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Cognitive Dysfunction and Emotional-Behavioral Disorders in Patients with Ischemic Stroke: Correlation with Neurological Status and Quality of Life

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Abstract This study presents the results of analyzing cognitive, emotional, and behavioral disorders in 75 patients during the early recovery period of ischemic stroke. Depending on the localization of the lesion, patients were divided into two groups: cortical and subcortical strokes. Cognitive functions were assessed using a modified MoCA scale with additional subtests designed to detect specific deficits associated with right hemisphere lesions (right–left orientation, simultanagnosia, prosopagnosia, ideational apraxia, and metaphor comprehension). The emotional sphere was evaluated using the Hospital Anxiety and Depression Scale (HADS) and the Starkstein Apathy Scale (SAS). Quality of life was assessed with the Stroke-Specific Quality of Life Scale (SS-QOL). The findings revealed that cortical strokes were more often associated with pronounced cognitive deficits and anxiety-depressive disorders, while subcortical strokes were characterized by apathetic-abulic manifestations and reduced motivation. These results highlight the pathogenetic role of stroke localization in the development of cognitive-emotional impairments and emphasize the importance of developing differentiated neurorehabilitation programs.

Keywords Ischemic stroke, Early recovery period, Cortical stroke, Subcortical stroke, Cognitive impairment, Modified MoCA scale, Depression, Anxiety, Apathy, Quality of life

1. Introduction

Stroke is one of the key medical and social challenges for healthcare worldwide. According to the World Health Organization, stroke ranks second among the leading causes of mortality, accounting for about 10% of all deaths [1,2].

In Uzbekistan, stroke remains one of the primary causes of death and disability. According to the Ministry of Health of the Republic of Uzbekistan and WHO, more than 40–45 thousand new cases of stroke are registered annually, with approximately 70% being ischemic forms. Stroke mortality rates in the country range from 18–20%, and more than half of survivors are left with persistent disability. Stroke accounts for over 40% of all disability cases, which highlights the high social significance of the problem [1].

The issue of early rehabilitation of patients after acute cerebrovascular accident (ACVA) is particularly important, as a significant proportion of them lose their working capacity [4]. Motor impairments caused by disruptions in motor activity regulation remain the leading factor of long-term disability [5]. Equally important are cognitive and emotional disorders, which may represent the dominant clinical manifestation of stroke and significantly influence prognosis, quality of life, and recovery potential [6,7].

The study of etiological factors, pathogenetic mechanisms, and molecular biomarkers of stroke, along with the development of modern methods for early diagnosis and correction of neuropsychological impairments, is of particular importance, since these processes directly determine rehabilitation outcomes, life expectancy, and quality of life in patients who have suffered acute cerebrovascular accidents [5–8,16,17]. Neuropsychological disorders often serve as the only clinical manifestation of stroke or occupy a central role in its symptomatology. An important milestone in neuropsychology was the introduction of the concept of the "neuropsychological factor", which enabled the identification and explanation of the interrelation between cognitive, emotional, and behavioral changes in patients with lesions of different areas of the right and left hemispheres [3–10].

Currently, functional asymmetry and interhemispheric interaction of the brain are considered among the most promising directions in clinical neurology of stroke [9,10]. The recognition of ontogenetic patterns of higher mental functions, their systemic organization, and topographic specificity has become the foundation for further research on interhemispheric differences [11].

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Over the past decades, extensive data on functional lateralization have been accumulated in global and domestic science; however, in clinical practice, individual asymmetry features are often insufficiently taken into account, which may affect stroke progression, disease outcomes, and processes of social adaptation [12,13]. Of particular clinical importance are neuropsychological syndromes that occur in focal lesions of the right or left hemisphere during the acute phase of stroke, as they may represent the leading or even the sole manifestation of pathology [14,15].

Comparative studies demonstrate pronounced differences in emotional-volitional, motivational, and cognitive-behavioral domains in patients with right- versus left-hemispheric lesions. In particular, individuals with right hemisphere damage more frequently experience impairments of attention, perception, learning, as well as difficulties in recognizing and expressing emotions [16]. They are characterized by a low level of awareness of their condition, reduced emotional responses, manifestations of anosognosia and neglect syndrome, as well as difficulties in performing complex language tasks involving semantic and lexical processing.

A particularly urgent issue remains the delayed seeking of medical care and insufficient access to modern methods of neurorehabilitation, including cognitive-behavioral correction and the use of innovative neuromodulation technologies.

Objective of the Study

The aim of the study was to assess the severity of cognitive and psycho-emotional disorders in patients during the early recovery period of ischemic stroke.

2. Materials and Methods

The study was conducted at the Neurology Department of the Multidisciplinary Clinic of the Fergana Medical Institute of Public Health between January 2024 and January 2025. A total of 75 patients diagnosed with ischemic stroke in the early recovery period were included.

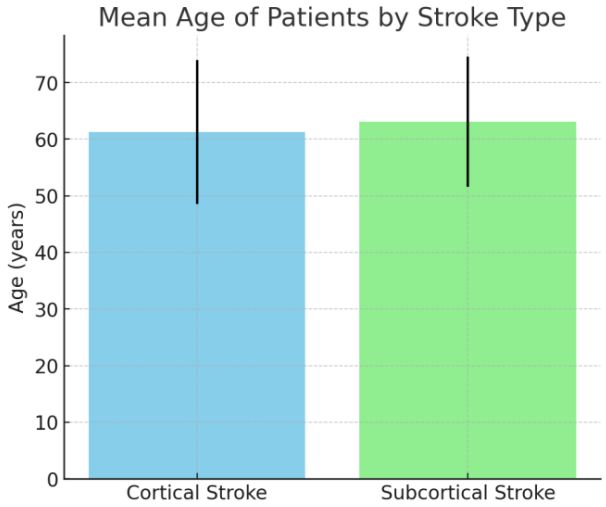

Figure 1. Age characteristics of the studied patients

Depending on the lesion site, patients were divided into two groups:

Group 1 — 37 patients with cortical stroke (15 men — 40.5% and 22 women — 59.5%); mean age: 61.3 ± 12.7 years.

Group 2 — 38 patients with subcortical stroke (21 men — 55.3% and 17 women — 44.7%); mean age: 63.1 ± 11.5 years (figure 1).

No significant differences in sex or age were found between the groups (p = 0.482 and p = 0.911) (figure 2).

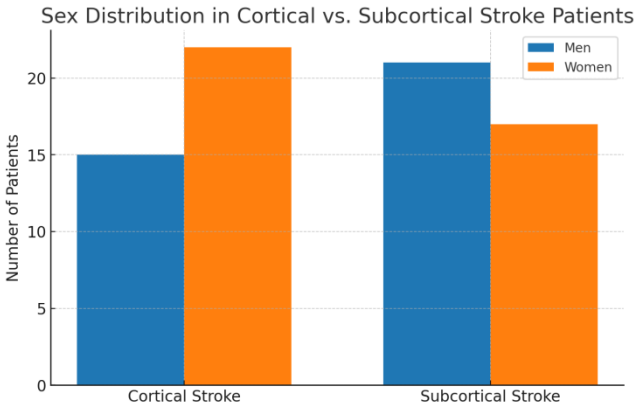

Figure 2. Gender characteristics of the studied patients

Stroke subtypes were distributed as follows (figure 3):

Cardioembolic subtype — 4 (10.8%) patients in Group 1 and 5 (13.1%) in Group 2;

Lacunar stroke — 7 (18.9%) and 6 (15.7%), respectively;

Atherothrombotic stroke was the most frequent — 21 (56.7%) and 20 (52.6%);

Other specified subtypes — 5 (13.6%) and 7 (18.4%).

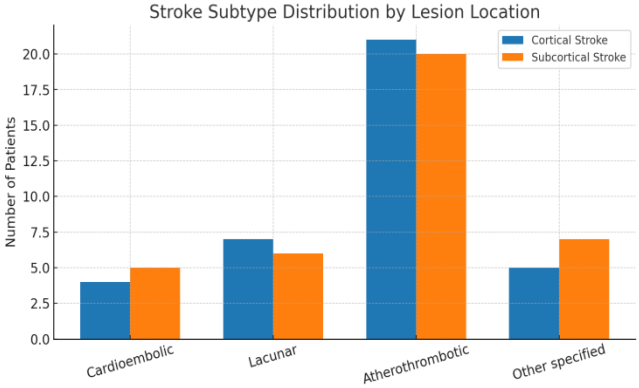

Figure 3. Types of ischemic stroke causes according to TOAST

Most patients experienced stroke against the background of severe premorbid conditions. Arterial hypertension (grade II–III) was recorded in 25 (67.6%) patients in Group 1 and 27 (71.0%) in Group 2. Coronary heart disease (including post-infarction cardiosclerosis and effort angina of functional class I–II) was identified in 17 (22.7%) patients. Atrial fibrillation occurred in 13 (17.3%) patients, equally in both groups. Diabetes mellitus was diagnosed in 5 (13.5%) patients of Group 1 and 8 (21.0%) of Group 2. No significant intergroup

differences were observed for these characteristics ($p > 0.05$).

Neuropsychological assessment began on the first day of hospitalization and included:

- Cognitive function testing: Montreal Cognitive Assessment (MoCA) with additional subscales for detecting deficits typical of right hemisphere lesions;
- Emotional sphere evaluation: Hospital Anxiety and Depression Scale (HADS), Starkstein Apathy Scale;
- Quality of life assessment: Stroke-Specific Quality of Life Scale (SS-QOL).

Statistical analysis was performed using SPSS and Statistica software. Descriptive data were expressed as mean values ($M \pm SD$). For intergroup comparisons, Student's t-test, χ^2 test, and Mann–Whitney U test were applied. Differences were considered statistically significant at $p < 0.05$.

3. Results and Discussion

Before conducting the study, an assessment of the somatic and neurological status of the patients was performed. All patients demonstrated stable hemodynamics. Neurological disorders were evaluated using the National Institutes of Health Stroke Scale (NIHSS). Upon hospital admission, patients in Group 1 had a median NIHSS score of 6.0 [3.7; 9.2], while patients in Group 2 had a median score of 5.0 [5.7; 9.0]. By day 7 of the disease, the neurological deficit in both groups was reduced to 3.0 [1.7; 5.0].

Cognitive status was assessed using the modified Montreal Cognitive Assessment (MoCA), which enabled a detailed analysis of both global cognitive decline and specific deficits associated with right hemisphere damage. The standard MoCA protocol was expanded with additional subscales to verify the following impairments: right–left disorientation, simultanagnosia, prosopagnosia, ideational apraxia, and difficulties in understanding metaphors.

In patients with cortical brain lesions (Group 1, n=37), cognitive impairments were more diverse and pronounced. The mean MoCA score was 22.1 ± 3.4, indicating moderate cognitive impairment. The main deficit domains included: attention and concentration – impaired in 64.9% of patients, manifesting as difficulties in retaining information and shifting attention; short-term memory – reduced in 70.3%, with difficulties in word recall after a brief delay; language – deficits in naming and verbal fluency were present in 59.5%; visuospatial functions – impaired in 56.7%, with difficulties in the clock-drawing test and figure copying.

Additional findings from the modified MoCA: right –left disorientation – 29.7%; simultanagnosia (difficulty perceiving whole images) – 24.3%; prosopagnosia (impaired face recognition) – 18.9%; ideational apraxia (difficulty performing sequential actions) – 27.0%; impaired metaphor comprehension – 32.4%.

In patients with subcortical strokes (Group 2, n=38), cognitive impairments were less pronounced but more specific. The mean MoCA score was 23.8 ± 3.1, closer to normal but still indicating mild cognitive impairment. The main deficit domains included: processing speed and attention – impaired in 52.6%, with reduced concentration and slowed mental shifting; executive functions (sequencing, planning) – impaired in 47.3%; working memory – impaired in 44.7%, with difficulties retaining and manipulating information; visuospatial functions – reduced in 34.2%, though less severe than in the cortical group.

Additional findings from the modified MoCA: simultanagnosia – 10.5%; prosopagnosia – 7.9%; ideational apraxia – 13.2%; difficulties in metaphor comprehension – 15.8%; right–left disorientation – rare (5.3%).

Comparative analysis demonstrated that cortical strokes are associated with more severe cognitive deficits (MoCA < 26 in 81.1% of patients), particularly affecting language, associative, and visuospatial domains, while subcortical strokes were associated with milder impairments (MoCA < 26 in 65.8%), primarily affecting attention, executive functions, and processing speed. In the modified MoCA, cortical deficits (agnosias, apraxias, metaphor comprehension difficulties) occurred significantly more often in cortical stroke patients ($p < 0.05$).

Emotional status was assessed during the early recovery phase of ischemic stroke using the HADS and the Starkstein Apathy Scale. Analysis with the HADS revealed that patients with cortical stroke more frequently experienced pronounced anxiety-depressive disorders, whereas patients with subcortical stroke demonstrated less severe anxiety but persistent emotional lability (Table 1).

Table 1. Analysis of the emotional sphere in patients with ischemic stroke using the Hospital Anxiety and Depression Scale (HADS)

№	Indicator (HADS)	Cortical Stroke (n=37)	Subcortical Stroke (n=38)
1	**Mean anxiety score**	10,8 ±3,2	9,1 ±2,9
2	**Mean depression score**	11,6 ±3,5	8,9 ±3,1
3	**Clinically significant anxiety (>11), %**	48,6%	31,6%
4	**Clinically significant depression (>11), %**	54,1%	28,9%

Table 2. Analysis of the emotional sphere in patients with ischemic stroke using the Starkstein Apathy and Depression Scale (SAS)

№	Indicator (HADS)	Cortical Stroke (n=37)	Subcortical Stroke (n=38)
1	**Mean apathy score**	20,4 ±5,2	23,7 ±4,6
2	**Clinically significant apathy (>18), %**	59,5%	71,1%
3	**Severe apathy (>24), %**	27,0%	44,7%

Analysis using the SAS scale showed that cortical stroke is more often associated with anxiety-depressive disorders (emotional lability, helplessness, low mood), whereas subcortical stroke is more commonly characterized by apathy and reduced motivation, which is consistent with the involvement of subcortical-frontal connections.

The predominance of behavioral disorders, reduced

executive function, and verbal working memory deficits in patients with right-hemisphere ischemic stroke is in agreement with the findings of other authors, indicating the involvement of right-hemisphere structures in the implementation of these functions. Evaluation of the emotional-motivational characteristics in both groups revealed a distribution of these disturbances consistent with the "valence theory," which explains the lateralization of such affective processes as empathy, attachment, aggression, as well as avoidance-related emotions.

The issue of depression predominance in patients with right-hemisphere lesions remains debatable, as numerous domestic and international studies indicate that this psychoemotional disorder is more typical of patients with left-hemisphere ischemic stroke. This may be explained, on the one hand, by the predominance of cognitive impairments in Group 1 patients, since depression and cognitive deficits share common pathogenetic mechanisms. On the other hand, apathy and lack of motivation, which are also predominant in this group—play an important role in the development of depression. Therefore, for a more comprehensive diagnosis, it is necessary to include assessment methods aimed at detecting apathy, along with more detailed depression scales.

Further analysis of quality of life in patients with ischemic stroke during the early recovery period was carried out using the Stroke-Specific Quality of Life Scale (SS-QOL). The results show that in cortical stroke (n=37), patients exhibited more pronounced impairments in language functions, mood, cognition, and social roles. They reported difficulties in communication, low mood, and problems in restoring professional and family functions. In subcortical stroke (n=38), quality of life was higher across most domains, with the main complaints being apathy and reduced energy, while language and cognitive functions were less affected. The total SS-QOL score was significantly higher in patients with subcortical stroke (3.3 vs. 2.8; p=0.01), indicating more favorable adaptation in the early recovery period (Table 3).

Table 3. Analysis of quality of life in patients with ischemic stroke during the early recovery period using the Stroke-Specific Quality of Life Scale (SS-QOL)

№	Quality of life domain (SS-QOL)	Cortical Stroke (n=37)	Subcortical Stroke (n=38)	p-value
1	**Mobility**	3,1 ±0,9	3,5 ±0, 8	0,07
2	**Hand function**	2,8 ±1,0	3,4 ±0,9	0,03*
3	**Language**	2,7 ±1,1	3,2 ±0,8	0,04*
4	**Thinking / Cognition**	3,0 ±0,8	3,6 ±0,7	0,02*
5	**Mood**	2,6 ±1,0	3,1 ±0,9	0,05
6	**Personality changes**	2,9 ±0,9	3,3 ±0,8	0,08
7	**Energy**	2,7 ±0,8	3,0 ±0,7	0,09
8	**Social roles**	2,5 ±1,0	3,2 ±0,9	0,03*
9	**Family roles**	2,8 ±0,9	3,3 ±0,8	0,04*
	Overall SS-QOL score	2,8 ±0,7	3,3 ±0,6	0,01*

Note: statistically significant differences (- p < 0.05)*

4. Conclusions

The study demonstrated that cognitive, psycho-emotional, and behavioral disorders in the early recovery period of ischemic stroke have distinct neuropathogenetic features determined by the localization of the lesion.

In patients with cortical stroke, more pronounced cognitive deficits were observed, which can be explained by damage to the associative brain regions involved in the organization of speech, memory, visuospatial, and executive functions. The modified MoCA scale revealed a high frequency of agnosias, apraxias, and difficulties in understanding metaphors, indicating disintegration of cortical networks responsible for complex cognitive operations. Emotional disturbances in this group were mainly represented by anxiety-depressive disorders, reflecting the pathogenetic link between frontal-limbic damage and dysfunction of emotion regulation systems.

In patients with subcortical stroke, cognitive deficits were less severe, but disturbances in attention, processing speed, and executive functions predominated. These changes can be explained by the involvement of subcortical-frontal connections and disruption of the fronto-striato-thalamic circuits. In the emotional sphere, apathy and reduced motivation were more frequently observed, reflecting dysfunction of dopaminergic and medial frontal structures.

A decline in quality of life was found in both groups, but with different pathogenetic profiles: in cortical strokes, impairments of language functions, mood, and social roles predominated, whereas in subcortical strokes, the main factors reducing quality of life were apathy and low energy, with relatively preserved language and cognitive functions.

Thus, the pathogenesis of cognitive and psycho-emotional disorders in the early recovery period of ischemic stroke is determined by lesion localization: cortical strokes are associated with more severe cognitive deficits, anxiety-depressive disorders, and pronounced socio-communicative impairments; subcortical strokes are characterized by apatho-abulic manifestations and executive dysfunction, with less prominent speech and spatial deficits.

These findings confirm the necessity of a comprehensive approach to the diagnosis and rehabilitation of stroke patients, which should include not only the assessment of cognitive and neurological deficits but also analysis of the emotional-motivational sphere and quality of life. This allows the development of individualized rehabilitation programs.

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