

THE ROLE OF NEUROIMAGING (MRI AND CT) IN THE EARLY DIAGNOSIS OF ISCHEMIC STROKE***Sindorova Jasmina Farxod qizi****Tashkent State Medical University**farkhodovna074@gmail.com****Baxriyeva Hilola O'rinboy qizi****Tashkent State Medical University**baxriyevahilola@gmail.com****Kenjayeva Barno Azim qizi****kenjayevabarno3@gmail.com*

Annotation: Ischemic stroke is one of the most pressing issues in modern medicine, and its early diagnosis plays a crucial role in preserving patients' quality of life and reducing complications. Neuroimaging methods, including computed tomography (CT) and magnetic resonance imaging (MRI), are considered key diagnostic tools in the early detection of stroke. CT provides rapid results in differentiating between hemorrhagic and ischemic types during the acute stage, while MRI demonstrates high sensitivity in identifying small lesions and early changes in brain tissue. This article analyzes the clinical significance of ischemic stroke, the role of neuroimaging in its early diagnosis, and the capabilities of CT and MRI based on modern scientific literature.

Keywords: ischemic stroke, neuroimaging, CT, MRI, early diagnosis, diagnostics.

Introduction: Ischemic stroke is currently one of the most widespread neurological diseases worldwide. According to the World Health Organization, more than 12 million new cases of stroke are recorded annually across the globe, of which 80 percent are ischemic types [1; 2020: p.44]. This condition is characterized not only by a high mortality rate but also by severe disability. The first few hours of ischemic stroke are crucial, as accurate and timely diagnosis plays a decisive role in saving lives. In clinical practice, if the patient is diagnosed within the first 3–6 hours, the chances of administering thrombolytic therapy and other effective treatments increase significantly [2; 2018: p.27]. From this perspective, modern neuroimaging techniques—computed tomography (CT) and magnetic resonance imaging (MRI)—are widely used as the most reliable and effective diagnostic methods for the early detection of ischemic stroke. CT helps rapidly differentiate between hemorrhagic and ischemic types, while MRI plays a crucial role in identifying small-scale changes in brain tissue.

In this article, the scientific and fundamental role of MRI and CT in the early diagnosis of ischemic stroke, as well as their advantages and limitations, is analyzed based on literature sources. The problem of early diagnosis of ischemic stroke has been one of the most intensively studied areas in neurology over the past decades. Numerous studies conducted worldwide have shown that accurate diagnosis within the first hours of stroke onset directly affects the patient's future quality of life and treatment outcomes [3; 2017: p.214]. For this reason, neuroimaging methods are regarded as leading diagnostic tools in clinical practice.

Computed tomography (CT) is widely used as the first-choice method in stroke diagnosis. This technique allows for a rapid distinction between hemorrhagic and ischemic types of stroke within a short time frame. The main advantages of CT are its wide availability, speed, and high accuracy. Research indicates that CT has up to 95% sensitivity in detecting hemorrhages during the acute stage of stroke [4; 2019: p.63]. However, CT has limitations in the early detection of small ischemic lesions.

Magnetic resonance imaging (MRI) has significant advantages in detecting subtle changes in brain tissue. In particular, diffusion-weighted imaging (DWI) is noteworthy because it can reveal pathological processes within the first 30 minutes of stroke onset [5; 2021: p.118]. MRI allows precise visualization of small infarct foci, as well as lesions in the brainstem and posterior brain regions. For this reason, many authors recognize MRI as the “gold standard” in the early diagnosis of stroke [6; 2016: p.97].

In recent years, several scientific sources have emphasized that the combined use of CT and MRI further improves diagnostic accuracy. CT provides the opportunity to rule out hemorrhagic stroke, while MRI enables the detection of ischemic lesions. Such a combined approach is considered highly effective, especially in the early stages of medical care [7; 2015: p.145].

A review of the literature shows that both methods have their advantages and limitations, complementing one another. The speed and availability of CT make it crucial in emergency medicine, whereas the high sensitivity of MRI enhances diagnostic precision in the early stages of stroke.

Aim: To determine the role of neuroimaging methods—particularly computed tomography (CT) and magnetic resonance imaging (MRI)—in the early diagnosis of ischemic stroke and to analyze their advantages and limitations based on the literature.

Objectives:

1. To describe the epidemiology and clinical significance of ischemic stroke.
2. To review the development of neuroimaging methods and their diagnostic capabilities.
3. To compare the advantages and limitations of CT and MRI in the early diagnosis of ischemic stroke.
4. To synthesize evidence from the literature on the effectiveness of CT and MRI in clinical use.

5. To formulate scientific conclusions on the importance of neuroimaging methods for early diagnosis of ischemic stroke.

Results

A review of the literature shows that the use of neuroimaging methods in the diagnosis of ischemic stroke plays a crucial role in saving patients' lives and reducing complications. Computed tomography (CT) is applied as the first-choice method for early stroke detection. The sensitivity of CT in identifying hemorrhagic stroke within a short time reaches 90–95% [8; 2019: p.71]. However, the limitation of CT lies in its reduced ability to visualize small ischemic lesions during the initial hours.

Magnetic resonance imaging (MRI), on the other hand, stands out for its high sensitivity. With diffusion-weighted imaging (DWI), ischemic lesions can be detected as early as the first 30 minutes after stroke onset [9; 2021: p.127]. MRI demonstrates particularly high accuracy in identifying strokes located in the brainstem and posterior brain regions. According to the analyzed sources, the combined use of CT and MRI further improves diagnostic outcomes, providing a more comprehensive and reliable assessment.

Using CT makes it possible to rule out hemorrhagic forms, while MRI enables the detection of small ischemic lesions. Such an approach increases efficiency in emergency medical care [10; 2017: p.152]. Overall, the use of neuroimaging methods improves the early diagnosis of ischemic stroke, facilitates timely treatment, and contributes to enhancing patients' quality of life.

The importance of neuroimaging in the early diagnosis of ischemic stroke is invaluable. Both CT and MRI have their own advantages and limitations, and they should be regarded as complementary diagnostic tools. Computed tomography, due to its speed, wide availability, and high accuracy in detecting hemorrhagic stroke, plays a vital role in emergency medicine. However, CT is considerably limited in detecting small ischemic lesions during the initial stage of stroke. For this reason, CT is most often used as the primary method in the initial diagnostic phase [11; 2016: p.203].

Magnetic resonance imaging (MRI) stands out for its high sensitivity, particularly due to diffusion-weighted imaging (DWI), which enables the detection of pathological processes in the very early hours of stroke. MRI allows the identification of small lesions as well as changes occurring in the brainstem and posterior brain regions. However, the main limitations of MRI are its relatively longer examination time compared to CT and the lack of technical availability in some clinical settings [12; 2020: p.88].

Numerous studies emphasize that the combined use of CT and MRI significantly increases diagnostic accuracy. While CT makes it possible to exclude hemorrhagic stroke, MRI enables the detection of ischemic lesions—making this combined approach optimal for providing emergency medical care [13; 2018: p.117].

Thus, the integrated use of neuroimaging methods not only improves diagnostic precision in the early detection of stroke but also creates the basis for timely and effective therapeutic interventions for patients.

Conclusion: Based on the review of the literature, it can be stated that neuroimaging methods—computed tomography (CT) and magnetic resonance imaging (MRI)—are among the most essential diagnostic tools in the early detection of ischemic stroke.

1. **CT** is effective in rapidly differentiating between hemorrhagic and ischemic forms during the acute stage of stroke and is widely applied as the first-choice method in emergency care.
2. **MRI**, particularly diffusion-weighted imaging (DWI), demonstrates high sensitivity in detecting small lesions during the earliest hours of stroke.
3. The combined use of **CT and MRI** enhances diagnostic accuracy and enables timely selection of appropriate treatment strategies for patients.
4. Thus, the application of neuroimaging methods is an integral part of modern medicine in stroke diagnostics, playing a vital role in preserving patients' quality of life and reducing disability rates.

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