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STUDY OF AUDITORY FUNCTION IN HYPERTENSION DISEASE

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Abstract:
Comprehensive audiometry was performed in 100 patients with hypertension. Threshold pure-tone audiometry was used, the phenomenon of accelerating the increase in volume was studied according to the differential threshold of sound intensity, and speech audiometry was used by air and bone conduction. The thresholds for undifferentiated speech, 50 and 100% speech intelligibility were determined. The examination revealed various degrees of increase in tonal hearing thresholds in 89% of patients, and impaired speech intelligibility in 78% of patients. The nature of the tonal and speech curves was characteristic of damage to sound perception. The degree of hearing impairment for sounds and speech depended on the stage of hypertension. Speech intelligibility by bone conduction in the majority of patients with stage 2 and 3 hypertension was worse than by air conduction.

Keywords: auditory function, cortical hearing loss, speech intelligibility, pure-tone audiometry, audiogram

RELEVANCE. Hypertension is one of the most common diseases, accompanied by functional and organic changes in various organs and systems, including auditory and vestibular function. According to many authors, hearing changes in hypertension can be caused by damage to various parts of the auditory analyzer - the cochlea, pathways, and cerebral cortex. According to S.L. Kristosturyan and co-authors, who revealed dysfunction of the sound-perceiving apparatus in patients with hypertension. Johnson, Zonderman found changes in the sound-conducting system, but did not find significant changes in hearing. This diversity in the assessment of auditory function can apparently be explained by the different populations of patients examined and the difference in the methods used to study hearing. We did not find any works on the use of speech and tone suprathreshold audiometry in patients with hypertension in the literature. The value of speech audiometry lies in the fact that certain types of speech intelligibility growth curves correspond to different forms of damage to the auditory analyzer, and these curves can be used for differential diagnosis. The ability to use standard speech tables and quantify the degree of speech intelligibility make the method of speech audiometry objective. Speech audiometry by bone conduction can be used for the same purpose.

MATERIALS AND RESEARCH METHODS. We conducted a comprehensive study of auditory function in 100 patients with hypertension (40 men and 60 women) aged 45 to 70 years, who had no pathological changes in the ENT organs. 20 people were diagnosed with stage 1 hypertension, 60 people - stage 2 and 20 people - stage 3. We used threshold pure-tone audiometry by air and bone conduction to study these patients. The phenomenon of accelerating the increase in volume according to the differential threshold of sound intensity was studied. Speech audiometry was used using air and bone conduction; thresholds for undifferentiated, 50 and 100% speech intelligibility were determined. All these studies were carried out in a soundproof chamber on a MA-31 pure-tone audiometer. Most patients complained of tinnitus, which had the character of the ringing of a bell, the noise of the wind and forest, the hum of wires, the hissing of a samovar, etc. In some patients it was constant, in others it was periodic; during periods of increased blood pressure and increased headaches, it became more pronounced . Subjectively, decreased hearing (mainly deterioration in speech intelligibility) was noted by persons with cerebral hypertension, as well as by the majority of patients with stage 2 and 3 hypertension. Only 11 patients had normal hearing thresholds for tones. A slight increase in them for individual tones of the high-frequency range (4000, 6000, 8000 Hz) with normal hearing sensitivity for other tones was noted in 11 people. The remaining subjects observed an increase in hearing thresholds of varying degrees across the entire frequency range. Out of 200 tone audiograms, the horizontal type of curve was established in 32.5% of observations, a horizontal curve with a decline at some high frequencies in 35.5%, a steeply descending curve in 12%, a gently descending curve in 14% and a concave curve in 6% of observations. Tone audiometric air conduction curves completely coincided with the bone conduction curve in 40% of cases, crossed in 47%, the bone-air interval of 5-20 dB was expressed in 13% of patients. Hearing thresholds based on bone conduction

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in 44 audiograms were higher than those based on air conduction; in 6 of them, a break in the curve was observed in the high-frequency zone. Analysis of speech audiograms showed that speech intelligibility was within normal limits in only 22 people. Its unilateral decrease was observed in 3, and bilateral - in 75 patients. The degree of hearing impairment for speech depended on the stage of hypertension. Of the 20 patients suffering from stage hypertension, a decrease in speech intelligibility to 20 dB was noted in only 7. Of the same number of people with stage 3, such a decrease in hearing was detected in 6, more than 20 dB - in 22, and in 2 people 100% speech intelligibility was not reached at the audiometer limit (110 dB).

RESULTS. We found that speech intelligibility by bone conduction was worse than by air conduction in the majority of patients with stages 2 and 3 hypertension. Thus, in stage 2, speech loss of 21 dB or more by air conduction was observed in 23% of patients, and by bone conduction the same hearing loss was detected in 40%. Optimal speech intelligibility was not achieved at the limit of the audiometer by air conduction in 10% of those examined, and by bone conduction in 23%, while lower speech intelligibility when examined through a bone telephone compared to an air one, according to Hahlbrock (2015), is typical for damage to sound perception. Depending on the degree of speech intelligibility, the audiometric curves had different slopes, and in 46% of those examined with mild impairment of auditory function, the growth curves of speech intelligibility ran parallel to the curve of normal hearing. In 54% of patients with hearing loss of varying degrees, they were located more hollowly. In this case, the correct relationships between three intensity levels were violated: the threshold of undifferentiated speech, 5 50 and 100% speech intelligibility. According to B.A. Rastov (2012), such curves are characteristic of damage to the sound-receiving apparatus.

When analyzing speech curves, the ratio of the intensity reserves of air and bone conduction was studied by dividing the value of the intensity reserve for air conduction by the same value for bone conduction. It has been established that in persons with normal hearing, the coefficient of intensity reserves, conventionally designated "CRI," is equal to 1.7 dB (60 dB: 35 dB = 1.7 dB). When the sound-conducting system is damaged, it is less than 1.7 dB, and with receptor hearing loss it reaches 5-8 dB or more. In the hypertensive patients we examined with normal and mildly reduced hearing (up to 20 dB), the CRI is 1.7-2.2 dB. In patients with hearing loss of more than 20 dB, the CRI reaches an average of 8 dB. This fact is explained by the fact that as hearing loss increases, speech intelligibility via bone conduction suffers to a greater extent than via air conduction. In this regard, the intensity reserve for bone conduction sharply decreases, and in some patients completely disappears. Thus, a high ratio of intensity reserves indicates damage to the sound-receiving apparatus. Differential diagnostic significance is also attached to the range of speech intelligibility, i.e., the increase in intensity from the threshold of undifferentiated speech to its optimal intelligibility. In 66% of patients with hypertension with mild impairment of auditory function, a normal range of speech intelligibility was observed. In 32% of patients with a high degree of hearing loss, the range of speech intelligibility was extended, and only in 200 patients it was shortened. Some patients experienced speech-tonal dissociation, i.e., a discrepancy between the nature of speech curves and tonal hearing thresholds. Determination of speech-tone dissociation by comparing thresholds of 50% intelligibility with average hearing loss for tones in the speech range showed that in some patients it was absent at the threshold of 50% speech intelligibility, but was expressed at the level of 100% of speech intelligibility. This phenomenon, apparently, can be explained by the peculiarities of the growth curves of speech intelligibility, sharp changes in the tonal audiometric curve from low to high tones, as well as changes in the central sections of the auditory analyzer. To clarify the reasons for the detected speech-tone dissociation, the differential sound intensity threshold according to Luscher was studied. The study results were compared with other audiological tests. It was found that in 22% of patients, normal or slightly increased hearing thresholds for tones by air and bone conduction in the high-frequency zone were combined with normal speech intelligibility and normal values of the differential threshold of sound intensity according to Luscher; in 4% of those examined, with normal perception of tones, speech intelligibility was severely disrupted. Speech-tone dissociation was 25 dB, the differential sound intensity threshold was high and reached 3.10-6.02 dB. This hearing loss is considered characteristic of cortical hearing loss.In 29% of patients with speech loss of no more than 20 dB and the same decrease in hearing for tones in the range of conversational frequencies (125-2000 Hz), speech-tonal dissociation was absent; in the high-frequency zone (4000, 6000, 8000 Hz) the tonal curves of these patients had a pronounced descending character, which is a characteristic sign of damage to the receptor apparatus of the cochlea, but the fact that they did not have the phenomenon of accelerated increase in volume along the differential threshold of sound intensity indicates the retrolabyrinthine nature of hearing loss. In 43% of patients, high tonal hearing

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thresholds and pronounced speech-tone dissociation (from 15 to 25 dB) were established. Speech intelligibility was impaired to a greater extent than tone perception. In 12 of these patients with descending curves in the treble frequency zone and a normal differential sound intensity threshold according to Luscher, speech-tone dissociation was apparently caused by sharp changes in the curve from low to high tones. such hearing loss can also be considered retrolabyrinthine hearing loss. In the remaining patients (31 people), in the presence of tonal and speech curves typical for damage to sound perception, a high coefficient of intensity reserves, the absence of the phenomenon of accelerated increase in loudness according to Luscher and pronounced speech-tonal dissociation, a combination of retrolabyrinthine hearing damage with a functional disorder of the cortical parts of the auditory analyzer can be assumed. Only in 2 patients, in whom 100% speech intelligibility was not achieved either by air or bone conduction, and the tonal hearing curves were descending in the treble frequency zone with a positive fung, one could think about damage to the receptor apparatus of the cochlea.The absence of the phenomenon of accelerated increase in loudness according to Luscher and pronounced speech-tone dissociation can suggest a combination of retrolabyrinthine hearing damage with a functional disorder of the cortical parts of the auditory analyzer. Only in 2 patients, in whom 100% speech intelligibility was not achieved either by air or bone conduction, and the tonal hearing curves were descending in the treble frequency zone with a positive fung, one could think about damage to the receptor apparatus of the cochlea.The absence of the phenomenon of accelerated increase in loudness according to Luscher and pronounced speech-tone dissociation can suggest a combination of retrolabyrinthine hearing damage with a functional disorder of the cortical parts of the auditory analyzer. Only in 2 patients, in whom 100% speech intelligibility was not achieved either by air or bone conduction, and the tonal hearing curves were descending in the treble frequency zone with a positive fung, one could think about damage to the receptor apparatus of the cochlea.

CONCLUSIONS 1. A comprehensive audiological examination of hearing using pure tone threshold and suprathreshold audiometry, as well as speech audiometry using air and bone conduction, more objectively reflects the state of auditory function.
2. The most common form of hearing impairment in patients with hypertension is retrolabyrinthine damage such as cochlear neuritis, cortical hearing loss, and their combination. Intracochlear damage to the peripheral receptor is much less common.

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