

## **Cognitive disorders in persons of working age with dyscirculatory encephalopathy**

Olena V. Litvin<sup>1</sup>, Tetiana V. Chernii<sup>1</sup>, Olga Ye. Kovalenko<sup>1,2</sup>, Liliana V. Klymenko<sup>2</sup>,

Nina O. Perederii<sup>3</sup>

<sup>1</sup>State Institution of Science «Research and Practical Centre of Preventive and Clinical Medicine» State Administration Department, Kyiv, Ukraine

<sup>2</sup>P. L. Shupyk National Medical Academy of Postgraduate Education, Kyiv, Ukraine

<sup>3</sup>Ukrainian Medical Stomatological Academy, Poltava, Ukraine

### **ABSTRACT**

#### **Introduction**

Decreased cognitive function is one of the most common and socially significant disorders of the nervous system. The prevalence of cognitive disorders is associated with an increase in the occurrence of major risk factors for the development of cognitive decline such as arterial hypertension, atherosclerosis of cerebral vessels, diabetes mellitus etc., which causes the relevance of this problem for neurologists and doctors.

**The aim** of the study was to study the neuropsychological features of cerebrovascular disorders in persons of working age at the outpatient clinic stage.

**Materials and methods.** 90 persons of working age were surveyed. Clinical neurological and clinical instrumental examination.

**Results.** The first group consisted of patients with dyscirculatory encephalopathy on the background of arterial hypertension - 60 people, the second with dyscirculatory encephalopathy on the background of cerebral atherosclerosis - 30. Assessment of cognitive function was examined using the MMSE Mental Status Scale, Anxiety, and Depression Scale using the DASS-21 scale.

**Conclusions.** According to the results of the study, significant memory impairment on the MMSE scale ( $p < 0.003$ ) was found in patients with dyscirculatory encephalopathy without arterial hypertension. In patients with dyscirculatory encephalopathy on the background of

hypertension, anxiety ( $p < 0.001$ ) and depressive disorders ( $p = 0.033$ ) were significantly more prevalent compared with patients with dyscirculatory encephalopathy without arterial hypertension. The increase in depressive disorders and anxiety in patients with dyscirculatory encephalopathy on the background of arterial hypertension decreases orientation and memory.

**Key words:** hypertensive dyscirculatory encephalopathy, hypertension, memory, anxiety, depressive disorders.

## INTRODUCTION

Decreased cognitive function is one of the most common and socially significant disorders of the nervous system. A high level of cognitive and intellectual functions is a positive prognostic feature of life expectancy. Cerebrovascular pathology, neurodegenerative diseases and their combination are the main causes of cognitive deficit [1, 2, 3, 4]. Prevalence of cognitive disorders is associated with the current tendency to increase life expectancy and growth of the elderly people in the population, as well as to increase the occurrence of major risk factors for cognitive decline such as arterial hypertension, cerebral atherosclerosis and diabetes mellitus, which determines relevance of this problem for neurologists and doctors of other specialties [5].

Cardiovascular risk factor for cognitive impairment is metabolic syndrome, which includes: arterial hypertension, dyslipidemia, obesity, diabetes mellitus, impaired carbohydrate tolerance, underlying pathological mechanisms of cardiac and cerebrovascular disease. Recently, the prevalence of metabolic syndrome has been observed among able-bodied young and middle-aged people, which makes this problem extremely urgent [6, 7].

At present, arterial hypertension is considered as the most significant risk factor for the development of both acute and chronic disorders of the cerebral circulation, as well as disorders of memory and cognitive disorders. In many studies the relationship of persistent increase in blood pressure with the risk of progression of cognitive disorders has been proven

[8]. Also, a large number of studies have shown that the predominance of dementia is a predominant increase in systolic pressure [7]. Chronic cerebral hypoperfusion due to increased vascular resistance in patients with hypertension may be a major factor in the development of dementia in hypertension. The brain is dependent on adequate oxygen and glucose delivery, and a decrease in cerebral blood flow impairs neuronal function, with possible subsequent brain damage [9].

The most common pathogenetic cause of cognitive impairment is the "small vessel disease" of the brain, which is more common in patients with hypertension and diabetes [10]. One of the substrates for the development of "small vessel disease" is atherosclerosis, which leads to the loss of smooth muscle cells tunica media, deposition of fibrogialin substances, narrowing the lumen and thickening of the vessel wall (lipogialinosis). In a more pronounced process, fibrinoid necrosis of the vascular wall leads to rupture of vessels and micro- or macro-hemorrhages, more often in the basal ganglia or thalamus [11].

Thus, the problem of chronic disorders of cerebral circulation and cognitive function in patients with hypertension is relevant in modern angioneurology. It should be noted that the number of patients with chronic disorders of the cerebral circulation, especially against the background of hypertension, is virtually none, which determines the relevance of the problem of further diagnosis and treatment.

**The aim** of the study is to study the neuropsychological features of cerebrovascular disorders in persons of working age at the outpatient clinic stage.

### **Materials and methods**

Under our observation, there were 90 people aged 40 to 68 at the State Institution of Science «Research and Practical Centre of Preventive and Clinical Medicine» State Administration Department, Kyiv, Ukraine.

Patients were divided into two groups statistically comparable by major disease - dyscirculatory encephalopathy, sex and age. The first group consisted of patients with dyscirculatory encephalopathy and hypertension - 60 people, the second with DE on the background of CAC - 30. Among the examined patients in the first group were 17 men and 43 women. In the second group - 9 men and 21 women. The mean age of men in the first group was  $51.54 \pm 0.76$ , in the second  $51.83 \pm 2.24$ , women in the first group  $54.63 \pm 0.42$ , in the second  $56.88 \pm 0.72$ .

Clinical-neurological and clinical-instrumental examination was performed for all patients in order to establish the stage and form of vascular-brain pathology.

The study did not include patients with severe somatic pathology, clinically significant vascular events, and history of traumatic brain injury. Clinical and laboratory study included general blood test, biochemical blood test, lipidogram. Clinical and instrumental examination methods included electrocardiography, blood pressure measurements, and heart rate.

To assess patients' cognitive function, they used: a short MMSE mental status rating scale (determining time and place orientation, status of short-term, long-term memory, language, gnosis, praxis) [12]. According to the MMSE, 29–30 points were assessed as no cognitive impairment, 27–28 points were mild cognitive impairment, 24–26 were moderate cognitive impairment, 20–23 points were initial dementia, <20 were pronounced stages of dementia.

Anxiety and depression were examined using the Depression Anxiety Stress Scales (DASS-21) [13]. The survey found normal, mild, moderate, severe and very severe depression, anxiety, and stress.

### **Results.**

Based on the history of complaints, anamnesis data, as a result of clinical and instrumental examination in 90 patients revealed a symptom complex that meets the criteria

for the diagnosis of manifestations of cerebral circulation, among patients of the first group in 19 (31.7%) were diagnosed dyscirculatory encephalopathy, stage I and in 41 patient (68.3%) - stage II of dyscirculatory encephalopathy. In the second group in 10 patients (33.3%) were diagnosed stage I of dyscirculatory encephalopathy and in 20 patients (66.7%) - stage II. Arterial hypertension was observed in all patients in the first group. According to this classification 7 (11.7%) patients had stage I hypertension and 53 (88.3%) - arterial hypertension, stage II.

After conducting a neuropsychological test on the MMSE scale, 40% of patients with hypertensive dyscirculatory encephalopathy and 47.8% with dyscirculatory encephalopathy were found to have cognitive impairment (Table I). A significant difference, on the MMSE scale,  $p < 0.003$  by Wilcoxon's W test in the two surveyed groups was observed in the memory study (Table II). In the study of memory, the incidence rate of  $X^2 = 0.02$  significantly prevailed in patients of the first group - 15% of memory was assessed at 2 points, at 85% - 3 points. At the same time, 48% of patients in the second group had 2 points, 52% had 3 points. Table I. Frequency of cognitive impairment of varying degrees of expression on the MMSE scale.

Table II. Results of the MMSE study.

The significant decrease in memory level was mainly due to the impairment of self-reproduction of information that was manifested in operational activities and training, while the memory of life events remained largely preserved. Such modal-nonspecific mnestic disorders with primary disorders of short-term memory in combination with fatigue and emotional instability indicate the defeat of the middle nonspecific structures of the brain at the level of the lower parts of the brain stem (I-th functional block of the brain according to Luriya AR [14]).

It can be assumed that the irregularities of the calculus operations recorded initially are not related to organic changes of the frontal lobes of the brain (primary and secondary "frontal acalculia"), but depend on the lesions of the basal and medio-basal divisions of the frontal lobes of the brain (limbico-hippocampal system), which is known to lead to significant changes in the emotional sphere of the patient's behavior [15]. Defects of this type of intellectual activity - counting operations, in our category of patients arise on the basis of impulsivity and manifest themselves in violation of the orienting basis of action by reducing attention. Errors in them occur due to the acceleration of the flow of nervous and mental processes due to defects in the inhibitory processes [16] and/or cholinergic dysregulation [17]. After testing on the DASS-21 scale, it was found that mild depression was observed in 35% of patients with hypertensive dyscirculatory encephalopathy, moderate anxiety in 50%, severe anxiety in 16.7%; in patients with dyscirculatory encephalopathy mild depression - 8.7%, mild anxiety - 39.1%. Significant difference on the DASS-21 scale of anxiety  $p < 0.001$  and depression  $p = 0.033$  between the indicators of the two groups according to Wilcoxon's W criterion was shown in Table III.

Table III. The results of the study on the scale DASS-21.

Such changes in the level of anxiety should be associated, probably, with the recovery after treatment of neurohumoral balance: GABA-ergic inhibitory effects, serotonin, dopamine-peptidergic activation systems [18].

In most cases, the law of distribution of values was different from the normal one, so Spearman's rank correlation index was calculated for correlation analysis.

A negative correlation between the mean severity of depression and anxiety and overall cognitive performance ( $r = -0.348$ ,  $p = 0.006$ ), ( $r = -0.337$ ,  $p = 0.008$ ) was found in patients with hypertensive dyscirculatory encephalopathy. As depression and anxiety increase, the overall cognitive performance index decreases. The negative correlation was found in the

mean severity of depression and anxiety and orientation ( $r = -0.327$ ,  $p = 0.01$ ), ( $r = -0.335$ ,  $p = 0.001$ ), respectively, with increasing depression and anxiety the orientation value decreases. Also, a negative correlation was found between the mean severity of depression and anxiety and memory ( $r = -0.287$ ,  $p = 0.02$ ), ( $r = -0.398$ ,  $p = 0.001$ ), respectively, with increasing index depression and anxiety the value of memory decreases (Table IV).

Table IV. Characterization of the correlation between the cognitive function on the MMSE scale and the indicators of emotional-volitional function on the DASS-21 scale in patients with hypertensive dyscirculatory encephalopathy.  $r$  - Spearman rank correlation index.

Patients with dyscirculatory encephalopathy on the background of cerebral atherosclerosis revealed a negative correlation between the mean severity between depression and memory ( $r = -0.447$ ,  $p = 0.03$ ), the value of depression memory decreases (Table V).

Table V. Characteristic of the correlation between the cognitive function on the MMSE scale and the emotional-volitional function on the DASS-21 scale in patients with dyscirculatory encephalopathy.

$r$  - Spearman rank correlation index.

## **Discussion**

When performing the analysis of the frequency of cognitive impairment in patients with hypertensive dyscirculatory encephalopathy and dyscirculatory encephalopathy on the background of cerebral atherosclerosis was almost unchanged at 40% and 46.7%, respectively. A significant difference was observed in the study of memory in the two surveyed groups. Based on the findings, it can be assumed that memory impairment in patients with dyscirculatory encephalopathy on the background of cerebral atherosclerosis compared with patients with hypertensive dyscirculatory encephalopathy was observed because that patients were constantly receiving antihypertensive therapy. In the study of emotional and volitional disorders, anxiety ( $p < 0.001$ ) and depressive disorders ( $p = 0.033$ )

were significantly more prevalent in patients with hypertensive encephalopathy compared with patients with dyscirculatory encephalopathy without hypertension. An increase in the index of depressive disorders and anxiety in patients with dyscirculatory encephalopathy on the background of hypertension decreases the index of orientation and memory. Our data coincide with the results of the research of T. S. Melnikova, N. V. Ponomareva, A. A. Mitrofanov, L. V. Androsova, O. A. Pavlova. In their publications, the authors state that anxiety and depressive disorders are likely to be associated with impaired neurohumoral balance.

### **Conclusions**

1. Significant memory impairment on the MMSE scale ( $p < 0.003$ ) was found in patients with dyscirculatory encephalopathy without arterial hypertension compared with patients with dyscirculatory encephalopathy on the background of hypertension.
2. In the study of emotional and volitional disorders in persons of working age, it was proved that in patients with dyscirculatory encephalopathy on the background of arterial hypertension, anxiety ( $p < 0.001$ ) and depressive disorders ( $p = 0.033$ ) significantly outweighed compared with patients without arterial hypertension.
3. It is proved that the increase of the index of depressive disorders and anxiety in patients with dyscirculatory encephalopathy against the background of arterial hypertension decreases the index of orientation and memory.

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