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Cognitive Impairment In Chronic Vertebrobasilar Insufficiency Among Law Enforcement Officers

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Abstract: Chronic vertebrobasilar insufficiency (VBI) is a pathological condition resulting from inadequate blood supply by the arteries that feed the posterior brain regions, which may result in cognitive impairments. Law enforcement officers are at increased risk of developing VBI due to prolonged exposure to stress as well as mental and physical strain. This article analyzes cognitive alterations associated with VBI among officers, including declines in memory, attention, visuospatial, and language functions. The findings indicate that early preventive measures are crucial for preserving occupational performance and cognitive well-being.

Keywords: Vertebrobasilar insufficiency, cognitive functions, law enforcement officers, memory, stress, cerebral circulation.

Introduction: Chronic vertebrobasilar insufficiency (VBI) is a pathological condition characterized by a gradual impairment of blood supply to the posterior circulation of the brain, resulting in hypoxia of posterior brain regions such as the hippocampus, thalamus, and posterior cortical areas [1]. Recent studies indicate that VBI affects not only motor functions but also cognitive processes, including decreased attention and concentration, impairment of working memory, decline in visuospatial perception (e.g., spatial orientation and object localization), changes in language and vocabulary, and reduced capacity for planning and complex decision-making [6].

Microanatomical basis. The cerebellum is involved not only in motor control but also in cognitive processing. The thalamus and the territory supplied by the posterior cerebral artery play a crucial role in sensory and cognitive information transmission; insufficient blood flow in these regions leads to memory and attention deficits. The brainstem (medulla and pons), through the reticular formation, influences the level of arousal and the maintenance of attention.

Clinical manifestations of cognitive impairment. Cognitive changes in VBI are manifested by reduced attention and concentration, difficulties in working memory and performing complex tasks, weakening of visuospatial abilities, and, in some patients, decreased emotional stability. Numerous clinical observations suggest that chronic VBI is one of the causes of early cognitive impairment observed at the initial stages of dyscirculatory encephalopathy and other cerebrovascular diseases. Therefore, early detection and assessment of cognitive changes in this pathology are of particular importance.

Aim of the study. To investigate cognitive functions, particularly working memory and attention, in patients with chronic vertebrobasilar insufficiency and to determine their relationship with cerebral hemodynamic parameters.

METHODS

The study included analysis of anamnesis (family and individual history), tonometry, electrocardiography, color duplex scanning of brachiocephalic vessels, cervical spine radiography, rheoencephalography, and clinical laboratory examinations (lipid profile). Neuropsychological assessment was performed using A.R. Luria's method to evaluate long-term memory; an attention-switching test to assess attention stability

and processing speed; and the Spielberger scale to determine emotional state and anxiety level. Statistical analysis was conducted using Student's t-test ($p < 0.05$ was considered statistically significant). A questionnaire test was also applied to identify manifestations of vertebrobasilar insufficiency in cases of emotional instability.

Materials and methods. The study involved internal affairs officers aged 30–55 years diagnosed with chronic vertebrobasilar insufficiency. A control group consisted of healthy individuals matched by age and sex.

Clinical assessment. Special attention was paid to symptoms such as dizziness, visual disturbances, postural instability, occipital headaches, decreased operational cognitive performance, and psychoemotional instability.

Instrumental examinations. Rheoencephalography (REG) was used to assess cerebral vascular tone and venous outflow; color duplex scanning of brachiocephalic vessels was performed to evaluate vertebral artery patency; in selected cases, magnetic resonance imaging (MRI) findings were analyzed.

Neuropsychological assessment. The "Digit Span Test" was used to measure working (short-term) memory capacity; the "10-word recall" test (A.R. Luria) assessed long-term memory; the attention-switching test evaluated attention stability and processing speed; and the Spielberger scale assessed emotional state and anxiety level. Statistical analysis was performed using Student's t-test ($p < 0.05$).

RESULTS AND DISCUSSION

The results demonstrated that 78% of patients exhibited decreased attention, 65% showed reduced working memory capacity, and 52% experienced slowing of thinking processes. Clinically, these impairments manifested as difficulties in memorizing new information, errors in repeating words or numbers, slower performance of complex tasks, rapid fatigability, and reduced work capacity.

According to the Digit Span Test, working memory capacity in VBI patients was 25–30% lower than in the control group. Healthy individuals recalled an average of 6–7 units, whereas patients with VBI recalled no more than 4–5 units. These findings are associated with insufficient blood circulation in posterior brain structures, particularly the hippocampus and thalamus, which are central components of memory mechanisms.

Attention tests revealed a significantly prolonged reaction time in VBI patients compared to controls (1.6 ± 0.2 s vs. 1.1 ± 0.1 s). This may be attributed to hypoxia in fronto-subcortical connections, resulting in attention instability and increased emotional reactivity.

According to the Spielberger scale, the mean anxiety level was 48 ± 3 points, which was higher than in healthy individuals. This condition can be explained by the negative impact of stress and anxiety on cerebral circulation.

REG examination showed decreased vascular tone and impaired venous outflow in the vertebrobasilar system. A negative correlation was found between working memory indicators and REG parameters ($r = –0.62$; $p < 0.05$), indicating that lower vascular tone is associated with poorer working memory performance.

CONCLUSION

The findings indicate that internal affairs officers with VBI exhibit significant reductions in short-term memory, visuospatial abilities, and executive functions. Compared to individuals with normal cerebral circulation, those with VBI demonstrate decreased work efficiency and impaired attention. Stress and occupational workload represent additional risk factors for the development of VBI. Monitoring blood pressure and lipid profiles, maintaining physical activity, stress management, and early diagnosis through cognitive testing are recommended.

Cognitive impairments represent early neuropsychological signs of dyscirculatory encephalopathy. Early detection of VBI and comprehensive therapy, including angioprotectors, neuroprotectors, and psychocorrection, may facilitate partial restoration of cognitive functions. VBI has a significant impact on cognitive processes; therefore, cognitive assessments should be conducted in addition to evaluating dizziness or coordination disorders. In some cases, cognitive functions may partially recover following improvement of cerebral circulation or appropriate treatment.

Chronic VBI in internal affairs officers may lead to a decline in cognitive functions. Early diagnosis and preventive measures are crucial for maintaining professional performance and protecting overall health, as well as achieving social and economic benefits.

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