

PEDIATRIC STROKE: EARLY DIAGNOSIS AND MODERN THERAPEUTIC APPROACHES

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Abstract

Pediatric stroke is a serious cause of long-term neurological disability in children. Early diagnosis and modern therapeutic approaches can significantly improve clinical outcomes. This article reviews the etiology, clinical presentation, and contemporary diagnostic tools for pediatric stroke, including magnetic resonance imaging (MRI), computed tomography (CT), biomarkers, and vascular studies. Therapeutic strategies such as anticoagulant and antiplatelet therapy, neuroprotective interventions, surgical options, and rehabilitation are discussed.

Keywords: pediatric stroke, early diagnosis, MRI, treatment, rehabilitation, anticoagulation

ПЕДИАТРИЧЕСКИЙ ИНСУЛЬТ: РАННЯЯ ДИАГНОСТИКА И СОВРЕМЕННЫЕ ПОДХОДЫ К ЛЕЧЕНИЮ

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Аннотация

Педиатрический инсульт является важной причиной неврологической инвалидизации у детей. Ранняя диагностика и современные методы лечения способны значительно улучшить исход заболевания. В статье рассмотрены этиология, клиническая картина и современные диагностические методы педиатрического инсульта, включая МРТ, КТ, биомаркеры и сосудистые

исследования. Обсуждаются терапевтические подходы, такие как антикоагулянтная и антиагрегантная терапия, нейропротективные методы, хирургические вмешательства и реабилитация.

Ключевые слова: педиатрический инсульт, ранняя диагностика, МРТ, лечение, реабилитация, антикоагулянты

Introduction Pediatric stroke is a rare but potentially devastating condition, differing from adult stroke in etiology, pathophysiology, and clinical presentation. Unlike adults, children present a unique set of challenges due to the ongoing development of the brain and vascular system. Neonates and infants have immature cerebrovascular networks, which increase their susceptibility to ischemic events and hemorrhage. Additionally, the clinical manifestations of pediatric stroke are often nonspecific, including seizures, altered consciousness, or focal neurological deficits, which can delay diagnosis. The spectrum of pediatric stroke encompasses arterial ischemic stroke, cerebral sinovenous thrombosis, and hemorrhagic stroke, each with distinct mechanisms and risk factors. Recognizing these differences is critical for timely intervention.

Early and accurate diagnosis is essential to minimize neurological sequelae and optimize rehabilitation. Advances in neuroimaging, including MRI, diffusion-weighted imaging, and MR angiography, allow for detailed assessment of ischemic regions, vascular anomalies, and hemorrhagic lesions. Biomarkers and genetic screening further enhance the identification of underlying risk factors. Pediatric stroke requires a multidisciplinary approach involving neurologists, hematologists, cardiologists, and rehabilitation specialists. This introduction highlights the importance of understanding developmental neurovascular physiology and the distinct etiologies of pediatric stroke, forming the foundation for effective management and improved long-term outcomes.

Etiology of Pediatric Stroke

- Congenital heart defects (e.g., single ventricle, hypoplastic left heart)
- Arteriopathies and vasculitis (e.g., Moyamoya disease, infection-related vasculopathy)
- Hematologic disorders (anemia, thrombophilia)
- Trauma and vascular dissection
- Genetic syndromes (COL4A1 mutations, others)

Early Diagnosis Early diagnosis is critical in reducing morbidity and improving outcomes.

Neurological Assessment

- Motor function evaluation
- Assessment of vision, speech, and cognitive abilities

Imaging Techniques

- MRI: identifies ischemic and hemorrhagic lesions
- CT: rapid detection of hemorrhage
- MR/CT angiography: evaluation of cerebral vessels

Biomarkers

- D-dimer, antiphospholipid antibodies, thrombophilia panels

Vascular Studies

- Echocardiography: detect cardioembolic sources
- Doppler ultrasound: assess cerebral blood flow

Modern Therapeutic Approaches

Pharmacological Therapy

- Anticoagulants: heparin, warfarin
- Antiplatelet agents: aspirin
- Neuroprotective agents: NMDA receptor blockers, antioxidants

Surgical Interventions

- Craniotomy for hemorrhage
- Endarterectomy or stenting for arteriopathies

Rehabilitation

- Early motor therapy
- Physical and occupational therapy
- Cognitive and speech rehabilitation

Conclusion Early diagnosis and modern therapeutic strategies are essential for pediatric stroke management. MRI, CT, and biomarker evaluation facilitate rapid and accurate diagnosis. Treatment must be individualized, combining pharmacologic, surgical, and rehabilitation approaches to optimize long-term neurological outcomes.

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