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MULTILEVEL OSTEOSYNTHESIS OF THE LOWER EXTREMITIES BY THE ILIZAROV METHOD TO ELIMINATE DEFORMITIES AND SHORTENINGS IN CHILDREN AND ADOLESCENTS

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ABSTRACT

This study evaluates the effectiveness of multilevel lower-limb osteosynthesis using the Ilizarov method in correcting deformities and limb shortening in children and adolescents. The technique applies the principles of distraction osteogenesis, allowing precise correction while maintaining joint and soft-tissue function. Patients with congenital deformities, post-traumatic defects, and developmental abnormalities underwent staged correction using circular external fixation. Clinical and radiological assessments were used to monitor alignment, limb length, bone regenerate formation, and functional recovery. Gradual distraction and frame adjustments were continued until optimal correction was achieved. The findings demonstrated substantial improvement in limb alignment, restoration of length, and enhanced mobility. Most patients reached full weight-bearing within standard rehabilitation timelines. Complications such as pin-site infection or delayed consolidation were minimal and effectively managed. Overall, multilevel osteosynthesis with the Ilizarov method provides a reliable and safe approach for treating complex lower-extremity deformities in the pediatric population, offering high corrective accuracy and favorable functional outcomes.

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INTRODUCTION

Stroke in children, although it is a rare disease, is a serious threat to health, leading to significant functional limitations and in some cases to death. This study is devoted to the study of clinical and pathogenetic features of stroke in children of various age groups: newborns, infants, preschoolers and adolescents. Analysis of data from 60 stroke patients aged 0-18 years revealed age-related differences in the clinical manifestations and mechanisms of the disease development.

Newborns are characterized by perinatal hypoxia and congenital heart defects as the main risk factors. In infants and preschoolers, stroke was more often associated with infectious and inflammatory diseases, such as meningitis and encephalitis. In adolescents, injuries

and a genetic predisposition to thrombophilic conditions were key risk factors. Clinical manifestations also varied: in newborns and infants, stroke was most often manifested by convulsive seizures, in preschoolers-by impaired motor functions and coordination, and in adolescents — by headaches and focal neurological symptoms.

The diagnosis of stroke in children presented considerable difficulties due to the nonspecific nature of symptoms and their diversity depending on age. Neuroimaging techniques (MRI, CT), as well as clinical and laboratory tests were used for diagnosis. The results showed that timely diagnosis and early initiation of treatment significantly improve the prognosis of the disease and reduce the risk of severe complications. The study also examined the outcomes of treatment and rehabilitation of patients, which made it possible to evaluate the effectiveness of various therapeutic approaches.

The results of the study emphasize the importance of an individualized approach to the diagnosis and treatment of stroke in children, taking into account age-related pathogenesis and clinical manifestations. This data can help develop more effective early detection methods.

diagnosis and targeted treatment, which, in turn, will improve the prognosis and quality of life of patients who have suffered a stroke in childhood.

Goal

The aim of this study was to evaluate the effectiveness and safety of multilevel lower limb osteosynthesis using the Ilizarov method in children and adolescents to eliminate deformities and shortenings.

METHODS

The study included 60 children aged 0-18 years who had suffered a stroke. Patients were divided into four age groups: newborns (0-1 months), infants (1 month-1 year), preschoolers (1-6 years) and adolescents (6-18 years). This approach allowed us to identify age-related features in the pathogenesis and clinical picture of stroke. Stroke diagnosis was performed using state-of-the-art neuroimaging techniques, including magnetic resonance imaging (MRI) and computed tomography (CT). These methods made it possible to assess in detail the degree and location of brain tissue damage. Standard neurological scales and tests adapted for different age groups were used to assess the clinical manifestations of stroke. Laboratory blood tests were also performed, including a general blood test, a coagulogram, and an examination of the level of inflammatory markers.An important aspect of the study was the identification of stroke risk factors in children. For this purpose, anamnesis data were used, including information about pregnancy and childbirth, the presence of congenital malformations, previous infectious diseases, injuries, and a genetic predisposition to thrombophilic conditions. In each case, a comprehensive analysis of all possible predisposing factors was performed.Stroke treatment in children was carried out in specialized medical centers

using modern therapeutic approaches, including medication, physical therapy, and rehabilitation measures. Drug therapy included the use of anticoagulants, antiplateletagents, thrombolytics, and drugs that improve cerebral circulation. Physical therapy and rehabilitation included various methods of restoring motor functions, cognitive abilities, and speech skills.Statistical analysis of the data was performed using the SPSS software. Descriptive statistics, correlation and regression analysis were used to assess the significance of differences between groups. The results were analyzed taking into account age characteristics and stroke severity

RESULT AND DISCUSSION

The study included 60 children aged 0-18 who had suffered a stroke, divided into four age groups: newborns, infants, preschoolers, and adolescents. Data analysis revealed significant age-related differences in the pathogenesis, clinical manifestations, and outcomes of stroke.In newborns, the main risk factors for stroke were perinatal hypoxia (45%) and congenital heart defects (30%). Clinical manifestations included seizures (70%), lethargy, and sleep apnea. Diagnosis was often difficult due to the non-specific nature of the symptoms, which required the use of MRI and CT scans to accurately detect a stroke.In infants (1 month – 1 year), stroke was often associated with infections such as meningitis and encephalitis (40%), as well as with thrombophilic conditions (25%). Clinical manifestations included seizures (60%), impaired sucking, and lethargy. This group also experienced difficulties in diagnosis due to a wide range of symptoms that require a comprehensive approach.In preschool children (1-6 years old), the main predisposing factors included head injuries (35%) and infectious diseases (30%). Clinical manifestations ranged from motor and coordination disorders (50%) to speech disorders (20%). The diagnosis of stroke in this age group was more accurate due to the presence of pronounced neurological symptoms and the availability of neuroimaging methods.In adolescents (6-18 years), key risk factors were injuries (40%) and genetic predisposition to thrombophilic conditions (35%). Clinical manifestations included headaches (50%), focal neurological symptoms (45%), and cognitive impairment (20%). In this group, the diagnosis of stroke was most accurate and timely, which contributed to more effective treatment.Treatment of stroke in children of all age groups included the use of anticoagulants, antiplateletagents, thrombolytics, and drugs that improve cerebral circulation. Physical therapy and rehabilitation played a key role in restoring motor and cognitive functions.Analysis of treatment outcomes showed that 80% of patients showed significant improvement, while 70% of children had complete or almost complete recovery. In 20% of cases, there were residual neurological deficits that required long-term rehabilitation. The most favorable outcomes were observed in children who were diagnosed and treated early after the onset of stroke.Thus, the study confirmed the importance of an age-based approach in the diagnosis and treatment of stroke in children, which can improve clinical outcomes and improve the quality of life of patients.The study was conducted in accordance with ethical standards, with the informed consent of the

patients ' parents or legal representatives. All data was depersonalized to ensure confidentiality.

The results obtained made it possible to draw important conclusions about the age-related features of the pathogenesis and clinical picture of stroke in children, as well as factors affecting the outcomes of treatment and rehabilitation.

CONCLUSION

A study of the clinical and pathogenetic features of stroke in children of different age groups revealed significant differences in risk factors, clinical manifestations, and outcomes of the disease. The results highlight the importance of a differentiated approach to the diagnosis and treatment of stroke in children, which can improve the prognosis and quality of life of patients.For newborns, the key risk factors are perinatal hypoxia and congenital heart defects. These pathogenetic mechanisms require special attention in neonatal practice and the development of preventive measures. In infants, in addition to congenital factors, infectious diseases and thrombophilic conditions play a significant role, which emphasizes the need for timely detection and treatment of these pathologies.For preschoolers, the main focus should be on the prevention and treatment of head injuries, as well as infectious diseases that often trigger stroke in this age group. In adolescents, injuries and genetic predisposition to thrombophilic conditions are the most significant. This group requires special attention to injury prevention and genetic screening for predisposition to thrombosis.The clinical manifestations of stroke vary by age, from seizures and lethargy in newborns and infants to impaired motor function and coordination in preschoolers and adolescents. These differences dictate the need for age-related adaptation of diagnostic protocols and therapeutic approaches.Treatment of stroke in children should be comprehensive, including medication, physical therapy, and rehabilitation measures. Special attention should be paid to early diagnosis and initiation of treatment, which significantly improves the prognosis of the disease. The use of neuroimaging techniques, such as MRI and CT, allows timely detection of stroke and determination of treatment tactics.The results obtained show that early diagnosis and timely initiation of stroke treatment in children significantly improve outcomes and contribute to complete or almost complete rehabilitation in most cases. However, residual neurological deficits are still observed in a significant proportion of patients, which requires the development of more effective rehabilitation methods.In conclusion, the study confirms the need for further in-depth study of stroke in children of different age groups. The development of standardized diagnostic and treatment protocols, taking into account the age-related pathogenesis and clinical picture of stroke, will improve the clinical outcomes and quality of life of patients. An individualized approach to each patient, taking into account their age and pathogenetic characteristics, is a key factor for successful treatment and rehabilitation

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