



# The Degree of Cognitive Impairment in Patients with Lacunar Stroke Depending on the Hemispheric Lateralization of the Lesion

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**Abstract:** The most susceptible to vascular dementia persons with lesions of small cerebral vessels. This variant of the pathology is characterized by subacute course and pathologic basis is diffuse changes in the white matter of the cerebral hemispheres and lacunar infarctions, in most cases - multiple. That is why the appearance of lacunar infarcts associated with step-progression of the disease. However, not in all cases, there is a significant cognitive defect even in a lacunary condition. The aim of the study was to identify cognitive impairment in patients with lacunar stroke, depending on hemispheric lateralization of the lesion. We observed and surveyed 70 patients (mean age  $60.2 \pm 6.3$ ) suffered the lacunar stroke with hemispheric lateralization of the lesion. In this work, we used the Mini-Mental State Examination (MMSE) and Montreal scale assessment of cognitive functions (MoCA), the Saint Louis University Mental Status Examination (SLUMS), which have been developed as a tool to identify and assess the severity of cognitive functions in general practice. Comparative analysis of cognitive impairment on the stage of the disease in the control group showed that in general, patients suffered lacunar stroke level of violations was significantly higher than the control group ( $p \leq 0.01$ ). Cognitive function in right lacunar stroke corresponded moderate cognitive impairment and the restoration of the neurological defect in the dynamics were less expressed and are not complete. Cognitive impairment in the left hemisphere lacunar stroke had a mild degree of cognitive impairment and restoration of disturbed functions is progressing at a faster pace, about what speak reliable indicators of the late recovery period ( $p \leq 0.05$ ). The differences in cognitive disorders at different focus lateralization underlie the clinical features and determine the nature and pace of the recovery of lost functions. Mild cognitive impairment in the left-hand lacunar stroke is a favorable prognostic factor in terms of the recovery of lost functions.

**Keywords:** Lacunar Stroke, Vascular Dementia, Cognitive Impairment

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## 1. Introduction

In recent decades, the rate of cerebrovascular disease is steadily increasing (30%). Vascular diseases are the cause of disability and the social level of life. According to WHO, mortality from brain stroke takes the second place (21.4%) in overall mortality cases. A primary stroke occurs in 15 million. In the U.S., the death rate from stroke is 750,000, which is 40 per 100,000 of the population in Russia is 175 people per 100,000 population. Ischemic stroke occurs 5-6 times more frequently and is 80-85% and hemorrhagic 15-

20%. Disability leaves after suffering a stroke equal to 3.2 per 10,000 population, and to work after suffering a stroke back only 20.2% of previously worked. When you consider that 80% of stroke survivors remain motor and speech disorders, it is quite obvious high medical and social importance of this problem, and the study of diagnostic problems and aspects of a stroke is extremely important. In Uzbekistan, the incidence of cerebral stroke ranges from 0.9 to 1.4 per 1000 population, and in Tashkent is 1.5 per 1000 population. The mortality rate In Uzbekistan after stroke is 44.6%, disability – 42.2%, in 10% of retained work capacity.

Cerebral small vessel disease (cSVD) is a pathology of small arteries and arterioles in the brain irrigating subcortical structures. One of main cause cSVD is the arteriolosclerosis and/or microatheromatosis of small calibre cerebral arterial vessels caused by various pathologies. The violation of the capillary circulation of the brain, leading to lacunar stroke (LS), the defeat of the white matter of the brain and microchromosomes. Infarcts or LS of the brain contribute to most cases of vascular cognitive impairment (VCI), but multiple smaller infarcts and small vessel disease are more often a substrate of VCI than single major infarcts. Early work on VaD often concentrated on infarct volume with debate over the minimum volume of infarction needed to produce dementia and implicated volumes over 20 ml, and in particular over 50 ml. In more work that is modern, smaller volumes, usually in the range of 1–30 ml, are more typical and low volumes (mean of 8 ml) correlate with cognitive status in VCI. More recently, much less attention has been paid to infarct volume. This is partly because of the contribution from additional pathologies such as leukoariosis, but also because of the importance of location, which is much more important. For example, some locations, such as the thalami, can produce dementia with tiny lesions. Clinically silent infarcts also contribute to cognitive decline.

However, almost a quarter of people over 60 have a lacunar infarct, LS localised in the white matter of the cerebral hemispheres, basal nuclei, thalamus, internal capsule and the brain stem. In 80% of cases, IF is leaking, asymptomatic, without causing the significant neurological deficit. The frequency of lethal outcomes in patients LS is 9.8% and recurrent ischemic stroke (IS) develop in 11.8% of patients in the first year. Functional outcomes in patients with, in most cases, satisfactory.

Most susceptible to vascular dementia persons with damage to small cerebral vessels. For this variant of a pathology characterised by a subacute course and pathological basis of diffuse changes of the white matter of the cerebral hemispheres and lacunar infarcts, in most cases multiple. With the occurrence of lacunar, infarctions associated step-like progression of the disease. However, not all cases even with a lacunar state, there is a significant cognitive defect.

The aim of the study was to identify cognitive impairment in patients with lacunar stroke, depending on the hemispheric lateralization of the lesion.

## 2. Materials and Method

We examined 130 patients with cSVD and of these, 85 subjects with LS, 45 patients with vascular dementia. However, under our observation were only 70 patients suffered a lacunar stroke with a hemispheric laterality of the focus in the period from 2013 to 2015. Patients with lacunar infarction depending on the lateralization taken arbitrarily apart into two groups. In the first group consisted of patients with lacunar infarction of the right localization and in the 2nd group subjects with lacunar infarction of the left localization.

All patients were hospitalized in the Neurology Department of the clinic of Tashkent Medical Academy.

In the hospital, patients were subjected to clinical, neurological, instrumental and clinical-laboratory, biochemical examination.

Before and after treatment (on the 1<sup>st</sup> day of prescription, and 20<sup>th</sup> day from the beginning of the Protocol) patients of both groups were objective clinical and neurological examination according to the standard scheme with the detailed study of neurological status. It included the definition of the function of cranial nerves, motor areas (active and passive movement, muscle tone, presence of paresis and paralysis, tendon, parietal reflexes, reflexes from mucous membranes, pathological signs), sensitive areas (surface deep, complex sensitivity), the presence of locomotor disorders, meningeal signs, disturbance of higher cortical functions, disorders of consciousness, and symptoms of cerebral edema.

Especially, we investigated deep white matter and periventricular hyperintensities on MRI and eyeground, and compared with the level of hypercholesterolemia.

In this work we have used mini-outline for the study of the mental state (Mini-Mental State Examination – MMSE), the Montreal scale assessment of cognitive functions (MoCA), the Saint Louis University Mental Status Examination (SLUMS) for the study of the mental state that was developed as a tool to identify and assess the severity of cognitive functions in general practice.

## 3. Results

Patients 1<sup>st</sup> group were aged 45 to 75 years. The average age of patients is  $61.7 \pm 0.304$  years. Of these, 21 men (70%), female 9 (30%). Patients of group 2 were aged 45 to 75 years. The average age of the surveyed –  $60.6 \pm 0.378$  years. Men-27 (68%), female 13 (22%). And as can be seen from table 1, the number of men prevailed over women in two groups, respectively.

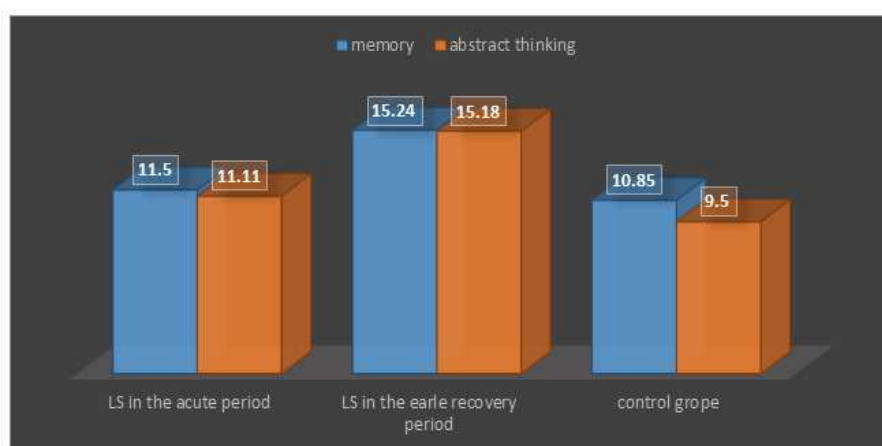
*Table 1. Distribution of observed patients with LS according to sex.*

Gender of patients	1 <sup>st</sup> group		2nd group	
	Abs. number	Percentage (%)	Abs. Number	Percentage (%)
Men	21	70	27	68
Women	9	30	13	22
Total	30	100	26	100

Comparative analysis of indicators of the severity of cognitive impairment for periods of the disease with a first group showed that, in General, in patients with lacunar stroke level of violations was significantly higher compared with the control group ( $p \leq 0.01$ ). However, it can be noted that in certain stages after a stroke these disorders prevailed in comparison with other stages of the disease.

In particular, according it may be noted that the maximum expressed as loss of memory ( $15.24 \pm 1.5$ ) and abstract thinking ( $15.18 \pm 1.31$ ) in the early recovery period of the disease with a significant difference compared with the control group

( $10.85 \pm 0.23$  and  $9.5 \pm 0.22$ ) respectively, and with data in the acute period of the disease ( $11.5 \pm 0.85$  and  $11.11 \pm 0.41$ ).



**Figure 1.** Comparative studies of memory and abstract thinking in patients with LS in different period.

Cognitive function in right-sided lacunar stroke corresponded to moderate cognitive impairment, and restoration of a neurological defect in the dynamics was less pronounced and was not full. Cognitive disorders in case of

the left hemisphere lacunar stroke had mild cognitive disorders and the restoration of disturbed functions is progressing more rapid pace, talking about the significant parameters in the late recovery period ( $p \leq 0.05$ ).

**Table 2.** Comparison between groups Mental State Examination.

Mental State Examination	1 <sup>st</sup> group left hemisphere lacunar stroke	2 <sup>nd</sup> group right hemisphere lacunar stroke
MMSE	26.1 $\pm$ 0.5	24.6 $\pm$ 1.1
MOCA	25.5 $\pm$ 0.3	24.2 $\pm$ 0.8
SLUMS	24.9 $\pm$ 0.7	22.5 $\pm$ 0.1

A comparative analysis of cognitive performance and neurological impairment in right - and left hemispheric lateralization of the lesion showed that the dynamics of a neurologic lesion of the left hemisphere progresses more accelerated pace, and in late recovery period between the comparison groups had significant differences.

## 4. Discussion

In this study, we have tried to investigate cognitive impairment in stroke patients according to age, sex, education, stroke risk factors, localization and hemispheric lateralization of the lesion. Hypertension was the most common risk factor, and it was present in 102 (78,5%) patients. The second most common risk factor was hyperlipoproteinemia, present in 58% of patients. Even though there were patients with multiple stroke risk factors, there was no certain association with the level of cognitive impairment because multiple risk factors were found among cognitively unimpaired patients too. It was found that patients with better cognitive status in acute and subacute phase had better motor deficit recovery, which is consistent with the reports by Hajek *et al.* [16], Schumann *et al.* [14] and Heruti *et al.* [15]. Cognitively impaired stroke patients had a large ischemic lesion in the left-brain hemisphere, which is consistent with the findings reported by Tatemichi *et al.* [13]. The modified mini Mental State Examination and SKT scales (a short cognitive performance test for assessing

memory and attention) applied from the acute to chronic stroke phase showed improvement of the patients' cognitive status. These results are consistent with those reported by Meier *et al.* [17], showing that greatest recovery of cognitive function was found in the period from the onset to three months after stroke. Cognitive impairment was detected in all of patients in the chronic phase of stroke, which is below the standards in the literature [9, 13]. The large proportion of lacunar ischemic strokes, which showed faster recovery, as also found in the literature, may have influenced better results of cognitive functions in the chronic phase of stroke. An inverse relation of age and cognitive status has already been considered in the literature. The association of cognitive impairment with lower educational level is consistent with the results reported by Tatemichi *et al.* [13].

## 5. Conclusion

Cognitive impairment in patients with stroke begin to appear in the early recovery period when completely regresses cerebral symptoms, starts with awareness of the defect by the patient, although it is in this period is the most intensive restoration of lost functions and overcoming neurological deficits.

Differences of cognitive disorders in different lateralization of the lesion are the basis of the clinical features and determine the nature and pace of recovery of lost functions. Mild cognitive impairment with left-sided lacunar

stroke is a favourable prognostic sign in terms of recovery of lost functions.

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