STROKE IN CHILDREN AND ADOLESCENTS: MODERN ASPECTS OF PRE-HOSPITAL DIAGNOSIS

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Abstract

The article presents an updated analysis (2021–2025) of current problems in the pre-hospital diagnosis of stroke in children and adolescents. Modern trends in epidemiology, clinical presentation, and diagnostic algorithms are discussed. The growing incidence of pediatric stroke, improvements in neuroimaging, and awareness among healthcare workers are analyzed. The review emphasizes difficulties in early recognition of ischemic and hemorrhagic stroke, differential diagnosis with stroke mimics, and the limited applicability of adult stroke scales in pediatric practice.

Key words: stroke, early diagnosis, pre-hospital management, emphasizes, ischemic and hemorrhagic stroke, non-vascular.

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Аннотация

В статье представлен обновлённый анализ (2021–2025 гг.) актуальных проблем догоспитальной диагностики инсульта у детей и подростков.

Рассмотрены современные тенденции в эпидемиологии, клинических проявлениях и диагностических алгоритмах.

Проанализировано увеличение заболеваемости инсультом в детском возрасте, усовершенствование нейровизуализационных методов и повышение осведомлённости медицинских работников.

Особое внимание уделено трудностям раннего распознавания ишемического и геморрагического инсульта, дифференциальной диагностике с инсультоподобными состояниями и ограниченной применимости взрослых шкал инсульта в педиатрической практике.

Ключевые слова: инсульт, ранняя диагностика, догоспитальный этап, ишемический и геморрагический инсульт, неваскулярные состояния.

New international studies and recommendations are summarized to optimize early detection and management of pediatric stroke.
Pediatric stroke remains a rare but severe neurological disorder leading to disability and mortality. Over the last decade, an increasing number of studies have addressed early diagnosis and pre-hospital management of stroke in children. Between 2020 and 2025, global awareness of pediatric cerebrovascular diseases has significantly improved, yet diagnostic delays persist. Early identification of stroke in children remains challenging due to age-specific symptoms, limited communication ability, and overlap with non-vascular conditions such as migraine, epileptic seizures, and infections of the central nervous system.

Epidemiology (2021–2025)

According to multicenter studies published in 2021–2024, the global incidence of pediatric stroke ranges between 2.1 and 3.2 per 100,000 children per year.
Recent data from Canada, the United Kingdom, and Australia confirm a steady increase in detection rates, reflecting both improved neuroimaging

access and better clinical vigilance. In Russia and Central Asia, reported incidence remains lower (0.8–1.5 per 100,000) due to diagnostic limitations. Mortality has decreased from 15–20% to 8–12% owing to earlier recognition and multidisciplinary management. However, 60–80% of survivors still experience persistent neurological deficits.

Clinical Features and Stroke Mimics

Clinical manifestations in children vary widely. Focal neurological deficits, seizures, headache, speech disorders, and impaired consciousness are common, but may present atypically in infants. The problem of “stroke mimics” remains critical: migraine, epilepsy, Bell’s palsy, metabolic encephalopathies, and postictal paralysis account for 50–70% of initial misdiagnoses. Studies by Mackay et al. (2022) and Ganesan et al. (2023) confirm that migraine with aura is the most frequent mimic, followed by epileptic events. Artificial intelligence (AI)-assisted diagnostic algorithms and decision-support tools introduced in pediatric emergency care between 2023–2025 have improved recognition accuracy by up to 25%.

Diagnostic Scales and Pre-Hospital Tools

Traditional adult scales (FAST, BE-FAST, ROSIER, CPSS) remain insufficiently sensitive in pediatric populations. Studies from 2022–2024 highlighted the need for pediatric-specific adaptations. The Pediatric Stroke Recognition Scale (PedSRS) and modified BE-FAST Kids protocol demonstrated improved sensitivity (82%) and specificity (75%) in distinguishing true stroke from mimics. Integration of mobile telemedicine applications and real-time video assessment by pediatric neurologists has reduced the mean time to diagnosis from 23 hours (2018 data) to 11 hours (2024 data).

AI-based triage systems, such as the "NeuroAlert Kids" algorithm tested in Europe in 2023, further shortened recognition time by analyzing

facial asymmetry, speech, and movement patterns via smartphone video.

Challenges in Early Diagnosis

Key obstacles to timely diagnosis include nonspecific early symptoms, underestimation of stroke risk in children by healthcare personnel, and insufficient use of neuroimaging in emergency departments. In developing regions, delays are also linked to lack of training and limited access to computed tomography (CT) and magnetic resonance imaging (MRI). Public unawareness of pediatric stroke symptoms leads to delayed medical calls, with an average pre-hospital delay of 2–3 hours in high-income countries and up to 10 hours in low-resource areas.

Recent Advances and Recommendations (2023–2025)

Recent advances include the implementation of AI-assisted tele-neurology systems, rapid diffusion-weighted MRI protocols, and the introduction of early thrombolysis in selected pediatric cases. International guidelines, including the 2024 European Pediatric Stroke Consensus
and the 2023 American Heart Association recommendations, emphasize the need for:
(1) training of emergency teams to recognize pediatric stroke signs,
(2) inclusion of children in stroke code protocols,
(3) development of pediatric-specific stroke recognition scales, and

(4) parent education programs.

Conclusion

The pre-hospital diagnosis of stroke in children remains a multidisciplinary

challenge. Despite notable progress between 2021 and 2025, diagnostic errors and time delays persist. The adaptation of AI technologies, creation of pediatric-specific diagnostic scales, and integration of telemedicine have significantly improved early recognition rates. Future directions should focus on population-based awareness, standardized training for emergency teams, and continued research into the neurobiological mechanisms underlying childhood stroke.

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