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METHOD FOR DETECTING FEATURES OF HEARING DISORDERS IN PATIENTS WITH ARTERIAL HYPERTENSION

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ABOUT ARTICLE

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Abstract: This article presents otoneurological characteristics of pre-stroke cerebrovascular disorders in patients with hypertension. Among the problems of modern otorhinolaryngology, one of the leading places belongs to cochleovestibular disorders in some cardiovascular diseases, in particular, hypertension. The state of vestibular function in arterial hypertension was studied by many authors who noted a decrease in resistance in such patients. It has been established that one of the reasons for the formation of secondary cochleovestibular disorders is chronic hypertensive encephalopathy that develops in patients with arterial hypertension, often already in the early stages of the disease. In studying the features of the pathogenesis of cochleovestibular disorders, certain results have been achieved by studying the nature of the vestibulovascular interaction. In particular, the difference between vestibulovascular reactions in central and peripheral lesions of the vestibular analyzer was shown, which is important for the differential diagnosis of these pathological conditions.

INTRODUCTION

The cochleovestibular apparatus is one of the most ancient analyzers; it is the first of all receptors to form in embryogenesis [1]. According to its structure, extensive connections within the CNS and functional properties, the cochleovestibular apparatus differs sharply from all cranial nerves: when it

is stimulated, not a narrow local reaction occurs, but an effect on all body functions (somatic and autonomic) is observed.

The central parts of the vestibular and auditory analyzer are very complex, which reflects the diversity and complexity of the function of this peculiar nerve [2]. Morphologically and functionally, the vestibular apparatus is clearly divided into two sections: the otolith apparatus and the system of semicircular canals. The first responds to rectilinear accelerations and deviations from the vertical, while the second to angular accelerations in any of the three main planes in which the channels are oriented.

The vestibular nerve enters the brainstem at the level of the cerebellopontine angle, slightly above the external (cochlear) root, between it and the spinal root of the Y nerve. In the internal parts of the rope body, not reaching the bottom of the I Y ventricle, the vestibular nerve is divided into ascending and descending branches. Part of the descending fibers terminate in the lower nucleus, part in the medial and lateral nuclei. The ascending fibers of the vestibular nerve terminate in the superior nucleus. Some of these fibers, passing through the nucleus, end in the roofing nucleus of the cerebellum.

The vestibular nuclear complex is located at the level of the upper part of the medulla oblongata and stretches in the retrocaudal direction by 9.5-12 mm. The works of the above authors have shown that the nuclei of the vestibular complex are very complex in structure. The cytoarchitectonics of each of them has features, as well as extensive afferent-efferent connections with various formations of the central nervous system, and from the latter to the vestibular nuclei. A distinctive feature of the nuclear vestibular complex is an unusually large number of pathways emerging from it in a wide variety of directions and connecting the nuclei with various anatomical structures of the brain. These connections provide a diffuse effect of the vestibular apparatus on all functions without exception. The most important clinically are the following connections of the vestibular nuclei: connections with the spinal cord; with eye muscles ; vestibulo-vegetative connections; vestibulocerebellar connections; connections with the reticular formation of the brain stem; with the cerebral cortex [3].

Hypertension is a widespread disease that affects people of working age, and is also the most common cause of disability and death from cardiovascular diseases [4]. The fight against this disease, early detection of signs of damage to target organs is an urgent problem of modern medicine [5,6].

According to the literature, hemodynamic, humoral, reflex and other disorders that occur in hypertension can lead to the development of various cerebrovascular disorders, up to strokes. So Feigin V.L. (2006) reports that according to the International Congress on Stroke, arterial hypertension can

cause stroke in 75% of cases. According to Khodzhaev A.A. (2002) pre-stroke cerebrovascular disorders (DCVR) in hypertensive patients are detected in 83% of cases. At the same time, according to many researchers, Majidov N.M., Troshin V.D. (2000), Kistnev B.L. et al . (2001) the diagnosis of CVD, especially its initial forms, as well as their differential diagnosis from brain lesions of other etiologies presents certain difficulties. In this regard, otoneurological studies can play an important role. In particular, the connections of the vestibular analyzer within the CNS with most functional systems, the objectivity and sensitivity of vestibular reflexes make vestibular symptoms invaluable in determining the level of brain damage, assessing the dynamics of the process, and the degree of compensation of stem and hypertensive processes [7,8] .

It should be noted that the existing literature reflecting cochleovestibular disorders in HD patients is presented mainly on the basis of prescription, HD stage, but without taking into account cerebrovascular disorders [9,10]. In separate reports on LCVR in HD, cochleovestibular disorders are only listed among the pathologies of other cranial nerves [11]. We did not find in-depth otoneurological studies in HD patients with CVD, especially with a reflection of their dynamics against the background of the use of modern antihypertensive drugs. It is also impossible to consider the issue of the frequency of occurrence and nature of auditory and vestibular disorders as resolved, so if Tanchev K.S. (1999), believes that in hypertension, hearing loss is mild and rare, then according to Agakhanova A.G. and Lebedeva N.V. (2003) such a pathology is detected in more than 90% of cases.

The purpose of this work is to study the otoneurological characteristics of pre-stroke cerebrovascular disorders in patients with hypertension .

Material and methods. Under our supervision were 110 patients with GB of a stable course treated in the clinical bases of the Research Institute of Cardiology of the Ministry of Health of the Republic of Uzbekistan . GB was diagnosed according to WHO criteria (1978). The control group consisted of 30 persons not suffering from GB.

All examined were males, whose age was distributed as follows. 25-44 years old - 12 people (10.9%), 45 - 59 years old - 76 patients (69.1%) and over 60 years old - 22 examined (20%).

As can be seen from the above data, among the patients with GB examined by us, persons aged 45-59 years predominate, i.e. mature and older persons.

The duration of GB varied from 1 year to 20 years, including; 1 year suffered from hypertension 1 person, 1 - 5 years - 30 patients, 5-10 years - 36 examined, 10-15 years - 30 people and more than 15 years were 13 people.

Regarding the research methods, it should be noted that all patients underwent a general clinical examination, which included: examination of the somatic (cardiological), neurological and otoneurological status, rheoencephalography (REG), echoencephaloscopy (EchoES), electroencephalography (EEG), audiometry (AM) and electronystagmography (ENG) according to generally accepted methods.

In addition, all patients underwent a general analysis of urine, blood, the level of total cholesterol, lipid fractions in the blood, and a coagulogram were determined. Since the obtained results of biochemical studies did not differ from the literature data, we did not describe them.

Excluded from the study were persons who had previously suffered from ENT - diseases that could cause hearing loss, regardless of hypertension.

According to cerebrovascular pathology, patients were distributed as follows.

Distribution of patients according to CVR forms.

TsVR form	Number of patients	% to total qty
NPNMK	28	25.5
GE - I	37	33.6
GE -II	26	23.6
GE with PNMK	19	17.3

Results and discussions

Audiometric study of hearing.

1. The results of tone threshold audiometry.

For the purpose of a more detailed study of auditory reliefs over a wider frequency range, we conducted, along with tuning fork studies, a study of hearing with an audiometer.

Of the 110 examined, in 82 (74.5%) on the audiogram, damage to sound perception of varying degrees was detected, in 28 (25.5%) patients, tonal hearing was within the normal range. If we consider the state of tonal hearing according to the stages of HE, then normal hearing was detected in 11 out of 28 patients with NLMK, with HE - stage I. in 13 out of 37, with GE - II st. in 3 out of 26 patients and in HE with PNMK - in 1 out of 7 patients.

According to the degree of hearing loss in air and bone conduction, all audiograms were divided into 4 groups. Information about the number of patients in each group is presented in the table.

Degree of hearing loss by air conduction

Used-frequencies _	A loss hearing in %	Forms DTSVR				Total	
		NPNMK	I	II	With PNMK	Qty	% to total quantity
125-2000 Hz	5-10	13	15	9	5	42	38.2
	11 - 20	3	5	7	8	23	20.9
	21 - 30	1	3	5	3	12	10.9
	> 30	-	1	2	2	5	4.5
3000-8000 Hz	5-10	7	7	3	2	19	17.3
	11 - 20	8	10	5	2	25	22.7
	21 - 30	2	3	4	1	10	9.1
	> 30	-	4	eleven	13	28	25.5

As can be seen from the table, for damage to the organ of hearing in LCVR, a predominant decrease in the perception of high tones is characteristic. So, if during the perception of tones of the speech zone, hearing loss of more than 30% was detected in 5 (4.5%) patients, then with the perception of tones of 3000-8000 Hz in 28, which is more than 5 times more often.

In patients with NPLMC, a decrease in hearing acuity by more than 30% was not detected in any of them, in patients with HE- I stage. in 4 out of 37, with GE- II st. in 11 out of 26, and in those suffering from HE with PNMK - in 13 out of 19 examined. Consequently, with the aggravation of the disease, the volume of hearing for high tones decreases.

For a more complete reflection of the nature of the damage to the organ of hearing, we analyzed the degree of hearing loss for bone conduction sounds. Information about this is presented in the table.

The degree of hearing loss for bone conduction sounds.

Used - bathrooms frequencies	A loss hearing in %	DTSVR forms				Total	
		NPNMK	GE I	ET II	GE with PNMK	Qty	% to total
125-2000 Hz	5-10	eleven	eleven	7	2	31	28.2
	11 - 20	4	7	7	4	22	20
	21 - 30	2	4	5	6	17	15.5
	> 30	-	2	4	6	12	10.9
3000-8000 Hz	5-10	3	1	-	-	4	3.6
	11 - 20	4	4	4	-	12	10.9
	21 - 30	6	8	4	3	21	19.1
	> 30	4	eleven	15	15	45	40.9

As can be seen from the table, the drop in hearing acuity for bone-conducted sounds is also more pronounced for high tones. Thus, a decrease in auditory volume by more than 30% was detected in 12 (10.9%) patients with tones of the speech zone, and in 45 (40.9%) patients with tones of 3000-8000 Hz.

We have analyzed and systematized tone audiograms and obtained the following types: 1. Curves with almost normal hearing up to 2000 Hz followed by a sharp decline (“dip”) at 2000 Hz, 4000 Hz or 6000 Hz. This type of audiogram was obtained in 20 (18.1%), and 3 of them had it in only one ear. 2.

Curves of a descending type - with a gentle or steep drop in hearing to high tones or concave were present in 56 (50.9%) of the examined, 3 of them had only one ear. 3. The horizontal type of the curve was found in 6 (5.4%) examined patients with a loss of hearing acuity in air and bone conduction by an average of 20 dB .

Most of the surveyed met mainly the first and second types of audiometric curves. Thus , 28 examined patients had normal hearing, 20 had an isolated drop in tones of 2000 Hz, 4000 Hz or 6000 Hz, and 62 had impaired sound perception.

In the first type of curves, there was a slight decrease in hearing acuity or there was none at all up to 2000 Hz, and then a drop by 4000 Hz in 11 patients, by 6000 Hz in 8, and in one examined person - 2000 Hz.

According to the degree of hearing loss during air and bone conduction of sounds, the curves were divided into 4 groups. Information about the number of patients in each group is presented in the table.

The degree of reduction in the perception of sounds during air conduction in patients with the first type of audiometric curve.

downgrade hearing in %	Researched frequencies			
	125 -2000 Hz.		3000 - 8000 Hz	
	abs	%	abs	%
5-10	19	17.2	3	2.7
11 - 20	1	0.9	15	13.6
21 - 30	-	-	2	1.8
> 30	-	-	-	-

Thus , both with air and bone conduction of sounds with the second type of curve, hearing acuity decreases most often by 11-30% in the speech zone, and by more than 30% in high tones. With bone conduction of sounds, perception is disturbed more than with air conduction. For high tones, the sensitivity of the organ of hearing falls more, both with air and bone conduction of sounds.

In addition, in those examined with the second type of audiometric curve, a “break” in bone perception to high tones was revealed: at 3000-8000 Hz. - in one patient, at 4000-8000 Hz. - in 3 patients; at 6000-8000 Hz - in 4 patients; at 8000 Hz. - in 6 patients. Thus , 12.7% of the examined patients had a bone

break in high tones. Of all the persons who had a bone "breakage", 1 suffered from the first stage, 6 - from the second stage of HE, 7 - from HE with PNMK.

The third type of curve was found in 6 patients. As an illustration, we present an audiogram of the third type of curve. In 5 patients of this group, during air conduction of sounds to the speech zone, the acuity of tonal hearing was reduced by 20%, in one examined - by 30%. With bone conduction of sounds, the acuity of tonal hearing is reduced by tones of 125 - 3000 Hz. in 4 patients by 30%, in 2 by more than 30%, by high frequencies in 2 by 20%, in 4 examined patients by more than 30%. Consequently, in those examined with a horizontal type of curve, the decrease in tonal hearing both with bone and air conduction of sounds is almost the same.

In order to find out whether the found changes in hearing acuity depend on the suffering of LCVR, we compared the average curves of patients and persons in the control group, which is presented in the following figures.

As can be seen on the audiograms, the average curves in patients with NPNMK are located below the curves of the faces of the control group by 3-10 dB ., GE- I stage-4-15 dB , GE- II stage. - by 5 - 20 dB ., GE with PNMK - by 6 - 23 dB . Moreover, this difference is more pronounced for high tones in all stages of the LCVR. As can be seen on these audiograms, the loss of tonal hearing increases with the severity of the disease.

Comparison of complaints about hearing loss and the results of tone audiometry revealed that hearing loss is observed 1.5 times more often than the subjects themselves noticed.

Therefore, to accurately determine the acuity of hearing in patients with LCVR, it is necessary to conduct pure-tone audiometry. With the latter, the majority of those examined revealed a bilateral decrease in perception both during air and bone conduction of sounds. The curves are located almost at the same level, but the volume of hearing acuity in the vast majority of sounds examined during bone conduction decreases to a much greater extent, especially for high tones. Normal tonal hearing is quite rare. In the majority of the examined patients, there is a lesion of sound perception of varying degrees.

The decrease in the acuity of tonal hearing increases depending on the stage of the disease, and not on age.

At DTSVR three types of audiometric curves are characteristic; isolated drop on tones 4000 or 6000 Hz., descending and horizontal type of curve. For NPNMK and the first stage of HE, the first type is

characteristic with an isolated fall into separate tones, with HE- II st. and GE with PNMK - most often there is a gently descending type of audiogram. In patients with LCVR, regardless of the type of curves, a decrease in perception is especially pronounced, mainly during bone conduction of high-pitched sounds. The greatest hearing loss is found in those examined with the second type of curves.

The vast majority of hearing loss exceeds that of the control group. Consequently, with DTsVR there is a decrease in tonal hearing, and in the presence of age-related changes, the sensitivity of the sound analyzer decreases even more.

D. The results of the study of the organ of hearing by speech audiometry in patients with hypertension with CVD.

We performed speech audiometry in all 110 patients and 30 controls. Analyzing speech audiograms, we found: speech hearing is within the normal range in 15 (13.6%), and in 13 it is not changed in both ears, and in 2 - in one ear. Bilateral decrease in speech hearing in 95 (86.4%) patients. If we consider the state of speech hearing by stages of HE, then out of 28 patients with NLUMC, normal speech hearing was found in 6, in the first stage of HE - in 4 in both ears and in one - in 1 ear, in the second stage of HE - in 2 out of 26 examined - in both ears and in 1 - in one ear, with HE with PNMK in 1 examined out of 19. Thus , with the progression of the underlying disease, the number of people with normal speech hearing decreases.

According to the range of speech intelligibility, we divided the examined into 3 groups. The first included persons with an increased range of speech intelligibility - 54 (49.1%). Their speech intelligibility curves were flatter. In this group, 5 people did not have hearing impairments in pure-tone audiometry, 2 did not achieve 100% speech intelligibility. In 13 patients, with an increase in sound intensity, the percentage of speech intelligibility fell. Among those surveyed with an increased range of speech intelligibility, 11 suffered from NPLMC, 20-GE- I stage, 14 - GE- II stage, 9 - GE with PNMK.

The second group consisted of 45 (40.9%) patients with a normal range of speech intelligibility. Of these, 14 did not have tonal hearing impairment (6 people - NPNMK, 4 - GE- I st., 3 - GE- II st. and 1 - HE with PNMK). In 10 subjects, speech intelligibility curves followed the course of curves with normal hearing. Of the 23 people with hearing impairment according to tone audiometry, 12 had speech intelligibility curves parallel to the curve of normal hearing, but were shifted along the abscissa axis by an average hearing loss by tones of the speech frequency zone. In 15 subjects, the speech intelligibility curves were shifted more than the average hearing loss by the tones of the speech frequency zone.

The third group includes curves with a reduced range of speech intelligibility, when they go more steeply upwards than in normal hearing. All examined in this group - 11 people (10%) had tonal hearing impairment.

In the second and third groups, in persons with impaired tonal hearing, there was a discrepancy between the ratios between the three levels of intensity: “threshold of hearing”, 50% and 100% speech intelligibility. In such patients , tone -speech dissociation was also more common . To illustrate the above, we present the tonal and speech audiograms of a patient suffering from GE- II st. has : 1) no disturbance on the tone audiogram; 2) there is a correspondence of tonal hearing to the age-related physiological norm; 3) the range of speech intelligibility is increased and the ratios of three levels of intensity are violated - the threshold of “audibility of speech” is 15 dB , the threshold of 100% speech intelligibility is 60 dB , the range of speech intelligibility is 60-15 = 45 dB . Speech “hearing” threshold increased by 15 dB , 50% speech intelligibility threshold by 25 dB , 100% threshold by 15 dB ; 4) there is a dissociation between tonal and speech hearing: speech loss (at the level of 50% speech intelligibility) 55-30=25 dB , hearing loss for tones - 5 dB , dissociation is 25-5=20 dB . This ratio is typical for the defeat of the sound-perceiving and cortical parts of the sound analyzer.

To find out the dependence of the state of speech hearing on the severity of the disease, we analyzed the data of speech hearing by the stages of the disease, which is presented in

Table 1.

The state of speech hearing in patients with hypertension with various forms of LCVR.

Type parsing	Stage of the disease											
vivacity	NPNMK			GE-I			GE- II			GE with PNMK		
speeches	Total	N rech . hearing	lower . speech . Rumor	Total	N rech . hearing	lower . speech . hearing	Total	N rech . hearing	lower . hearing speeches	Total	N Rech . hearing	lower . hearing speeches
1 2	12 16	- 6	12 10	18 18	- 5	18 13	15 6	- 3	15 3	10 5	- 1	10 4

3	-	-	-	1	-	1	5	-	5	4	-	4
Total	28	6	22	37	5	32	26	3	23	19	1	18

As can be seen from the table, the majority of patients with NCLCM had the second type of speech intelligibility curve (57.1%) and 12 (42.9%) had the first type. In 6 speech hearing is within the normal range, in 22 it is reduced. With GE- I st. The first type of curve in 18 (48.65%), in 18 (48.65%) - the second type, the third type in 1 (2.7%).

Normal speech hearing was detected in 5 patients. With GE- II Art. the first type of curve in 15 (57.7%), in 6 (23.1%) - the second type, in 5 (19.2%) - the third type. In this group, 3 people (11.5%) had normal speech hearing. In case of HE with CIMC, 10 (52.6%) patients were diagnosed with the first type, 5 (26.3%) - with the second type, and 4 (21.1%) - with the third type. Only 1 out of 19 examined had speech hearing within the normal range (5.3%). Consequently, the acuity of speech hearing worsens with the severity of the disease. Some of the surveyed revealed tone -speech dissociation at the level of 50% speech intelligibility. Information about this is presented in Table. Tab. No.

Indicators of tone -speech dissociation in patients with GB with LCVR.

Tono -speech dissociation (db)	Number of examined Stage of the disease				Total	
	NPNMK	GE- I	GE- II	GE with PNMK	abs	%
5-10	6	8	9	10	33	thirty
11 - 20	2	3	6	6	17	15.5
21 - 30	1	2	1	-	4	3.6
> 30	-	1	-	-	1	0.9
Total	9	14	16	16	55	50

As can be seen from Table. Tone -speech dissociation is present in 50% of the examined patients, of which a third of the patients with NPLMC have a third of patients, with HE - I degree. - about half, with GE- II st. and HE with PNMK - in more than half of the examined.

The presence of tone -speech dissociation depending on the type of speech intelligibility curve is shown in the table.

Indicators of tone -speech dissociation depending on the type of speech intelligibility curve

Type of speech intelligibility curve	Tono -speech dissociation Number of patients	
	abs	%
1 2 3	36 15 4	32.72 13.64 3.64
Total	55	50

As can be seen from the table, tone -speech dissociation in 32.72% falls on the first type of speech intelligibility curve, which indicates the presence of this group of examined disorders in the cortical section of the sound analyzer.

In order to find out whether the detected speech hearing impairments depend on dyscirculatory disorders or on age-related changes in the hearing organ, we compared the average indicators of those suffering from CVD with the data of the control group. In the latter, the first type of speech intelligibility curve was found in 2 examined patients (6.67%), the second type of curve in 27 patients (90%), and the third type of curve in 1 (3.33%). Speech hearing disorder was found in 3 patients (10%).

Thus , in persons of the control group, speech hearing is changed to a much lesser extent than in patients with LCVR. They are less likely to have the first type of speech intelligibility curve than hypertensive patients.

We also performed speech audiometry with bass and treble words. In persons suffering from NPNMK and GE- I stage, the speech intelligibility curve for the bass group of words is shifted to the right along the abscissa axis (i.e., loss of speech acuity) by 5 dB , and for the treble group of words - by 10 dB ; in II Art. GE the speech intelligibility curve for the bass group is shifted by 10 dB , and for the treble by 15-20 dB . Approximately the same hearing loss is present for HE with MIH.

Therefore, when using the treble group of words, there is a slightly greater loss of speech hearing than when using the bass group of words, which is typical for the defeat of sound perception.

Summarizing the above, we note that in patients with LCVR, changes in speech hearing were detected in the vast majority. Violation of speech hearing, as well as tonal hearing, increases with the severity of the disease. Age-related changes only burden it somewhat. The change in speech hearing is bilateral. According to the type of speech intelligibility curves, the examined can be divided into 3 groups, which differ from each other in the range: increased, normal, shortened. Most patients with LCVR are characterized by speech intelligibility curves of the first type (increased range).

Among those with a second type of speech intelligibility curve (with a normal range), the majority of speech hearing is altered. Moreover, a significant number of their speech intelligibility curves are shifted along the abscissa to the right more than the average loss of tonal hearing in the speech frequency zone, which indicates the presence of tone -speech dissociation.

In the majority of patients with NPNMK and GE- I st. the second type of speech intelligibility curve is observed. For the majority of those surveyed with GE- II st. and GE with PNMK-1 type of speech intelligibility curve is typical. In persons with NPLMC, the quantitative loss of speech hearing is small, in persons with HE- I st. - it is increased by 2 - 3 times, with GE- II c t. - 3-4 times, and in HE with PNMK - 6-7 times, compared with loss of speech hearing in those suffering from PNMK. Consequently, the acuity of speech hearing worsens with the severity of the disease. Tono -speech dissociation also increases with the progression of the disease. Its presence is characteristic of the defeat of the sound-perceiving department of the cochlea and the cortical department of the sound analyzer.

When perceiving the words of the treble group, speech hearing is impaired more than the words of the bass group, which confirms our observations about the predominant lesion of the sound-perceiving section of the sound analyzer in those suffering from LCVR.

CONCLUSIONS

Speech hearing impairment is associated with the severity of the disease and, in addition, it increases with age.

The study of speech hearing allows to reveal subtle disorders in the functional state of the central parts of the sound analyzer, which cannot be detected with tone audiometry.

Thus, in patients with calorization, altered responses are noted, indicating the presence of central vestibular disorders. They can be used for diagnostic purposes.

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