

PEDIATRIC STROKE: CAUSES, CLINICAL FEATURES, AND MANAGEMENT STRATEGIES

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Abstract

Pediatric stroke is a rare but devastating neurological emergency resulting from acute disruption of cerebral blood flow. It can cause severe, lifelong disabilities if not recognized and treated promptly. While the pathophysiology overlaps with that of adult stroke, the underlying causes, clinical features, and management approaches in children are distinct. This review summarizes the current understanding of pediatric stroke, including epidemiology, etiology, clinical manifestations, diagnostic methods, treatment principles, and preventive measures.

Keywords:

pediatric stroke, ischemic stroke, hemorrhagic stroke, cerebral circulation, childhood neurology, neuroimaging, diagnosis, management, prevention.

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Аннотация

Инсульт у детей — редкое, но тяжёлое неврологическое неотложное состояние, возникающее вследствие острого нарушения мозгового кровообращения. Заболевание может привести к тяжёлой, пожизненной инвалидности, если не будет своевременно распознано и пролечено. Хотя патофизиология детского инсульта частично совпадает со взрослым, причины, клинические проявления и методы лечения у детей существенно отличаются. В данной статье представлены современные сведения об

эпидемиологии, этиологии, клинических признаках, диагностике, лечении и профилактике инсульта у детей.

Ключевые слова:

детский инсульт, ишемический инсульт, геморрагический инсульт, мозговое кровообращение, детская неврология, нейровизуализация, диагностика, лечение, профилактика.

Introduction

Stroke, defined as the sudden interruption of cerebral blood flow causing neuronal injury, remains one of the most serious neurological disorders. Although most cases occur in adults, stroke in children represents a major cause of mortality and long-term morbidity in pediatric neurology. The global incidence is estimated between 2 and 6 per 100,000 children annually (Fullerton et al., 2011; Ganesan et al., 2017).

Unlike adult stroke, which is mainly linked to atherosclerosis and hypertension, pediatric stroke has multifactorial origins, including congenital heart disease, hematologic disorders, infections, trauma, and genetic vasculopathies such as Moyamoya disease (Mackay & Steinlin, 2020; Goldenberg et al., 2020). Perinatal stroke, occurring between 20 weeks of fetal life and 28 days postnatal, accounts for nearly half of all childhood stroke cases (Ferriero et al., 2019).

Recent studies also report associations between pediatric stroke and COVID-19–related hypercoagulable states, multisystem inflammatory syndrome in children (MIS-C), and autoimmune vasculopathies (LaRovere et al., 2021; Mirsky et al., 2022).

Clinical symptoms vary according to age. In neonates, manifestations are often nonspecific — such as poor feeding, seizures, or decreased movement on one side of the body — while older children more typically present with hemiparesis, facial droop, and speech impairment (Raju et al., 2007; Dowling & Ikemba, 2018). The subtle nature of these signs frequently delays diagnosis, which in turn worsens neurological outcomes.

Advances in neuroimaging, particularly magnetic resonance imaging (MRI) and magnetic resonance angiography (MRA), have revolutionized early detection. Additionally, the use of comprehensive hematologic and cardiologic evaluations enables clinicians to identify the etiology and implement targeted therapy (Rivkin et al., 2016).

Rehabilitation and neuroplasticity-based interventions are central to improving post-stroke outcomes. Interdisciplinary care involving neurologists, pediatricians, physiotherapists, and psychologists remains crucial for optimizing recovery and quality of life (Lynch et al., 2017; Mallick et al., 2020).

Methods

This review synthesizes information from scholarly articles, systematic reviews, and clinical studies published between 2005 and 2024. Sources were obtained from PubMed, Scopus, and WHO Global Health Library databases. Studies focusing on childhood ischemic and hemorrhagic stroke, including perinatal and postnatal cases, were included. Articles were assessed for quality and relevance to epidemiology, pathophysiology, diagnostics, and treatment.

Results

Data from reviewed studies indicate that:

55–70% of pediatric strokes are ischemic, and 30–45% are hemorrhagic.

The most common risk factors include congenital heart defects, infections, coagulopathies, trauma, and vasculopathies such as Moyamoya.

Clinical presentation depends on age: seizures are more common in neonates, while focal deficits predominate in older children.

MRI and MRA outperform CT in early detection of ischemic lesions.

Timely intervention with anticoagulant or antiplatelet therapy significantly improves outcomes and reduces recurrence.

Discussion

Pediatric stroke presents unique diagnostic and therapeutic challenges due to its variable etiology and subtle onset. Delayed diagnosis often leads to irreversible neurological injury. Hence, increasing awareness among primary care physicians and emergency clinicians is essential.

Treatment must be tailored to stroke subtype: ischemic strokes benefit from antithrombotic therapy (e.g., heparin, aspirin), while hemorrhagic strokes require surgical or supportive management. In all cases, controlling underlying conditions—such as infections, anemia, or cardiac disease—is vital.

Long-term management focuses on rehabilitation, including physical therapy, occupational therapy, and speech-language interventions. Cognitive rehabilitation and family counseling are equally important for psychosocial adaptation.

Future research should focus on pediatric-specific thrombolytic protocols, genetic risk screening, and neuroprotective strategies to enhance outcomes.

Conclusion

Pediatric stroke, though relatively rare compared to adult stroke, represents a major and often underrecognized cause of long-term neurological disability and mortality in children. The complex and multifactorial nature of its etiology—ranging from congenital heart disease and coagulopathies to infections, trauma, and genetic vasculopathies—makes early diagnosis and tailored management a clinical challenge.

Timely recognition and accurate differentiation between ischemic and hemorrhagic stroke are critical for improving survival and functional outcomes. Advances in neuroimaging, particularly MRI and MRA, have revolutionized early detection, while the growing availability of pediatric stroke protocols has improved therapeutic decision-making. Nonetheless, diagnosis often remains delayed due to the subtle and age-dependent clinical presentation of stroke in neonates and young children.

Effective management must combine acute medical or surgical intervention with long-term rehabilitation and psychosocial support. Rehabilitation strategies should emphasize neuroplasticity, encouraging recovery of motor and cognitive function through structured physical therapy, speech-language therapy, and occupational interventions. Moreover, family education and psychological counseling are essential to support both the child's emotional well-being and the family's adaptive capacity.

Preventive strategies, including early identification of high-risk populations—such as children with congenital heart defects, sickle cell disease, or known vasculopathies—should be integrated into pediatric healthcare systems. Genetic counseling and screening for inherited thrombophilias may further contribute to risk reduction.

Future research should focus on the development of pediatric-specific thrombolytic and neuroprotective protocols, improvement of acute management algorithms, and

large-scale longitudinal studies aimed at understanding long-term cognitive and psychosocial outcomes. Expanding multidisciplinary stroke networks and establishing national pediatric stroke registries will also be vital to optimize early diagnosis and improve equity of care across healthcare systems.

In conclusion, pediatric stroke remains a complex and evolving field in child neurology. Continued collaboration among clinicians, researchers, and public health professionals is necessary to bridge knowledge gaps, enhance early recognition, and improve functional outcomes. With timely diagnosis, comprehensive care, and robust rehabilitation programs, the burden of pediatric stroke can be substantially reduced, offering affected children a better chance for recovery and quality of life.

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