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To Improve Existing and Develop New Methods of Surgical Treatment of Children With Acquired Knee Joint Deformities Adolescents

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Relevance. Acquired deformities of the knee joint account for 43.7% of the pathology of the musculoskeletal system in children. The most severe deformities of the knee joint are formed in 35.180.1% of young children after acute hematogenous osteomyelitis suffered during the newborn period. Post-traumatic deformities of the knee joint develop in 93.7% of children with fractures of the epimetaphyses forming the knee joint, which account for 1.42-9% of all hip and shin fractures. The use of transosseous distraction osteosynthesis in children for the purpose of lengthening and correcting the hip and lower leg axes in 28.1-53.1% of cases is accompanied by various complications, which requires long-term rehabilitation and surgical interventions. Despite the high frequency of acquired knee joint deformities, the variants of damage to the epiphyses, metaphyses, epiphyseal growth zones, and functional disorders of bone and muscle tissues have not been sufficiently studied. Not enough publications are devoted to the causes and factors involved in the formation of subluxations of the lower leg of various orientations, contractures and features of anatomical and functional disorders of the knee joint in various types of deformities of the hip and lower leg in children. The most common methods of treating children with acquired deformities and contractures of the knee joint are corrective osteotomies of tubular bones and various methods of percutaneous distraction osteosynthesis. The frequency of unsatisfactory results in surgical and conservative treatment of children with acquired knee joint deformities remains high and ranges from 8.7% to 34%. There are conflicting opinions about the effectiveness of using various biological tissues and synthetic materials to prevent the formation of synostosis and the development of tubular bone deformity after resection of the affected area of its epiphyseal growth zone both in experiment and in clinical practice. Post-traumatic deformities of the knee joint developed as a result of fractures of the epimetaphyses forming the knee joint in 11 (11.2%) patients. Iatrogenic deformities and contractures of the knee joint in 11 (11.2%) cases were caused by previous surgical interventions. It has been established that the variety of knee joint deformities requires a comprehensive examination of children with this pathology to clarify the degree of interest in the bone, muscle, cartilage and vascular systems of the lower limb. A direct relationship has been revealed between the features of anatomical and functional disorders of the knee joint, as well as bone, muscle and cartilage tissues, and the cause of deformities. A working classification of acquired knee joint deformities has been developed, which allows for a differentiated approach to orthopedic and surgical treatment of children with this pathology.

The effectiveness of the use of improved and developed surgical treatment techniques in children with acquired knee joint deformities in the clinic has been proven, allowing to improve the supporting and dynamic functions of the affected lower limb, achieve stable clinical results and reduce the number of complications. Based on a comparative assessment, the effectiveness of using wax as an interposite

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material in the replacement of a bony marginal defect of a long tubular bone in order to prevent the formation of synostosis and the development of knee joint deformity has been experimentally proven. Based on the analysis of long-term results of treatment of children with acquired knee joint deformities, as well as errors and complications, the expediency of using the developed algorithm for surgical treatment of children with this pathology has been established. The main causes of the development, frequency, and mechanisms of knee joint deformities in children have been established, and the relationship between the development of components involved in the formation of acquired knee joint deformities in children and the etiology of the disease has been determined. The proposed working classification of knee joint deformities and the patient management tactics developed on its basis allow for a differentiated approach to the treatment of children in each specific case. The use of developed and improved techniques makes it possible to restore the supporting and dynamic functions of the lower limb in 89.8% of patients, reduce the recurrence of deformity, the number of complications, and shorten the duration of inpatient and rehabilitation treatment. A comprehensive examination of patients with acquired knee joint deformities reveals characteristic anatomical and functional disorders of the knee joint, as well as disorders of bone, muscle and cartilage tissues, the severity and frequency of which have a direct relationship with the cause of the deformity. The developed working classification of acquired knee joint deformities in children, which is based on a comprehensive assessment of the anatomical and functional state of the knee joint, as well as bone, muscle and cartilage tissues, indicates the need for a differentiated approach to the treatment of children with this pathology.

The developed new and improved well-known surgical procedures, performed taking into account the revealed disorders in bone, muscle and cartilage tissues, make it possible to increase the effectiveness of treatment in children, reduce the number of complications and shorten the duration of treatment. A differentiated approach to the treatment of patients using the developed new and improved known surgical treatment techniques ensures the achievement of good and satisfactory treatment results in 89.8% of patients with this pathology. Of the materials used in the experiment (fascia-muscle tissue complex in a non-free version, fascia, hyaline cartilage, adipose tissue, wax), wax is the most effective to prevent the development of synostosis and the formation of deformity of the femur. Acquired deformities of the knee joint are most often formed after acute hematogenous osteomyelitis, much less often after traumatic damage to the bones forming the knee joint and as a result of surgical treatment of shortening and deformities of the hip and lower leg. Deformities of the knee joint formed after acute hematogenous osteomyelitis are characterized by impaired ossification and growth of the epiphyses forming the knee joint, impaired spatial orientation of the articular fissure and anatomical relationships of the knee joint, impaired function of growth zones up to their destruction, progressive deformation and shortening of tubular bones during growth, dystrophic changes in bone tissue, primary and secondary secondary dysfunction of the thigh and lower leg muscles, decreased regional blood flow. For post-traumatic deformities of the knee joint, the most typical are impaired function of the growth zones up to their partial destruction, progressive deformation and shortening of the thigh and shin, and a moderate decrease in electrogenesis of the thigh muscles. Characteristic manifestations of iatrogenic deformities of the knee joint are the presence in the anamnesis of elongation of the hip or shin, organic changes in the thigh muscles, their dystopia, in some cases a combination with subluxations of the shin of various directions, as well as the failure of the ligaments of the knee joint. The revealed clear pattern of formation of anatomical and functional disorders of the knee joint depending on the genesis and the working

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classification of knee joint deformities developed on the basis of the data obtained indicates the need for a differentiated approach to the treatment of children with this pathology. The basic principles of treatment of children with knee joint deformities with the consequences of acute hematogenous osteomyelitis and post—traumatic deformities of the knee joint are to perform corrective osteotomies, and in the presence of shortening, to use various methods of transosseous distraction osteosynthesis in order to eliminate shortening and deformity of the lower limb. Orthopedic surgical treatment of children with iatrogenic deformities of the knee joint consists in: removal of scar tissue, restoration of anatomical relationships in the knee joint and muscles of the thigh and shin, and, according to indications, the ligamentous apparatus of the knee joint. The use of a differentiated approach to surgical treatment of children with acquired knee joint deformities, taking into account the genesis of knee joint deformity, the severity of changes in bone and soft tissues, and the use of developed surgical treatment techniques, ensures the restoration or significant improvement of the supporting and dynamic functions of the lower limb in 89.8% of children. Experimental studies on animals using interpositional materials (muscle tissue, fascia, hyaline cartilage, bone wax) in order to prevent the formation of hallux valgus deformity of the knee joint have revealed that bone wax has the most pronounced effect preventing the formation of tubular bone deformity. Examination of patients with acquired knee joint deformities should be comprehensive and include clinical, X-ray functional, computed tomographic, electrophysiological, and scintigraphic research methods, which provides an objective assessment of the true anatomical and functional condition of the affected limb. Corrective osteotomies of the femur and shin bones are indicated in cases of hallux valgus deformity of the femur and tibia over 15°, varus deformity over 8°, antecurvation and recurvation deformity over 10° in children over 2 years of age. The use of transosseous distraction osteosynthesis to eliminate deformity and shortening in children aged 4-5 years is indicated for deformities exceeding the above and segment shortening of more than 3 cm, as well as for segment shortening of more than 4 cm. Fixation of the knee joint with an additional ring of the Ilizarov apparatus is indicated for instability of the knee joint, narrowing of the X-ray articular fissure of the knee joint, shortening of the segment by more than 5 cm, performing supracondylar osteotomy of the femur or subcondylar osteotomy of the tibia for the period of distraction and elimination of deformity. The use of osteotomy with the formation of a bone-periosteal flap, as an additional source of distraction regenerate formation in the correction of angular and axial deformities, is used for scarring of soft tissues (according to clinical studies), regional osteoporosis, thinning of the diaphysis of the tubular bone, thinning of the cortical plates of the diaphysis (according to radiography), decreased bone metabolism (according to radionuclide research). The use of V-shaped corrective osteotomy of the tibia in children, including using transosseous extra-focal osteosynthesis, is shown in order to preserve the proximal epiphyseal growth zone and tuberosity of the tibia, allows for bone intersection at the apex of the deformity, eliminate all components of the deformity, and perform transposition to the condyle with an unaffected growth zone to shorten the formation time of distractive regeneration. Surgical intervention to eliminate posterior shin subluxation provides for open reduction of the shin after tenolysis, myolysis, arthrolysis of the knee joint, stabilization of the patella and corrective shortening osteotomy of the femur in order to restore anatomical relationships in the femoral-tibial and femoral-patellar joints, restore the spatial orientation of the knee joint gap and reduce tension of the neurovascular bundle and muscles-shin flexors. The open reduction of the anterior subluxation of the shin, formed as a result of the elongation of the shin, consists in performing a shortening osteotomy of the shin bones with restoration of the spatial

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orientation of the knee joint gap and the axis of the lower limb, plasticizing the anterior cruciate and external lateral ligaments of the knee joint and lengthening its own patellar ligament. Outpatient monitoring of children in order to detect recurrence of lower limb deformities should be carried out up to the age of 18 annually, and during the period of active growth - 2 times a year. In the postoperative period, in order to assess the dynamics of the anatomical and functional state of the lower limb, outpatient follow-up is carried out 3 times a year for rehabilitation and spa treatment.

Conclusion. Thus, the need to clarify the mechanisms of formation of acquired knee joint deformities, the high percentage of unsatisfactory results after surgical treatment, and the lack of a working classification that allows a differentiated approach to the choice of surgical treatment for patients with this pathology was the basis for this work. 98 children with acquired knee joint deformities aged from 2.5 years to 18 years were examined and surgically treated. In 76 (77.6%) children, deformities of the knee joint with damage to 104 segments of the lower limb were formed after acute hematogenous osteomyelitis, mainly during the newborn period.

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