this disease is multifaceted: conservative and surgical, the choice of the type of which is often empirical and does not always lead to long-term remission. This is due to the fact that the etiology of the disease is unknown, and there are many discrepancies in the pathogenesis.

MD is a chronic, relatively common disease with an estimated prevalence of 17 to 513 patients per 100,000 people [2, 6]. In most cases, it occurs as a unilateral lesion, although it may not be bilateral [4, 5].

Clinical manifestations of MD are most pronounced during an attack of the disease [11]. However, often these manifestations are diverse, and therefore there are certain difficulties in diagnosing the disease. Often patients with MD arrive at the emergency department with sudden dizziness, and the disease may be inaccurately diagnosed [3]. In such situations, a rigorous analysis of all clinical manifestations of the disease comes to the fore [3]. An important and most constant clinical manifestation of MD is changes in the organ of hearing [9]. In assessing the state of the hearing organ in MD, both psychophysiological, electrophysiological and electroacoustic research methods are used. However, due to a number of circumstances, psychophysiological research methods are most widely used among them. In particular, this is due to their availability for physicians of various levels of healthcare, the presence of direct constant communication between the researcher and the subject, and the high information content of the results obtained. In this regard, in the sources of recent years, psychophysiological research methods are included in the list of the main methods for studying patients with MD [1, 10]. Over the past decades, objective methods of hearing research have been widely used for diagnosing, predicting the course and outcome of treatment for MD [7]. Their advantage is the speed of execution, the independence of obtaining a response from the psychosomatic state of the patient, the possibility of assessing all parts of the hearing organ [8].

In this regard, it is of interest to study the results of objective methods for the study of hearing, their manifestations in patients during an attack of MD.

Purpose of the study. Comparative evaluation of the results of electrophysiological and electroacoustic methods for the study of hearing in patients with Meniere's disease during an attack and between attacks.

2. Material and research methods.

Out of 518 patients, on the basis of a comprehensive examination, MD was detected in 281 (54.2%) patients. Of these, in 206 (73,3%), in accordance with the classification of the American Academy of Otorhinolaryngology and Head and Neck Surgery (AAO - HNS; 1995), which we used until the end of 2017, 13 patients were diagnosed with a possible, 21 with a probable and 172 with a reliable diagnosis MD. In 75 (26,7%) patients, based on the classification developed jointly by the European Academy of Otology and Otoneurology, AAO - HNS, the Barani Society, the Japanese Society for the Study of Balance, the Korean Society for the Study of Balance (2016), in 13 cases it was established possible, and 42 - confirmed diagnosis of MD (began to be used since 2018).

At the second stage, a selection was made from among 214 patients with a reliable or confirmed diagnosis of MD, the diagnosis of which was established at the first stage. The criteria for these two categories of MD classifications used by us are comparable to each other, and they combine the most reliable intravital manifestations corresponding to MD. In order to exclude an undesirable effect on the results of the studies, treatment and rehabilitation of patients in whom MD was combined with other diseases of the organs of hearing and balance, pathology of the central nervous system were not included in the development. All this was carried out in order to obtain reliable results of the research, treatment and rehabilitation. Ultimately, out of 214 patients, 191 were the material of this study. These patients constituted the main group. Of these, 159 patients had a reliable diagnosis in accordance with the classification of the American Academy of Otorhinolaryngology and Head and Neck Surgery (AAO - HNS; 1995), which we used until the end of 2017, and 32 - a confirmed diagnosis, according to the classification developed jointly by the European Academy of Otology and Otoneurology, AAO – HNS, Barany Society, Japan Balance Research Society, Korean Balance Research Society (used by us since 2018).

The age of the examined patients ranged from 31 to 67 years (mean age 48,8±0,7 years). There were 127 (66,5%) females, 64 (33,5%) males, their ratio was 1,5:1. 30 healthy individuals made up the control group.

All patients underwent an examination of the ENT organs and a study of the state of the organ of hearing and balance. The study of patients included the study of complaints, the history of the development of the disease and life, the assessment of the state of the organs and systems of the body, and endoscopic examination of the ENT organs. To assess the state of the hearing organ, the following objective research methods were used - impedancemetry, registration of delayed evoked otoacoustic emission (DTOAE), registration of the distortion product of otoacoustic emission (POAE), registration of short-, long-latency auditory evoked potentials.

3. Research results.

All examined patients underwent a comprehensive study of the state of the hearing organ using psychoacoustic and objective methods. The number of research methods conducted depended on the information content and the possibility of application in each specific case.

In all, the examination began with a questioning of complaints and a detailed discussion of the history of the disease and the life of the patient.

A comprehensive clinical and audiological examination of all patients was carried out in the interictal period. In addition, 47 (24,6%) patients were examined during an attack of MD. During this period, a part of the studies was applied based on the severity of MD, while provocation methods were not used in any case.

Complaints of patients differed depending on the treatment of patients in different periods of the disease.

During an attack of MD, the complaints of patients were reduced to the following: hearing loss, noise, impaired speech intelligibility and a feeling of congestion in the affected ear, intolerance to loud sounds, increased perception of one's own voice (autophony), paroxysmal dizziness with balance disorder, nausea, vomiting, increased heart rate, increased sweating.

In the interictal period, the number and severity of complaints of patients decreased and there was a decrease in hearing, noise, impaired speech intelligibility, intolerance to loud sounds in the affected ear.

In all cases, the disease began on one side, and in 12 (6,3%) patients, the process subsequently became bilateral. Based on the complaints of patients and the history of the development of the disease, a unilateral lesion occurred in 179 cases and, accordingly, a bilateral lesion occurred in 12 cases. With a unilateral process, it was localized in 86 (37,5%) patients on the right and 93 on the left ear.

All patients complained of decreased hearing acuity in the range of moderate and severe. Although hearing loss was permanent in all cases, 31 (16,2%) patients noted fluctuations in hearing acuity (the so-called “subjective” hearing fluctuation) in the diseased ear. Of these, in 28 cases, the relationship between hearing fluctuations and dizziness attacks was noted: a decrease in hearing acuity before and during an attack, followed by an improvement in hearing. In 3 patients with the initial stage of MD, hearing returned to the age norm. Hearing fluctuation in 7 patients was also observed with neuro-emotional or physical stress, with a change in atmospheric pressure.

Hearing loss was in 179 (93.7%) patients unilateral and 12 (6,3%) - bilateral. 94,2% of patients indicated a progressive hearing loss with an increase in the duration of the disease, especially after each subsequent attack. 17 (8,9%) noted a stable character, i.e., without a tendency to progression of hearing loss during the entire duration of the disease.

Noise in the affected ear was present in all examined patients, of which 167 (87,4%) were permanent and 24 (12,6%) were non-permanent. It is unilateral in 179 (93,7%) patients and bilateral in 12 (6,3%) patients. Immediately before the attack and during it, the intensity of the noise increased in all patients. 131 (68,6%) patients after them, a change in its nature was noted, i.e., an increase in the intensity and number of tones. In 41 (21,5%) cases, the noise exclusively corresponded to the low- and mid-frequency spectrum, i.e., patients assessed it as “humming”, “wind blowing”, “sea surf”, “forest noise”, “heartbeat sound” and other 27 (14,1%) patients described noise in the form of “whistling”, “ringing”, “buzzing”, “hum of high-frequency wires”, “steam noise”, i.e. its spectrum corresponds to the high-frequency range.

In the majority of patients, i.e., 123 (64.4%) cases, the noise was multicomponent, of which 47 cases had a combination of only low- and mid-frequency noises, and 76 cases had a combination of them with high-frequency noises. 7 patients with bilateral MD could not localize the noise in each ear separately, and described it as "noise in the head".

In 88 (46,1%) patients, a transient change in the intensity and tone of subjective noise was noted during neuro-emotional stress or during physical exertion without the development of an attack of dizziness. In 12 (6,3%), this condition was permanent.

According to the classification of the manifestation of tinnitus according to A.P. Velitsky patients were distributed in the following sequence:

- tinnitus of the 1st degree: it does not bother the patient a lot, it is detected only with an active survey - 13%;

- tinnitus II degree: disturbs the patient greatly, is one of the main complaints - 51%;

- tinnitus III degree: is the main leading complaint of the patient - 36%.

The feeling of congestion, heaviness or pressure in the affected ear or both ears was noted by 178 (93,2%) patients and it was periodic, i.e., before the attack period or at the time of the attack, while it was absent outside the attack. This condition is sick as “pressure”, “congestion” or “fullness” and“heaviness” of the ear. Of these,

10 (5,6%) patients at the height of the manifestation of this symptom noted the appearance of dull aching pain - otalgia. A feeling of congestion or pressure can be either in the entire head, or on the side of the affected ear, or localized in the occipital region and occur with neuro-emotional stress. 32 (16,8%) patients noted the progression of the frequency and intensity of this symptom.

Impaired speech intelligibility of varying severity on the affected side occurred in 178 (93,2%) patients. The distortion of perceived sounds usually increased before the attack or at the time of the attack. In 34 (19,1%) cases, this condition was noted on both sides.

151 (79,1%) patients indicated intolerance to loud sounds of varying severity, and 144 (95,4) of them increased immediately before the attack and remained at this level during and the next few hours after it.

In 164 (85,9%) patients, a feeling of pronounced increased perception of one's own voice (autophony) or surrounding sounds with a metallic tint in the diseased ear, of varying severity, was noted immediately before the onset of the attack and during it.

An analysis of complaints and the history of the development of the disease showed that the following were among the complaints of patients associated with the organ of hearing with an aura for a vestibular “attack”:

- “fluctuation” of hearing acuity;

- amplification of the intensity of the existing noise and the addition of noise of a different tone;

- the appearance of a feeling of ear congestion, which was combined with earache in 5,6%;

- the manifestation of a greater degree of impaired speech intelligibility;

- an increase in the state of intolerance to loud sounds;

- the appearance of a feeling of increased perception of one's own voice (autophony).

In most cases, these manifestations were combined with each other.

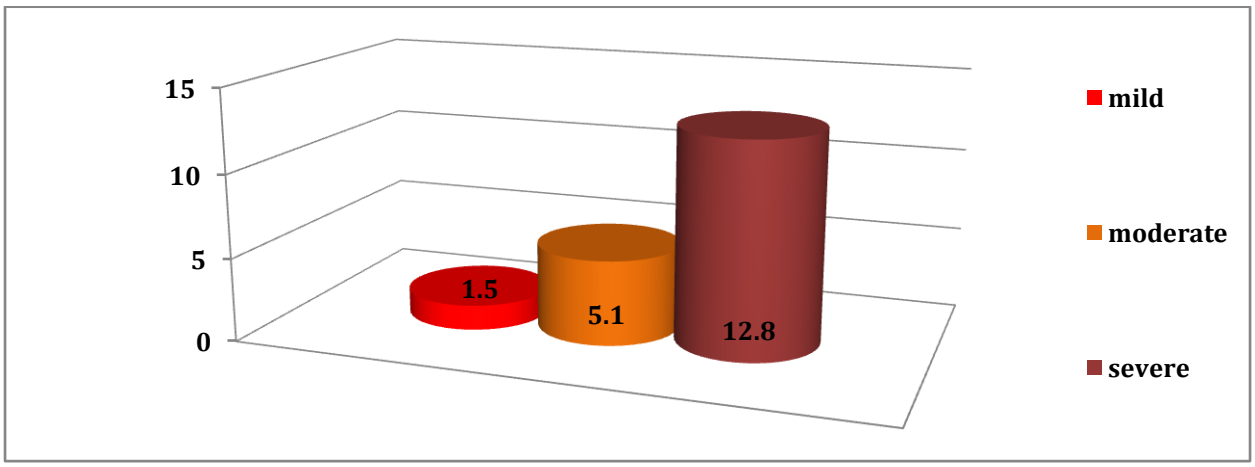

Figure 1. Information about the duration of vertigo attacks, per hour.

Systemic dizziness was a cardinal complaint of patients with MD and its manifestation during the course of the disease was varied in the examined patients. In all patients, systemic dizziness had a paroxysmal character, it began suddenly or against the background of an aura. It was manifested by a sensation of rotation of the patient himself or surrounding objects in a certain plane. More than 80% of cases it was clockwise in the frontal or horizontal plane. The duration of dizziness varied from 20 minutes to 12 hours, the average was 3,7±1,14 hours. The vestibular crises described by patients in 99% of cases manifested themselves in the above-described typical variant of dizziness attacks. The duration curve of MD attacks had a convex character with maximum values

within ½ - 3 hours. Clearly visible is a significant predominance of an attack of MD lasting within 1 - 2 hours, then in descending order 1/2 - 1 hour, 2 - 3 hours, 1/3 - 1/2 hour and beyond. Among our patients, the duration of an attack of MD was limited to the time interval of 10-11 and 11-12 hours, which occurred only 0,5% each (Figure 1).

In 1% of all cases, vestibular crises manifested themselves in the form of a sudden sudden and unexpected fall of the patient without loss of consciousness, but at the same time he immediately got up on his own without signs of imbalance and coordination (like a drop attack or Tumarkin'sotolithic crises).

In all cases, attacks of dizziness were accompanied by nausea and 31% vomiting. In all cases, vomiting occurred at the most pronounced stage of the vestibular crisis, was not associated with food intake, and after it there was no relief from an attack of dizziness. During the attack and the immediate period after it, all patients noted fatigue, irritability, headache. An analysis of complaints and the history of the development of the disease showed that in 2% of cases, the aura for the vestibular “attack” was a migraine-like headache, which had a “compressive” character and was combined with otalgia.

An isolated manifestation of only one complaint was not revealed, although when analyzing the history of the development of the disease in 17 (8,9%) patients at the onset of the disease, there was a short-term manifestation of all complaints only hearing loss or 22 (11,5%) - the presence of noise. Also, in 7 (3,7%) patients, the first attack of dizziness was the only manifestation of MD.

The duration of the disease varied widely - from 10 days to 15 years. The calculation of the duration of the disease was calculated from the moment when all indicators of each patient corresponded to reliable (according to the classification of AAO - HNS, 1995) or confirmed (according to the classification of the European Academy of Otology and Otoneurology, the American Academy of Otorhinolaryngology and Head and Neck Surgery, the Barani Society, the Japanese Society for the Study of Balance, Korean Society for the Study of Equilibrium, 2016) form MD.

The disease duration curve has a wave-like character, the minimum points in which correspond to periods of no more than 1 month, 9-10 years, 10 years or more. Among the examined contingent, patients with MD duration ranging from 1 to 8 years prevailed, with a maximum value in the interval of 5–6 years. Based on the analysis of the medical history of the material, low rates with a short duration of the disease can be associated with an unsatisfactory state of diagnosis of MD, because a certain part of the patients were initially assigned an incorrect diagnosis and, accordingly, inadequate treatment was carried out for a certain time. With a long duration of the disease, this can be explained in one case by a mild course of MD, in another by the onset of the final (burnt out) stage after a few years, at which vestibular manifestations subside, auditory disorders are corrected with the help of a hearing aid, and to a certain extent, patients adapt to the current situation.

Most often, the primary appeal of patients was to a neurologist (76%), then to a general practitioner (11%), an otorhinolaryngologist (10%), and 3% to other specialists. Only 2% of patients purposefully turned to clinics equipped with audiological and vestibulometric equipment. Prior to the admission of patients to the clinic, there were no vestibulometry and acumetry data, the following studies were performed: impedancemetry (0.5%), tone threshold audiometry (4%), radiography of the paranasal sinuses (4%), MSCT of the head (22%), MRI of the cervical spine (22%), MRI of the brain (51%), ultrasound dopplerography of cerebral vessels (59%), ultrasound dopplerography of neck vessels (82%). Attention is drawn to the lack of vestibulometry data, a very low rate and fragmentation of the conducted audiological studies, while a large proportion of unreasonable prescription of radiation methods of research.

187 (97,9%) patients at the time of contacting us were undergoing or continuing various treatment regimens. Of these, only 56 (29,9%) patients were recommended treatment according to the current standard or clinical guidelines. 29 (15,5%) patients began treatment on their own - after visiting doctors and dissatisfaction with their recommendations, according to the schemes recommended by the people around them who had this disease, based on data from the Internet and social networks, using non-traditional methods of treatment.

At the time of treatment from ongoing or completed therapy, 51 (27,3%) patients noted a significant improvement, 96 (51,3%) relative improvement, 31 (16,6%) no effect, and 9 (4,8%) worsening.

The data obtained indicate a low level of awareness of the population about this disease, doctors - the clinic, the algorithm for diagnosing and treating MD.
All patients underwent a speech study.
The average indicator of speech perception in the diseased ear was:
- whispering speech – 1,1±0,11 m (control group – 5,8±0,02 m);
- colloquial speech – 3,8±0,12 m (control group – 6,0±0,01 m).
The average indicator of speech perception in a healthy ear was:
- whispering speech – 5,7±0,01 m (control group – 5,8±0,02 m);
- colloquial speech – 6,0±0,02 m (control group – 6,0±0,01 m).
The studied parameters had a significant difference from similar values in the control group and healthy ear ($P<0,05$).
The results of tuning fork research methods (study of the absolute sounding time of tuning forks by air and bone conduction, tuning fork experiments according to Weber, Rina, Lewis-Federichi) in all patients corresponded to hearing impairment in the type of sound perception in the classical form.
The average indicator of the absolute sounding time of the C128 tuning fork in terms of air and bone conduction on the diseased ear was:
air conduction – 21,2±0,12 sec. (control group – 44,3±0,14 sec.);
bone conduction – 13,8±0,09 sec. (control group – 22,2±0,11 sec.).
The average indicator of the absolute sounding time of the C128 tuning fork in terms of air and bone conduction on a healthy ear was:
air conduction – 43,8±0,09 sec. (control group – 44,3±0,14 sec.);
bone conduction – 21,8±0,07 sec. (control group – 22,2±0,11 sec.).
The studied parameters of speech and tuning fork tests had a significant difference from similar values in the control group and healthy ear ($P<0,05$).
The patency of the auditory tubes in all patients on the diseased and healthy side were within the physiological limits, i.e., within the 0 degree (“empty” throat) in 87, I degree (Toinbey's experiment) in 91, II degree (Valsalva's experiment) in 13 cases.
Thus, although the psychophysiological methods of research are in the first positions of the list of the main methods for the study of patients with MD. but objective methods of hearing research make it possible to assess in detail and objectively the state of each department of the hearing organ.

4. Conclusions:

In patients with Meniere's disease, hearing is reduced; therefore, a more detailed study of hearing is required.

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