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# THE IMPORTANCE OF SCIENTIFIC ANALYSIS OF MORPHOLOGICAL ASPECTS IN THE TOPOGRAPHIC DIAGNOSIS OF ISCHEMIC STROKES AND THE PREVENTION OF COMPLICATIONS

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**Abstract.** This scientific article examines the role of analyzing pathomorphological changes in brain tissue in the topographic diagnosis of ischemic stroke and the prevention of its complications. The study provides a scientific explanation of neuronal destruction during ischemia, preservation of the penumbra (ischemic semi-shadow) region, and changes in the microcirculatory bed[1,2].

Furthermore, the article analyzes statistical indicators from Uzbekistan and global data for the years 2024–2026, modern neuroprotective strategies, and the importance of morphological markers in improving the accuracy of topographic diagnosis.

**Keywords:** ischemic stroke, topographic diagnosis, pathomorphology, penumbra, neuronal apoptosis, Uzbekistan statistics, ischemic cascade, neurovisualization, cerebral edema, angiogenesis.

## INTRODUCTION

Ischemic stroke, one of the most complex and pressing problems of modern medicine, is currently regarded not only as a medical condition but also as a significant socio-economic challenge. According to the 2025 report of the World Health Organization (WHO), more than 17 million people worldwide suffer a stroke each year, and approximately 87% of these cases are related to ischemic disturbances of cerebral circulation [3,4].

In the Republic of Uzbekistan, this indicator also remains concerning. In particular, more than 60,000 new cases of stroke are recorded annually, with a significant proportion occurring among the working-age population, further highlighting the urgency of the problem [5,6].

In the study of ischemic stroke, topographic diagnosis, which involves the precise identification of the anatomical location of the lesion, serves as the fundamental basis for selecting appropriate treatment strategies. Topographic diagnosis relies not only on clinical symptoms but also requires the analysis of deep morphological changes occurring in brain tissue.

From a morphological perspective, ischemic stroke represents a complex biochemical and structural cascade process, which begins with the cessation of blood flow in a specific arterial territory[7,8,9]. At the center of ischemia, rapid neuronal death (necrosis) occurs, while the surrounding area forms the so-called "penumbra," or ischemic semi-shadow region.

Scientific analyses indicate that neurons in the penumbra zone are functionally inactive but morphologically still viable. Preservation of this region is considered the key factor in reducing stroke complications, including disability and mortality. Morphological studies demonstrate that within the first 4–6 hours of ischemia (the therapeutic window), neurons undergo potentially reversible changes, such as swelling of intracellular organelles and decreased ATP synthesis [10,11,12].

If accurate topographic diagnosis is not established and cerebral blood flow is not restored during this stage, the process ultimately leads to neuronal apoptosis and the formation of glial scar tissue (gliosis). This results in irreversible loss of speech, motor, and cognitive functions in affected patients.

In recent years, the establishment of specialized Stroke Centers in Uzbekistan, along with the introduction of high-technology MRI and MSCT imaging systems, has increased the accuracy of topographic diagnosis to approximately 92% [13,14,15]. However, preventing complications requires more than visual imaging alone; it also demands a deeper understanding of the histomorphological state of brain tissue.

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One of the most dangerous complications of ischemic stroke is cerebral edema, which morphologically can be divided into vasogenic and cytotoxic stages. Scientific studies indicate that disruption of the blood–brain barrier (BBB) leads to the leakage of plasma proteins into the intercellular space, causing a rapid increase in intracranial pressure.

One of the most recent global advances in this field is the development of molecular neuromorphology, which investigates the biosynthesis of specific proteins that help neurons survive during ischemia, such as HIF-1 alpha [16,17,18]. Morphological analysis of these proteins opens new prospects for developing individualized neuroprotective therapy for each patient in the future[19,20].

**CONCLUSION**

In conclusion, the scientific analysis of morphological aspects in the topographic diagnosis of ischemic stroke represents a priority direction in modern medicine. This approach enables not only the accurate localization of the lesion, but also the prevention of complications, evaluation of the regenerative potential of brain tissue, and prediction of treatment effectiveness.

Statistical data from Uzbekistan and global studies indicate that successful stroke management requires closer integration of clinical practice with fundamental morphological research, as well as the combination of neurovisualization techniques with cellular-level analysis.

In the future, diagnostic systems based on morphological markers may contribute to reducing post-stroke mortality rates by at least 30–40%.

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