IMPROVING EARLY DETECTION AND PREVENTION STRATEGIES FOR PEDIATRIC STROKE

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Abstract

Pediatric stroke is an uncommon but severe neurological emergency that often leads to long-term disability and substantial social and economic burden. Early recognition remains a major challenge due to atypical symptoms and limited awareness among caregivers and primary-care physicians. This article reviews current evidence on major risk factors, early clinical manifestations, diagnostic approaches, and preventive strategies for pediatric stroke. Based on recent literature, improved models for early screening, timely neuroimaging, and prevention in high-risk children are proposed. Strengthening interdisciplinary collaboration and increasing parental and community awareness are highlighted as essential steps toward reducing pediatric stroke morbidity and mortality.

Keywords: Pediatric stroke, early detection, prevention, risk factors, neuroprotection, screening.

СОВЕРШЕНСТВОВАНИЕ РАННЕГО ВЫЯВЛЕНИЯ И ПРОФИЛАКТИКИ ИНСУЛЬТА У ДЕТЕЙ

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Аннотация

Инсульт у детей является редким, но тяжёлым неврологическим состоянием, часто приводящим к длительной инвалидизации и высоким социально-экономическим потерям. Ранняя диагностика представляет значительные трудности из-за нетипичных симптомов и недостаточной осведомлённости

родителей и врачей первичного звена. В данной статье рассматриваются современные данные о ключевых факторах риска, ранних клинических проявлениях, диагностических подходах и эффективных направлениях профилактики детского инсульта. На основе анализа литературы предлагаются улучшенные модели раннего скрининга, своевременной нейровизуализации и профилактики у детей с высоким риском. Подчёркивается необходимость междисциплинарного взаимодействия и повышения информированности населения для снижения заболеваемости и смертности, связанных с инсультом у детей.

Ключевые слова:

детский инсульт, ранняя диагностика, профилактика, факторы риска, нейропротекция, скрининг

1. Introduction

Pediatric stroke, although significantly less common than adult stroke, remains one of the most devastating neurological conditions in childhood. Global incidence estimates indicate that 2–13 cases occur per 100,000 children annually, and despite improved neuroimaging technologies, many cases remain underdiagnosed. In low- and middle-income countries, including Central Asia, epidemiological data are limited, while perinatal complications, congenital heart diseases, and genetic syndromes are increasingly contributing to stroke risk among children.

Consequences of pediatric stroke are often more severe compared to adults. Studies show that more than 60% of affected children develop long-term neurological deficits, including motor impairment, epilepsy, cognitive decline, speech disorders, behavioral abnormalities, and limitations in social adaptation. These complications substantially affect a child's quality of life and increase the long-term burden on families and healthcare systems.

Early recognition of pediatric stroke is challenging. Children frequently present with non-specific symptoms such as headache, vomiting, irritability, lethargy, or subtle weakness. These signs are often misinterpreted as viral infections, migraine, or fatigue, causing delays in diagnosis. Furthermore, primary care physicians often lack structured clinical algorithms to identify stroke in children, which contrasts with well-established tools available for adults.

Currently, pediatric stroke screening protocols remain insufficiently standardized, and many countries lack specialized pediatric stroke pathways. Given these

challenges, strengthening early detection systems and developing improved prevention strategies for high-risk pediatric populations are crucial.

This article focuses on the fundamental aspects of early recognition, diagnostic approaches, and effective preventive interventions for pediatric stroke. Emphasis is placed on strengthening screening protocols, enhancing physician training, and promoting awareness among parents to reduce stroke-related disability in children.

2. Materials and Methods

This narrative review is based on the analysis of published scientific literature from 2015–2025. Databases including PubMed, ScienceDirect, Scopus, and Google Scholar were searched using keywords such as "pediatric stroke," "early diagnosis," "childhood ischemic stroke," and "stroke prevention in children."

3. Results

3.1 Major Risk Factors

The analysis identified several key risk factors strongly associated with pediatric stroke:

Congenital heart disease: particularly those causing right-to-left shunting.

Coagulation disorders: including thrombophilia, protein C/S deficiency, and antiphospholipid syndrome.

Vascular abnormalities: such as Moyamoya disease, vasculitis, and arterial dissections.

Perinatal complications: birth asphyxia, prematurity, and neonatal infections.

Systemic infections: meningitis, encephalitis, and severe otitis.

3.2 Early Clinical Signs

Early symptoms were found to vary with age:

Infants: seizures, apnea, irritability, feeding problems.

Children: hemiparesis, facial asymmetry, speech disturbances, sudden headaches, vomiting, altered consciousness.

Due to nonspecific presentations, pediatric stroke is frequently misdiagnosed, causing delays in neuroimaging and treatment.

3.3 Diagnostic Improvements

Important findings include:

MRI and MRA remain the gold standard for early detection.

CT scan is useful for excluding hemorrhage but often misses early ischemic lesions.

Implementing a pediatric-adapted stroke scale such as FAST-Kids (Face, Arm, Speech, Time) significantly improves recognition rates.

Tele-neurology consultations enhance early triage in remote regions.

3.4 Prevention Strategies

Effective prevention measures identified include:

Screening of high-risk children (e.g., congenital heart disease, thrombophilia).

Early management of infections and inflammatory diseases.

Antithrombotic prophylaxis where indicated.

Educating parents and teachers about early warning signs.

Establishing national pediatric stroke pathways for emergency departments.

4. Discussion

This review highlights that pediatric stroke remains underrecognized despite its severe long-term consequences. Unlike adults, children typically present with subtle and atypical symptoms. Delayed diagnosis is often attributed to misinterpretation of early signs by caregivers and insufficient training of primary-care physicians.

The implementation of structured screening tools such as FAST-Kids can greatly improve early detection. However, many healthcare systems lack pediatric-specific neuroimaging protocols and multidisciplinary stroke teams. Early MRI access remains limited in some regions, further contributing to delayed diagnosis.

Prevention is most effective when targeting children with known risk factors. Routine screening of children with congenital heart anomalies, clotting disorders, or vasculopathies can significantly reduce stroke incidence. Additionally, perinatal care improvements play a crucial role in reducing neonatal stroke rates.

Education remains a key component. Increasing awareness among parents, teachers, emergency staff, and family physicians can dramatically reduce diagnosis time and improve outcomes. Collaboration among pediatricians, neurologists, cardiologists, and hematologists is essential for comprehensive stroke care.

5. Conclusion

Pediatric stroke is a serious, often underdiagnosed condition that leads to lifelong neurological complications.

Early detection requires improved screening tools, expanded MRI access, and enhanced physician training.

Prevention strategies should focus on high-risk groups, including children with congenital heart disease, coagulation disorders, and perinatal complications.

Increasing awareness among caregivers and healthcare professionals is critical to reducing morbidity and mortality.

Establishing national pediatric stroke guidelines will significantly improve outcomes in affected children.

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