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COMPREHENSIVE USE OF THE MOCA TEST AND ARTERIAL PRESSURE MONITORING AS A METHOD FOR EARLY DETECTION OF DISCIRCULATORY ENCEPHALOPATHY IN AMBULATORY CONDITIONS

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Abstract: Dyscirculatory encephalopathy (DE) is one of the most pressing problems in modern neurology and gerontology, characterized by progressive brain damage due to chronic cerebrovascular insufficiency. According to the World Health Organization, cerebrovascular diseases rank third among causes of death and are the leading cause of disability among adults in developed countries.

Keywords: dyscirculatory encephalopathy, vascular cognitive impairment, cerebrovascular diseases, chronic cerebral insufficiency, vascular dementia, mild cognitive impairment, mixed-genesis encephalopathy

Introduction. Pathogenetic mechanisms of dyscirculatory encephalopathy development are closely related to chronic arterial hypertension, which is the main modifiable risk factor for cerebrovascular diseases. Prolonged increase in blood pressure leads to structural and functional changes in cerebral vessels, including hypertrophy of smooth muscle media cells, thickening of the intima, endothelial dysfunction, and impaired autoregulation of cerebral blood flow. These pathological processes initiate a cascade of neurodegenerative changes manifested by demyelination of the white matter, the formation of lacunar infarcts, atrophy of the cerebral cortex, and progressive decline in cognitive functions.

The clinical manifestation of dyscirculatory encephalopathy is characterized by the polymorphism of symptoms and the gradual progression of neurological disorders. In the early stages of the disease, patients' subjective complaints about memory decline, reduced concentration, increased fatigue, headaches, and emotional instability predominate, often interpreted as manifestations of age-related changes or functional disorders. Objective neurological symptoms at the initial stages of the disease may be minimal or absent altogether, which creates significant difficulties in timely diagnosis and initiation of pathogenetic therapy.

Traditional approaches to the diagnosis of dyscirculatory encephalopathy are based on clinical assessment of the neurological status, the results of neuroimaging studies (magnetic resonance imaging, brain computed tomography), and neuropsychological testing. However, the availability of high-tech research methods in routine clinical practice, especially at the primary healthcare level, remains limited, necessitating the development of simple, cost-effective, and reliable screening tools for the early detection of cognitive impairments of vascular origin.

The Montreal Cognitive Assessment (MoCA) is a validated neuropsychological tool specifically designed for screening mild cognitive impairments in adult patients. Unlike the widely used short mental status assessment scale (Mini-Mental State Examination, MMSE), the MoCA test demonstrates higher sensitivity to detecting early cognitive changes, especially in the domains of executive functions, visual-spatial perception, and memory, making it a particularly valuable tool for diagnosing vascular cognitive impairments.

The MoCA test structure includes eight cognitive domains: visual-constructive skills and executive functions, object naming, attention, language, abstraction, delayed reproduction, orientation. The maximum score is 30 points, while a result less than 26 points is considered an indicator of cognitive impairment. The duration of the test is 10-15 minutes, which makes it applicable in outpatient practice with limited doctor's appointment time.

Blood pressure, as a key hemodynamic parameter, plays a critical role in maintaining adequate cerebral perfusion and is one of the most important modifiable risk factors for the development of cerebrovascular diseases. Chronic arterial hypertension not only contributes to the development of structural changes in cerebral vessels but also disrupts the mechanisms of brain blood flow autoregulation, leading to the formation of zones of chronic hypoperfusion and the development of ischemic-hypoxic brain tissue damage.

Modern clinical recommendations emphasize the importance of not only the absolute values of systolic and diastolic blood pressure, but also the indicators of its variability, circadian profile, and reaction to antihypertensive therapy. Daily blood pressure monitoring allows for more complete information about the patient's hemodynamic profile, reveals hidden arterial hypertension, assesses the effectiveness of ongoing therapy, and stratifies the risk of cardiovascular complications.

The relationship between arterial hypertension and cognitive impairments is confirmed by the results of numerous epidemiological and clinical studies. A meta-analysis of prospective cohort studies shows that an increase in systolic blood pressure per 10 mm Hg is associated with a 9-16% increase in the risk of developing dementia. Special attention is paid to the concept of "optimal" blood pressure for maintaining cognitive functions, which can differ from target values for the prevention of other cardiovascular complications.

The integration of neuropsychological testing with cardiovascular risk factor assessment represents a promising approach to early diagnosis of dyscirculatory encephalopathy, allowing for increased screening accuracy and optimized patient risk stratification. Combined use of the MoCA test and blood pressure monitoring can provide a comprehensive evaluation of brain functional state and the primary pathogenetic factor of cerebrovascular disorders.

Outpatient primary care practice offers an optimal platform for implementing screening programs aimed at early detection of dyscirculatory encephalopathy. District therapists and general practitioners have the opportunity to observe patients long-term, enabling assessment of cognitive function dynamics and hemodynamic indicators throughout the natural course of the disease and during ongoing therapy.

The economic efficiency of early diagnosis of vascular cognitive impairments stems from the possibility of timely initiation of pathogenetic therapy, prevention of disease progression to dementia, reduction in the need for costly examination and treatment methods, as well as preservation of patients' work capacity and quality of life. Introducing simple and accessible screening methods into routine clinical practice can significantly improve public health indicators and reduce the economic burden of cerebrovascular diseases.

Personalized medicine in the field of cerebrovascular pathology requires an individualized approach to risk factor assessment, selection of optimal diagnostic methods, and development of personalized prevention and treatment strategies. A comprehensive evaluation of cognitive status and hemodynamic parameters can serve as a foundation for creating individual risk profiles and determining priority areas for therapeutic interventions.

The interdisciplinary approach to managing patients with dyscirculatory encephalopathy involves close collaboration among neurologists, cardiologists, therapists, psychiatrists, and other specialists. Standardization of screening and diagnostic methods at the primary healthcare level can contribute to improving the continuity of medical care and optimizing patient routing within the healthcare system.

Purpose of the research. Justify the feasibility of using a combined assessment of cognitive screening on the MoCA scale and blood pressure indicators in the diagnostic algorithm for dyscirculatory encephalopathy at the prehospital stage.

Research material and methods. The study material was the clinical and neurological examination data of 73 patients who sought medical care at the Polyclinic under the Multidisciplinary Clinic of Samarkand State University between 2023 and 2025. Among the examined patients, 44 (60.3%) were women and 29 (39.7%) were men. The age of the patients ranged from 40 to 75 years, with an average age of 57.4±1.2 years. The inclusion criteria for inclusion in the study were: the presence of clinical signs of dyscirculatory encephalopathy, a diagnosis established according to ICD-10 (I67.8 - other specified cerebrovascular diseases), and the presence of the patient's written informed consent for examination and testing. Depending on the severity of the clinical manifestations of dyscirculatory encephalopathy, patients of the main group were divided into two subgroups. The first group included 38 (52.1%) patients with moderate clinical disorders, characterized by a combination of cognitive impairments, emotional-affective disorders, and autonomic dysfunction while maintaining independence in daily activity. The second group included 35 (47.9%) patients with mild clinical manifestations of dyscirculatory encephalopathy, who predominantly had subjective complaints (headache, dizziness, decreased work capacity, fatigue) and initial cognitive impairments without pronounced neurological deficit. The control group consisted of 33 relatively healthy volunteers who had applied to the clinic for a preventive examination, had no neurological complaints, and had no history of diagnosed cerebrovascular diseases. The exclusion criteria for the study were: the presence of oncological diseases, severe somatic pathologies in the decompensation stage, pronounced neurodegenerative diseases, dementia, past acute cerebrovascular disorders, and the patient's refusal to participate in the study. All patients underwent comprehensive clinical and neurological examination at the prehospital stage in outpatient settings. The examination included collecting anamnestic data with clarification of the duration of the disease, the nature of complaints, the presence of vascular risk factors (arterial hypertension, diabetes mellitus, dyslipidemia, smoking), and assessing the drug therapy received by patients at the time of admission. The clinical research method included neurological examination with assessment of focal and scattered neurological symptoms, cranial nerves, muscle tone, reflexes, movement coordination, and autonomic manifestations. Particular attention was paid to identifying signs of chronic cerebral ischemia characteristic of dyscirculatory encephalopathy. Cardiovascular status assessment was carried out by measuring blood pressure at rest, determining heart rate, analyzing outpatient records, and anamnestic data on arterial hypertension. If necessary, the data of previously performed electrocardiography within the framework of outpatient examination were used. To assess cognitive functions at the prehospital stage, screening cognitive methods available for use in primary healthcare settings were used.

The Mini-Mental State Examination (MMSE) scale was used to assess the overall cognitive status, as well as the Montreal Cognitive Assessment (MoCA) to identify mild and moderate cognitive impairments. The psycho-emotional state of patients was assessed using the Hospital Anxiety and Depression Scale (HADS), which allows for the identification of subclinical and clinically significant levels of anxiety and depressive disorders, often accompanied by dyscirculatory encephalopathy. Instrumental examination methods at the prehospital stage included the analysis of previously performed neuroimaging data (magnetic resonance or computed tomography of the brain) in their presence, with an assessment of signs of chronic ischemia, leukoaraiosis, lacunar changes, and atrophic processes.

As part of the pre-hospital stage of the study, a module for early diagnosis of dyscirculatory encephalopathy was used, based on a step-by-step quantitative assessment of clinical, hemodynamic, and cognitive indicators available for use in primary healthcare settings. The module included analysis

of vascular risk factors (hypertension, diabetes mellitus, dyslipidemia, smoking), blood pressure indicators, MoCA scale cognitive screening results, and HADS scale assessment of psycho-emotional state. Each component was assigned points depending on the degree of deviation from the norm, after which the total integral indicator reflecting the severity of cerebrovascular disorders at the prehospital stage was calculated. The score of cognitive deficit was determined as the difference between the normative and actual MoCA indicator with a limitation of the maximum contribution of the indicator, which allowed avoiding hyperdiagnosis. Psychoemotional disorders were considered as a modifying factor that enhances clinical symptoms and influences the interpretation of cognitive complaints. The final integral indicator was used to stratify patients into groups with mild and moderate impairments, which ensured the objectification of clinical assessment and the standardization of approaches to further correctional tactics already at the prehospital stage.

Statistical processing of the obtained data was carried out using methods of variation statistics. Quantitative indicators are presented as the average value and standard error of the average (M±m), while qualitative indicators are presented as absolute values and percentages. Parametric and non-parametric methods were used to compare the groups depending on the nature of the data distribution. Differences were considered statistically significant at a level of $p<0.05$.

Research results. When analyzing the clinical and neurological manifestations, it was established that patients of the 1st group (moderate disorders, n=38) reliably more often complained of dizziness in 76.3% of cases, memory and attention decline in this case in 81.6%, increased fatigue and asthenic syndrome in 73.7%, emotional lability was detected in 68.4% of patients. In the 2nd group (mild disorders, n=35), these symptoms were less common and amounted to 42.9%, 45.7%, 40.0% and 34.3% respectively ($p<0.05$ for all comparisons). In the control group (n=33), similar complaints were registered sporadically and did not exceed 9.1% of observations. Upon neurological examination, scattered microsymptomatology (anisoreflexia, unstable pyramidal signs, mild coordination disorders) was detected in 57.9% of patients in the 1st group, in 22.9% of patients in the 2nd group, and was not detected in the control group ($p<0.01$). Assessment of cognitive status on the MoCA scale showed that the average score in the 1st group was 22.6±1.4, in the 2nd group, respectively, 25.1±1.2, and in the control group, the indicators were close to normal, 27.4±0.8. The intergroup differences were statistically significant both between the 1st and 2nd groups and in comparison with the control group ($p<0.001$). A similar, but less pronounced, trend was revealed in the analysis of the MMSE scale ($p<0.05$). Psycho-emotional disorders according to the HADS scale (≥8 points for anxiety and/or depression) were detected in 55.3% of patients in the 1st group, in 28.6% of patients in the 2nd group, and in 6.1% of individuals in the control group ($p<0.01$). Anxiety-depressive disorders were more frequently registered in women than in men (52.3% versus 33.3%, $p<0.05$). Analysis of hemodynamic parameters showed that arterial hypertension of II-III degree was diagnosed in 71.1% of patients in the 1st group, in 45.7% of patients in the 2nd group, and was not detected in the control group. The average values of systolic blood pressure were 162.4±11.6 mm Hg in the 1st group, 146.2±9.8 mm Hg in the 2nd group, and 122.6±7.4 mm Hg in the control group ($p<0.001$). Correlation analysis revealed a direct correlation between the value of the pre-hospital integral index and the level of systolic blood pressure ($r=0.56$; $p<0.01$), the total HADS score ($r = 0.41$; $p<0.05$), as well as a reverse correlation with cognitive status indicators according to MoCA ($r=-0.62$; $p<0.001$).

As can be seen from the presented data, patients with moderate clinical disorders were characterized by more pronounced cognitive, psycho-emotional, and hemodynamic changes, which was reflected in significantly higher values of the pre-hospital integral index compared to patients with mild forms of dyscirculatory encephalopathy and the control group.

Results of using the pre-hospital diagnostic module (MoCA+AD). The use of the developed pre-hospital diagnostic module, based on a combined assessment of cognitive screening indicators on the MoCA scale and blood pressure levels, made it possible to objectify the severity of dyscirculatory encephalopathy and differentiate patients already at the stage of outpatient treatment. In patients of the 1st group (moderate disorders, n=38), a decrease in MoCA indicators (<25 points) in combination with an elevated blood pressure level (≥140/90 mm Hg) was detected in 84.2% of cases, while in the 2nd

group (mild disorders, n=35), this diagnostic pattern was registered in 37.1% of patients ($p<0.001$). In the control group, such a combination of indicators was not detected (0%, $p<0.001$). The average MoCA value in patients with elevated blood pressure in the 1st group was 22.4±1.3 points, in the 2nd group, respectively, the indicators were within 24.9±1.1 points, while in patients of the control group, the data corresponded to the norm of 27.5±0.7 points ($p<0.001$). At the same time, the average values of systolic blood pressure were 164.1±10.8 mm Hg in the 1st group, 148.3±9.6 mm Hg in the 2nd group, and 121.8±6.9 mm Hg in the control group ($p<0.001$). Analysis of the distribution of patients according to the modular algorithm showed that the use of the "MoCA+AD" combination made it possible to classify 21.1% more patients into the moderate disorders group than in the clinical assessment based solely on subjective complaints and standard neurological examination. These patients were characterized by a hidden cognitive decline in the absence of pronounced focal neurological deficit.

Correlation analysis revealed a significant feedback link between MoCA indicators and the level of SBP ($r=-0.48$; $p<0.01$), as well as a direct correlation between the combined increase in blood pressure and the severity of clinical complaints ($r = 0.52$; $p<0.01$). It was established that the combination of cognitive deficit and hemodynamic load was the most sensitive indicator of moderate forms of dyscirculatory encephalopathy at the prehospital stage. Thus, the use of a diagnostic module based on the "MoCA + BP" algorithm made it possible to increase the detection of moderate forms of dyscirculatory encephalopathy, reduce the subjectivity of clinical assessment, and ensure standardization of patient stratification in primary healthcare settings.

Conclusions: The conducted study showed that dyscirculatory encephalopathy at the prehospital stage is characterized by clinical heterogeneity and often proceeds without pronounced focal neurological deficit, which complicates its early diagnosis in primary healthcare settings. Using standard clinical and neurological examination without quantitative assessment of cognitive and hemodynamic indicators can lead to underestimation of the severity of cerebrovascular disorders. Inclusion in the diagnostic algorithm of short cognitive screening according to the MoCA scale in conjunction with blood pressure assessment made it possible to increase the detection of moderate forms of dyscirculatory encephalopathy, objectify the clinical assessment of patients' condition, and reduce the subjectivity of complaint interpretation at the prehospital stage. It has been established that a combination of cognitive deficit and hemodynamic strain is a sensitive indicator of early and moderate forms of chronic cerebrovascular insufficiency. The proposed diagnostic module, based on the "MoCA + BP" algorithm, is characterized by its simplicity, accessibility, and practical orientation, does not require complex instrumental methods, and can be recommended for use in outpatient practice for the purpose of early detection of dyscirculatory encephalopathy and timely initiation of corrective measures.

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