Electronystagmographic and Caloric Investigation Data About Vascular-Vestibular Dysfunction Among Patients with Vertebrobasilar Insufficiency

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Abstract: Audiovestibular symptoms are the first and often the only clinical signs of vertebrobasilar insufficiency. The aim of our investigation was to analyze the results of caloric and electronystagmographic investigation of vascular-vestibular disorders among patients with vertebrobasilar insufficiency. We examined a total of 55 men (mean age, 51.8 ± 8.2 years)—a primary group of 35 men with proven vascular-vestibular dysfunction and vertebrobasilar insufficiency and a control group of 20 clinically healthy men. Standard and electronystagmographic ("Tönnies" type) caloric tests were used to evaluate the human vestibular analyzer. Our data from this investigation show that in both rotatory and caloric tests, the slow-phase speed is the most important index about function of the vestibular analyzer.

Key Words: amplitude; caloric test; electronystagmographic parameters; duration; frequency; slow-phase speed; vascular-vestibular disorders; vertebrobasilar insufficiency

Audiovestibular symptoms are the first and often the only clinical signs of vertebrobasilar insufficiency (VBI). The complicated perception of position of the body and its parts in space is a result of analyzed and synthesized impulses by the vestibular analyzer, by superficial and deep proprioception, and by the ocular analyzer, as the vestibular receptors play the main part in this system [1–4].

Anatomical and physiological investigations of blood supply of the vestibular analyzer and vestibular receptors show that these structures are found in most dysfunctional circulatory situations, as anastomotic links are absent and ischemic damage is possible [5–8]. With the exception of arterial hypertonia or atherosclerosis (or both), pathological changes in the cervical spine (cervical osteoporosis) may lead to disturbances in blood supply of the labyrinth and brainstem. According to various authors [2,3,5,9–14], chronic irritation of the sympathetic nerve plexus around the vertebral and basilar arteries provokes reflex changes in blood supply of the inner ear, which leads to vertigo, noise in the ears, and a feeling of hearing loss. Our aim in this investigation was to analyze the results of caloric and electronystagmographic (ENG) investigation of vascular-vestibular disorders among patients with VBI.

SUBJECTS AND METHODS
In the department of neurology and neurootology at the National Transport Hospital Tzar Boris III in Sofia, Bulgaria, we examined a total of 55 men (mean age, 51.8 ± 8.2 years), whom we divided into two groups: a primary group of 35 men with proved vascular-vestibular dysfunction and VBI and a control group of 20 clinically healthy men. All examined patients were divided into two groups according to their age: 40–49 years and 50–59 years.

Above-threshold vestibular provocation was registered by ENG, and asymmetrical reactions for duration, amplitude, frequency, and establishment of the slow-phase
Vestibular Dysfunction Among VBI Patients

RESULTS AND DISCUSSION

Rotatory Tests

On ENG registration, the curve of spontaneous nystagmus shows that the relative share of people with spontaneous nystagmus increases in accordance with increasing age: Among the primary group of patients 40–49 years old, 30% (3 of 10 men) exhibited nystagmus, whereas in the 50- to 59-year-old group, 72% (18 of 25 men) demonstrated nystagmus. Among the control group, 0% of 40- to 49-year-olds and 10% of 50- to 59-year-olds (1 of 10 men) were found to have nystagmus.

The presence of spontaneous nystagmus noted on ENG recordings in patients in the primary group who had no vertigo complaints, however, indicates blood pressure dimensions leading to vestibular dysfunction. The relative share of people in the primary patient group with duration asymmetry of more than 20% is 34.3% (12 of 35 men), much higher than that in the control group (10%, or 2 of 20 men) ($p < .001$).

As regards frequent asymmetry, we found that 31.4% of patients (11 of 35) in the primary group had more than 20% asymmetry, as compared to 5% among men (1 of 20) in the control group ($p < .01$).

Amplitude asymmetry was found in 28.6% of the examined men with vestibular dysfunction, whereas in the control group, the same factor was only 5% ($p < .001$). The SPS data showed that indices up to 20% were met in 54.3% of subjects (19 of 35) in the primary group and 25% of those (5 of 20) in the control group. The difference is rather essential ($p < .001$). The mean SPS index for the main group was 2.3 times higher than that in the control group: 22.11 ± 15.82 degrees/sec and 9.83 ± 8.28 degrees/sec, respectively ($p < .001$). These results show that the most important index is that of SPS, followed by amplitude asymmetry and duration asymmetry.

Caloric Vestibular Tests

In caloric tests, in contrast to rotatory tests, only one labyrinth in each subject was examined. As a whole, the reactions show hyporeflexion, which correlates with the data of rotatory tests. We found that 42.8% of patients in the primary group have a latent period between 30 and 40 seconds (in contrast to the control group’s 35%) and 37.1% have a latent period between

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Figure 1. Percentage of subjects according to labyrinth asymmetry (canal paresis).

According to max. SPS

Frequency in the culmination

Duration

Main group less than 20%  Main group more than 20%  Control group less than 20%  Control group more than 20%

Figure 2. Percentage of subjects according to directional asymmetry (directional preponderance).
asymmetry of more than 20% (CP: 20% of the primary group and 5% of the control group). The SPS indices up to 20% (CP) also showed a statistically significant difference between members of both groups: 45.7% of the primary group and 15% of the control group \( (p < .05) \). The relative share of people with asymmetry increases with increasing age.

The most important index proved to be the SPS index (Fig. 1). Therefore, this index must be applied in routine neurootological practice, especially in vascular-vestibular disorders. The results obtained by Jonkins and Philipson’s formula [4] for prevalence in relation to the direction (DP), at the same indices (Fig. 2), show that SPS asymmetry (DP) of more than 20% is again the most important index (main group, 28.6%; control group, 5%; \( p < .01 \)).

Frequent asymmetry (DP) was found in 17.1% of subjects in the primary group and in 5% of control subjects \( (p < .05) \). We noted no essential difference in regard to duration asymmetry (DP): primary group, 14.2%, and control group, 5%. Frequent asymmetry at culmination was 8.6% and 5%, respectively \( (p > .05) \).

It is the opinion of many authors that directional nystagmus is a symptom of vestibular system disturbance and is a sign of this system’s central damage. In comparing the results of CP and DP asymmetry, we found that CP asymmetry is predominant in all groups at all indices, as the most significant differences are determined in SPS asymmetry. The results of that objective investigation show that receptor damages of the vestibular analyzer prevail over the central ones in people with vascular-vestibular dysfunction at ages between 40 and 49 years.

CONCLUSIONS

The aforementioned, previously observed asymmetry indices—especially the SPS, duration, and amplitude indices of subjects in the primary group—showed statistically based increases relative to increasing subject age. The differences between the two examined groups—subjects and controls—are statistically important for indices of more than 25% asymmetry, relative to the exaggerated vascular disorders in the vertebrobasilar system and especially in the a. labyrinthica among people with vascular-vestibular disorders.

In caloric tests and rotatory investigations, important differences between the two groups were observed at an SPS asymmetry of more than 20% and frequent asymmetry of more than 20% at culmination. As regards DP results, the most important index was SPS asymmetry (DP) of more than 20%, followed by frequent asymmetry.

In comparing the results of CP and DP asymmetry, we found that CP asymmetry is predominant at all indices, as the most important differences are determined in SPS asymmetry. In both rotatory and caloric tests, this index was shown to provide the most information about functions of the vestibular analyzer.

REFERENCES


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