STATE OF THE PROTECTIVE FUNCTION OF THE ACOUSTIC REFLEX IN WORKERS OF NOISE OCCUPATIONS WITH LESIONS OF CORTICAL AND SUBCORTICAL PARTS OF THE AUDITORY ANALYZER

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Abstract: *The high degree of mechanization and automation of industrial enterprises places increased demands on the state of the central nervous system of people working on them, as well as sound and visual analyzers, and hemodynamics in general. The introduction of new technology, equipment, tools and materials leads to the emergence of various types of unfavorable factors affecting the body of workers. In this case, the main negative impact is noise, causing significant changes in the sound analyzer.*

Key words: *acoustic reflex, auditory analyzer, noise occupation*

Introduction: It follows from the literature that under the influence of intensive industrial noise there are changes not only in the receptor apparatus of the auditory analyzer, but also in the cortical and trunk sections (1,2).

The purpose of this work was to study the correlation between the indicators of audiometry, electroencephalography (EEG), registration of long-latency auditory evoked potentials (ALEP) and temporal characteristics of the acoustic reflex of the intra-ear muscles (IARM) in occupational hearing impairment.

On the basis of these studies we selected workers of noise professions with occupational hearing loss, having disorders of the cortical section of the auditory analyzer and its trunk (group 1), only cortical structures (group 2), as well as normally hearing persons who did not work in noise conditions (control group 3).

Materials and Methods: The age of the examined in all groups was almost identical - from 30 to 50 years old. Work experience in group 1 was

from 20 to 30 years, in group 2 - from 15 to 25 years. They were somatically healthy and had no pathology of ENT organs.

In addition to audiometric studies, all workers were recorded using a specialized system MK-6 from "Amplaid" (Italy). The patient was in a sound-isolating chamber, positive electrodes were placed on the parietal (+), negative electrodes - on the mastoid process (-), neutral - on the frontal bone (0).

As sound stimulation were presented tone parcels of 300 ms duration with filling frequency of 0.5 and 1.0 kHz (rise and fall time of 20 ms each).

The stimulus intensity was 40 dB above the subjective hearing threshold for the corresponding frequencies. The frequency of the tone parcels was 0.5 Hz. The analyzed curves recorded in each subject at separate sound stimuli were an algebraic sum of 32 separate averaged DSVPs recorded at a filter pass bandwidth of 2-20 Hz and analysis time of one sample of 750 ms. The evoked electrical activity was recorded in response to ipsilateral presentation of a sound stimulus through the cup electrodes, the location of which is indicated above.

The study of temporal characteristics of ARVM was carried out with the help of an impedance meter "Amplaid-720" (Italy) and recorded on a floppy diskette of a personal computer 1VM (USA). We used tones of frequency 0.5 and 1.0 kHz with duration of 1000 ms (rise and fall time up to 20 ms), intensity of 10 dB above the threshold of ARVM on each frequency at ipsi- and contralateral presentation.

According to audiometry data, in group 1 persons there was a decrease in air-bone conduction of tones in the speech frequency range of 125- 2000 Hz to 40 dB, and in the range of 3000-8000 Hz - to 70-80 dB. The differentiation thresholds at 2000 and 4000 Hz were in the range of 0.8-0.6 dB. In addition, they had a slow increase in the intelligibility of the verbal test with its paradoxical decrease with increasing intensity (according to E. M. Kharshak).

The EEG of the workers of this group showed a decrease in the amplitude of alpha-rhythms in all leads, as well as an increase in the percentage of beta-, delta- and theta-rhythms in temporal and occipital leads, which indicates dysfunction of cortical-subcortical parts of the brain. According to CSVP data, the inter-peak interval I-V and latency of wave N2 of DSVP were increased, which objectively confirms the involvement of brain stem and cortical structures in the pathological process.

In the workers of the 2nd group the perception of hearing for tones in the speech frequency range was normal, at frequencies 3000-8000 Hz -

26.5±3.5 dB on average. Thresholds of differentiation at frequencies 500-2000 Hz were equal to 1,5-1,0 dB, at 4000 Hz - 0,7±0,1 dB. The intelligibility of speech tests was within the normal range. On EEG in workers of this group predominance of beta-rhythm in all leads was noted both at background recording and at functional loads that testified to diffuse processes of irritation in cortical structures of the brain. There were no deviations in CSVP indices, but there was found an increase in the latency of the N2 wave compared to the control group, which indicated disturbances in the cortical part of the

The results of these two groups showed an increase in the latency of the peak of the N2 DSVP wave compared to the norm both at 0.5 kHz tone stimulation (1st - 308.9 + 5.6 ms; 2nd - 273.3 + 6.9 ms) and 1.0 kHz (1st - 309.1 ± 5.9 ms; 2nd - 264.4 + 7.4 ms) at an intensity of 40 dB above the hearing threshold. This objectively confirms the violation of the cortical part of the auditory analyzer in them. The reliable (P<0,05) lengthening of N2 wave peak latency at similar stimulation in group 1 compared to the data of group 2 draws attention. Differences in the values of the latency of the peaks of Pь N1, P2 waves in these groups are not reliable.

In the persons of the examined groups in the majority of cases there were detected dos-true deviations from the norm of duration of temporal characteristics of ARVM both at ipsi- and contralateral stimulation with tones 0.5 and 1.0 kHz. Thus, in group 1 at ipsilateral stimulation with 0.5 kHz tone the latent period of ARVM amounted to 138.5± + 5.3 ms, rise time - 97.5+5.9 ms; time of action of acoustic reflex - 787.5+10.7 ms, and fall time - 185.0±7.5 ms. Corresponding values of ARVM for the 2nd group with the same stimulation frequency were equal to respectively: 135.0+5.2 ms; 96.4+16.6 ms; 890.7±20.2 ms and 144.3+12.3 ms. At ipsilateral presentation with a 1.0 kHz tone in workers of group 1, the latent period of the ARVM, its rise, action and fall times were respectively: 155.8± ± 5.3 ms; 189.9± 8.2 ms; 689.7± 10.2 ms and 190.0± 9.4 ms, and in group 2 - 145.0± 8.0 ms; 160.0± 14.5 ms; 822.1± 20.1 ms and 155.7± 10.3 ms, respectively.

As can be seen from the given data, more pronounced deviations from the norm ARVM parameters were observed in workers of the 1st group, in whom, according to EEG data, both cortical and subcortical structures of the brain are interested. Here we should also note the greatest changes in the temporal characteristics of ARVM at contralateral stimulation. An increase (P<0.05) in the total duration of ARVM at ipsilateral stimulation with tones of 1.0 and 0.5 kHz was found in workers of the 2nd group compared with the 1st group, which amounted to 1139.3± 16.8 ms; 1138.6± 13.1 ms;

1060.0±11.1 ms and 1075.5±8.8 ms, respectively. The same reliable dependence was found for contralateral stimulation with 1.0 and 0.5 kHz tones: 1137.1 ±21.9 ms; 1130.7±14.2 ms; 1068.5±15.8 ms and 1070.0±9.2 ms, respectively. The duration of the latent period of ARVM both at ipsi- and contralateral stimulation in these groups was not statistically significant.

In group 1, the rise and fall time of the acoustic reflex increased ($P<0.05$), and its action time decreased, whereas in group 2, the rise and fall time decreased, and the action time increased. This regularity is traced at ipsi- and contralateral stimulation with tones of 1.0 and 0.5 kHz.

The study of the correlation analysis between the temporal parameters of the ARVM and the duration of the latency of the peak of the N2 DSVP wave showed a weak correlation with the duration of the acoustic reflex decline time at ipsilateral stimulation with a tone of 0.5 kHz in group 1 ($r = 0.35$) and at contralateral stimulation in group 2 ($r = -0.4$).

At ipsilateral stimulation with a 1 kHz tone, a weak degree of connection between the latency of the peak of the U2 DSVP wave in the workers of group 1 and the latency period of the ARVM ($r = 0.39$) and the decline time both at ipsi- ($r = -0.35$) and contralateral stimulation ($r = 0.30$) was observed. As for the 2nd group, the examinees showed a weak degree of correlation at ipsilateral stimulation with a tone of frequency 1.0 kHz with the latent period of the ARVM ($r = 0.46$), its decline time ($r = 0.32$) and total reflex time ($r = 0.44$), and for the total action time the correlation coefficient was 0.52, i.e. it was moderate. The highest correlation coefficient was found in workers of group 1 at ipsilateral stimulation with a tone of 1.0 kHz for the latent period of the ARVM ($r = 0.69$).

Conclusions: Thus, the analysis of the obtained data indicates that the protective function of the intra-ear muscles is affected to a certain extent in workers of noise occupations with disorder of cortical and subcortical structures of the auditory analyzer. Therefore, it is advisable to take into account the state of temporal characteristics of the acoustic reflex of the intra-ear muscles, as well as the central part of the auditory analyzer according to the EEG and DSVP. In this case, the persons who have deviations in the temporal characteristics of the acoustic reflex of the intra-ear muscles are contraindicated to work in noise conditions.

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