UDC 616.831-005.4-06:616.89-008.45/.48
DOI https://doi.org/10.32782/2415-8127.2026.73.5

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The neurocognitive profile of post-ischemic stroke patients

The highest risk of developing depression, anxiety, memory disorders, perception, executive functions, attention and thinking is observed in the first 6 months after ischemic stroke, therefore, the patient's quality of life and the prognosis of the disease will depend on the timely diagnosis of cognitive and psychological disorders.

The aim of the study: to investigate the features of neurocognitive disorders of post-ischemic stroke, which will have practical significance in the form of further optimization of treatment.

78 post-ischemic stroke patients were examined. The average age of the patients was 63.6±5.3 years. The examination was carried out 3 months after the onset. The control group consisted of 27 almost healthy individuals with an average age of 57,3±3.4 years. The modified Rankin Scale (mRS), the Montreal Cognitive Assessment (MoCA), the Frontal Assessment Battery (FAB) and the Hamilton Anxiety Scale (HAM-A) were used to assess the neurocognitive profile.

Patients with moderate and severe functional disorders according to mRS accounted for 74.4%. According to the MoCA scale, less pronounced disorders of attention, orientation, and recognition were observed, compared with the control group ($p<0.01$). According to the results of testing using the FAB scale, the most significant differences were established in the subtests "mental flexibility and verbal fluency", "programming and motor actions", "sensitivity and obstacles" compared with the control group ($p<0.0001$), which correlated with an increased level of anxiety according to the HAM-A scale.

1. The results of a study of patients who had suffered an ischemic stroke and were in the recovery period showed signs of damage to the pyramidal system in the majority of patients (60.3%), which was accompanied by motor deficits and correlated with the assessment data on the modified Rankin scale. 2. The average and above average degree of functional disorders correlated with neurocognitive disorders and a fairly high level of anxiety (34.6%).

Key words: ischemic stroke, anxiety, cognitive disorders.

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Нейрокогнітивний профіль пацієнтів, які перенесли ішемічний інсульт

Найвищий ризик розвитку депресії, тривоги, розладів пам'яті, сприйняття, виконавчих функцій, уваги та мислення спостерігається в перші 6 місяців після перенесеного ішемічного інсульту, тому від своєчасної діагностики когнітивних та психоемоційних порушень буде залежати якість життя пацієнта та прогноз захворювання.

Мета дослідження: дослідити особливості нейрокогнітивного профілю пацієнтів, які перенесли ішемічний інсульт, що матиме практичне значення у вигляді подальшої оптимізації лікування.

Обстежено 78 пацієнтів, які 3 місяці тому перенесли мозковий ішемічний півкульовий інсульт і знаходилися на етапі відновного періоду. Середній вік пацієнтів склав 63.6±5.3 роки. В контрольну групу увійшли 27 практично здорових осіб середнього віку 57,3±3.4 роки. Для оцінки нейрокогнітивного профілю використовували модифіковану шкалу Ренкіна (mRS), Монреальську шкалу оцінки когнітивних функцій (MoCA), батарею тестів для оцінки лобної дисфункції (FAB) та шкалу тривоги Гамільтона (HAM-A).

Пацієнти з помірними і вираженими функціональними розладами згідно mRS склали 74.4%. За шкалою MoCA спостерігалися менш виражені розлади уваги, орієнтації, впізнання, у порівнянні з контрольною групою ($p<0.01$). За результатами тестування з допомогою шкали FAB в субтестах «розумова гнучкість і вербальна плавність», «програмування та рухові дії», «чутливість та перешкоди» було встановлені найбільш значущі відмінності у порівнянні з контрольною групою ($p<0.0001$), що корелювало з підвищеним рівнем тривожності за шкалою HAM-A.

Результати дослідження пацієнтів, які перенесли ішемічний інсульт і знаходилися на етапі відновного періоду, продемонстрували ознаки ураження пірамідної системи у більшості пацієнтів (60,3%), що супроводжувалося руховим дефіцитом і корелювало з даними оцінювання за модифікованою шкалою Ренкіна. 2. Середній і вище середнього ступінь функціональних розладів корелював з нейрокогнітивними порушеннями та достатньо високим рівнем тривоги (34,6%).

Ключові слова: ішемічний інсульт, тривога, когнітивні розлади.

Introduction. Cerebrovascular diseases (CVD) are one of the most critical problems and occupy a leading position due to prevalence, morbidity, disability and mortality throughout the world. But in Ukraine the lifetime risk of stroke and mortality rates from CVD are 10–17% higher than in Europe [1, 2]. And it is war that is an important factor contributing to higher rates of CVD in Ukraine. Not only does war cause direct damage to people's health, safety, and property, but it also increases stress levels dramatically, causing severe social and economic insecurity [3]. The negative impact of military operations on morbidity and mortality from cerebrovascular diseases is proven scientifically [4, 5].

Cognitive and emotional impairment in post-stroke patients is diagnosed in 40-60% of cases, and approximately half of patients reach the level of dementia after 25 years. At the same time, up to 20% of patients with mild cognitive impairment recover almost completely. Risk factors include older age, pre-stroke depression, anxiety or cognitive impairment, stroke severity, and lesion location. The problem is that cognitive and emotional disorders are sometimes difficult to diagnose because they are masked by neurological symptoms, such as motor aphasia. In addition, their severity does not always correlate with neurological symptoms [6]. Despite their prevalence, cognitive and psychological disorders in post-stroke patients remain understudied and undertreated in clinical practice. Therefore, timely diagnosis of these disorders will help improve the neurorehabilitation program for patients who have suffered a cerebral ischemic stroke.

The aim of the study: to investigate the features of cognitive and emotional disorders and their impact on the quality of life of post-stroke patients, which will have practical significance in the form of further optimization of treatment.

Methodology/Methods. In compliance with the principles of bioethics and deontology, 78 post-stroke patients (45 men and 33 women) at 90 days from onset were examined (I group). In 44 patients, the stroke occurred in the right hemisphere (25 men, 19 women), in 34 patients – in the left hemisphere (20 men, 14 women). The average age of the patients was 63.6±5.3 years).

The exclusion criteria were: severe somatic pathology with pronounced respiratory, cardiovascular, hepatic and renal insufficiency, other concomitant pathology in the exacerbation stage; documented cognitive impairment before stroke; writing disorders and aphasia that prevented proper completion of the questionnaires, the presence of mental illnesses and taking psychoactive drugs. The examination included clinical, neurological and psychodiagnostic methods.

The control group (II group) of 27 healthy individuals (the average age was 57,3±3.4 years) was established to serve as a baseline comparison for studies on cognitive impairment. The group was carefully screened by gathering amnestic data, neurological and neuropsychological examination.

During this study, modified Rankin scale (mRS), Montreal Cognitive Assessment (MoCA), Frontal Assessment Battery (FAB), Hamilton anxiety scale (HAM-A) were used.

Statistical processing of the research materials was performed using different significance criteria – depending on the type of source data. Statistical processing of the obtained results was performed using the "BioStat" program and Excel from the Microsoft Office 2007 program package.

Results and discussion. Among the risk factors that led to the development of stroke, the most common was arterial hypertension – 53.8%; second place was occupied by ischemic heart disease – 33.3%; third – diabetes mellitus – 12.8%.

Among patients with ischemic stroke, the atherothrombotic subtype (52.6%), cardioembolic subtype (32.1%) and lacunar subtype (11.5%) were diagnosed. Analysis of the localization of cerebral strokes demonstrated a slight predominance of the frequency of right-hemisphere lesions over left-hemisphere lesions (56.4% and 43.6%, respectively).

According to neurological examination, 47 (60.3%) patients had signs of central hemiparesis, resulting in the formation of an asymmetric gait with Wernicke-Mann's posture. Limb motor disorders had varying degrees of severity: from mild paresis with predominant involvement of the distal and/or proximal parts to severe pronator-flexor position of the hand with limitation of voluntary movements, the formation of contractures and increased spasticity in the extensors of the lower limb.

To assess general disability and the approximate degree of the patient's dependence on the help of others, the mRS was used – an ordinal scale with 7 possible grades, from 0 to 6: 0 means no symptoms, 5 means severe disability, and 6 indicates death [7]. There were no asymptomatic patients or deaths in the cohort examined (Fig.1).

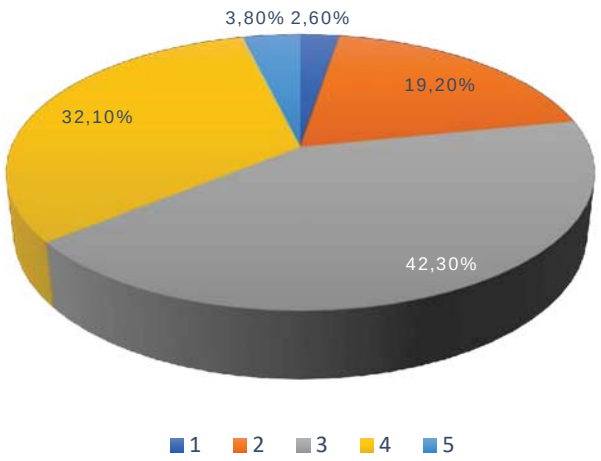

Fig.1. Modified Rankin Scale (mRS) at 3 months post-stroke (n=78)

Most patients (42.3%) had moderate functional impairments, requires some help but able to walk without assistance. In second place (32.1%) were patients with moderate to severe functional impairments, inability to walk without assistance and independently satisfy physiological needs.

The MoCA test is widely used to detect cognitive problems after a Stroke. MoCA displayed a pooled sensitivity of 0.80 (95% cognitive impairment 0.72 to 0.86) and specificity of 0.79 (95% cognitive impairment 0.71 to 0.85) [8]. In our study, mean total MoCA score (I group) was

Table 1

Results of a neuropsychological study in a group of post-stroke patients

Distribution of MoCA scores at I group, (n=78)		Distribution of MoCA scores at II group (n=30)	Distribution of FAB scores at I group, (n=78)		Distribution of FAB scores at II group, (n=30)
Cognitive domains	**Score**	**Score**	**Subtest Name**	**Score**	**Score**
Visiospatial/ Executive	17.2±0.8 p<0.0001	29.8±0.3	Conceptualization	13.6±1.2 p<0.001	17.8±0.2
Naming	23.1±0.4 p<0.001	30.0±0.2	Mental Flexibility	8.8±1.1 p<0.0001	17.6±0.3
Memory	15.6±1.2 p<0.0001	27.7±0.4	Motor Programming	11.2±0.9 p<0.0001	16.7±0.5
Attention	24.7±0.5 p<0.01	28.5±0.5	Sensitivity to Interference	11.9±0.8 p<0.0001	16.9±0.4
Language	19.3±0.8 p<0.0001	28.1±0.2			
Abstraction	16.3±0.7 p<0.0001	27.5±0.3	Inhibitory Control	12.3±0.8 p<0.0001	17.7±0.3
Delayed Recall	21.8±0.4 p<0.0001	28.3±0.3	Environmental Autonomy	13.4±1.1 p<0.01	16.8±0.2
Orientation	23.2±0.3 p<0.001	29.8±0.5			

n – number of people;

p – probability of difference between indicators of I and II groups.

20.2 points with a range from 17.2 to 24.7. The "normal" cutoff (≥26) was attained by 12 of 78 (15.4%) patients. It should be noted that the profile of post-stroke cognitive impairment was complex due to the involvement of different domains of cognitive function. The proportion of these impairments was higher in left-hemisphere lesions, especially in domains such as memory (p<0.0001), abstraction (p<0.001), and executive functions (p<0.0001) in comparison to II group (Table 1).

The Frontal Assessment Battery (FAB) [9] is an executive functioning screener that consists of 6 tasks assessing different facets: concept formation and abstract reasoning (conceptualization); mental flexibility; planning and Sequencing (motor programming); attention control (sensitivity to interference); response suppression (inhibitory control); environmental autonomy. Each task was scored from 0 to 3 points, the maximum score for 6 correctly completed tasks was 18 points. The sum of 16 to 18 was considered normal, 12-15 points corresponded to a minor neurocognitive disorder, 11 points and less – to a major neurocognitive disorder. The average value was 11.8 points with lowest indices for subtest Motor Programming and Sensitivity to Interference (Table 1).

The total FAB score in II group was probably higher (28.7±0.3 points) compared to patients in I group (11,8 ± 0,98 points) (p<0.0001).

The scale HAM-A is frequently used for the assessment of anxiety in stroke patients, which could be one of the predictors of depression. HAM-A is a 14-items rating scale that is developed to quantify the severity of anxiety symptoms. Each item is rated on a five-point scale, ranging from 0 (not present) to 4 (severe). Total scores on the HAMA range from 0 to 56. Patients with a HAM-A score equal to or larger than 7 were considered to have anxiety symptoms. The statistics in this study show that the frequency of anxiety is 34.6% evaluated by HAM-A and this results are consistent with the findings in other studies [10].

The performed analysis of the level of cognitive functioning of post-stroke patients demonstrated its dependence on disability. Patients with moderate and severe functional disorders according to the mRS accounted for 74.4%. According to the MoCA scale, less pronounced disorders of attention, orientation, and recognition were observed compared to the control group (p<0.01). According to the results of testing using the FAB, the most significant differences were established in the subtests "mental flexibility and verbal fluency", "motor acts are correctly executed", "sensitivity and interference" compared to the control group (p<0.0001).

Conclusions. 1. The results of a study of patients who had suffered an ischemic stroke and were in the recovery period showed signs of damage to the pyramidal system in the majority of patients (60.3%), which was accompanied by motor deficits and correlated with the assessment data on the modified Rankin scale. 2. The average and above average degree of functional disorders correlated with neurocognitive disorders and a fairly high level of anxiety (34.6%).

Conflict of interests. Authors declare the absence of any conflicts of interests**.**

Funding information: The authors guarantee that they have not received any remuneration in any form that could influence the results or interpretation of the manuscript.

Authors' contribution.

Vasylieva N.V. – research concept and design, data analysis, writing manuscript, supervision throughout the research, translatiopn and final editing;

Karvatska N.S. – collection of the data, data analysis, technical editing.

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Дата першого надходження статті до видання: 20.02.2026
Дата прийняття статті до друку після рецензування: 23.03.2026
Дата публікації (оприлюднення) статті: 29.05.2026

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