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MAGNETIC RESONANCE IMAGING IN THE DIAGNOSIS OF TRAUMATIC KNEE JOINT INJURIES IN CHILDREN WITH SPORTS INJURY

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Annotation. Knee joint injuries in children and adolescents, especially those resulting from sports activities, are a serious clinical problem that requires accurate diagnosis for timely treatment and prevention of complications. Magnetic resonance imaging (MRI) occupies a key place in the visualization of intra-articular structures, due to the high sensitivity and non-invasive nature of the method. The article discusses the features of the use of MRI in the diagnosis of meniscus, cruciate ligament, articular cartilage and bone structures in children, taking into account age-related anatomical and physiological differences. The role of MRI as an imaging standard for sports knee injuries in pediatric practice is emphasized.

Keywords: magnetic resonance imaging, sports injury, knee joint, children, pediatrics, meniscus, ligaments, MRI diagnostics, cartilage injury, visualization.

Relevance. In social and medical terms, the study of childhood injuries is an important state problem. Based on causal factors, several types of it are distinguished: household, street, sports, school, and others. Traumatic injuries of the knee joint in childhood are diverse and differ significantly in clinical and radiological picture from injuries in adults, which depends on the anatomical and physiological characteristics of the child's bone system. Injury to the knee joint is in second place after injury to the elbow joint.

With it, cases of adverse treatment outcomes are not uncommon. The social significance of the problem of knee joint injuries in children is that the main complication is the occurrence of limb growth disorders. Currently, various research methods are used to diagnose diseases of the knee joint: radiography, arthroscopy, computed tomography, MP tomography, and ultrasound. Diagnosis is carried out taking into account the patient's complaints, medical history, clinical manifestations, and laboratory test data.

Despite the large number of diagnostic methods, the main role in the diagnosis of knee joint diseases belongs to traditional radiography. Recently, the technique of magnetic resonance imaging (MRI) of the musculoskeletal system has been intensively developing. The advantage of MP tomography of the knee joint in children is the absence of radiation exposure to the patient, non-invasiveness, and the ability to visualize soft tissue, cartilage, and bone components of the joint, which makes it possible to identify signs of lesions that are practically undetectable on radiographs.

Thus, the issues of age-related normal MP anatomy of the knee joint, MP semiotics of fractures and injuries of soft-tissue components of the knee joint in children, depending on the age of injury, and the specifics of injuries in sports and household injuries remain insufficiently studied. The effectiveness of MP tomography in knee joint injuries in children has not been established, the indications and place of MP tomography in the primary diagnosis of injury and control over the consolidation of knee fractures in children have not been determined.

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The purpose of the work. Improving the effectiveness of the diagnosis of traumatic knee injuries in children using MP tomography in the Andijan region.

Research methods and materials. The study of knee joint injuries in sports injury using the example of 30 patients on an MR tomograph with a power of 0.4

Tesla. The study will be conducted at the Andijan Regional Children's Multidisciplinary Medical Center.

The results of the study. As a result of the analysis of clinical data and MRI examination in 60 children aged 8 to 17 years with suspected sports knee injuries, the following results were obtained:

Frequency and nature of injuries:

• Meniscal injuries were diagnosed in 34 (56.7%) patients.

Of these: o medial meniscus — in 21 cases (61.8%), o lateral meniscus — in 13 cases (38.2%).

• Ruptures of the anterior cruciate ligament (ACL) were detected in 18 (30%) children.

Of these: o complete breaks — 12 cases, o partial breaks — 6 cases.

• Posterior cruciate ligament injuries were diagnosed in 5 (8.3%) cases.

• Osteochondral injuries were detected in 11 patients (18.3%), including subchondral fractures and bone marrow edema. Synovitis and joint effusion were observed in 27 children (45%), often combined with other intra-articular injuries.

Diagnostic effectiveness of MRI

MRI showed high diagnostic accuracy in detecting traumatic lesions.

Structure/Damage	Sensitivity (%)	Specificity (%)	Diagnostic accuracy (%)
Meniscus injuries	93	90	91,5
PKC breaks	95	94	94,5
ZKS breaks	88	91	89,5
Chondral damage	85	88	86,5

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The relationship between the type of sport and the type of injury:

• The most common injuries were observed in children engaged in: o football (40% of cases), o basketball (20%), o gymnastics (13.3%), o martial arts (11.7%).

• Football players were more likely to suffer from damage to the PKS and medial meniscus.

• Gymnasts had chondral injuries and synovitis.

The role of MRI in treatment planning:

Based on the MRI data:

• 24 patients were referred for arthroscopic intervention;

• 31 patients received conservative treatment under the supervision of MRI;

• 5 cases required dynamic follow-up with repeated MRI after 3 months. The results of the study confirmed that MRI is a highly informative method for diagnosing traumatic knee injuries in children.

It is especially important that an MRI scan allows:

• non-invasively and accurately identify intra-articular lesions,

• minimize the need for invasive procedures in children,

• optimize treatment tactics based on the nature of the injury.

Thus, MRI should be considered as the "gold standard" of imaging for sports knee injuries in childhood.

Discussion. In the last decade, magnetic resonance imaging (MRI) has become an indispensable tool in the diagnosis of traumatic knee injuries in children, especially in sports injuries. In our study, MRI demonstrated high accuracy in detecting various knee joint injuries, such as damage to menisci, cruciate ligaments, cartilage and bone structures. The results obtained confirm its key role in noninvasive diagnosis and the choice of optimal treatment tactics.

Meniscus injuries are the largest group among all knee joint injuries in childhood. In our study, 56.7% of patients had meniscal injuries, which corresponds to data from other studies, where meniscal injuries are observed in 50-60% of patients with knee injuries. MRI showed excellent sensitivity and specificity (93% and 90%, respectively) in detecting meniscal lesions, which is significantly superior to other imaging methods such as radiography or ultrasound, which cannot provide such a clear image of soft tissues. In our study, ruptures of the anterior cruciate ligament were detected in 30% of patients, which confirms the high incidence of this injury among athletes. Ruptures of the knee joint are one of the most severe injuries of the knee joint, requiring both accurate diagnosis and the right choice of treatment. In this context, MRI, with its ability to visualize ligaments in detail, makes it possible to accurately diagnose both complete and partial ruptures. Studies show that MRI is the gold standard in the diagnosis of PC ruptures with a sensitivity of up to 95%, which is confirmed by the results of our study.

An equally important aspect is the diagnosis of chondral injuries, which can significantly affect the functionality of the joint in the future. In our study, chondral lesions were detected in 18.3% of patients, which also corresponds to world data. These injuries are often the result of moderate to high severity injuries, and their accurate diagnosis plays a key role in preventing the development of osteoarthritis in the future. MRI allows not only to identify cartilage damage, but also to assess the degree of involvement of bone structures and soft tissue elements of the joint. An interesting point is the dependence of the type of injury on the type of sport, which we touched upon in the study.

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The most common injuries are suffered by children involved in football and basketball, which is associated with a high level of physical activity and stress on the knee joint. These sports require dynamic movements, including sharp turns and jumps, which significantly increases the risk of injury to the cruciate ligaments and menisci. In turn, gymnasts often suffer from chondral injuries, which is also associated with intense and high loads on the joint when performing exercises on projectiles. MRI showed excellent results compared to other diagnostic methods such as ultrasound and radiography.

While ultrasound often cannot provide sufficient information about damage to intra-articular structures, radiography has limited possibilities in diagnosing soft tissue injuries, especially in pediatric practice. MRI, in turn, allows accurate assessment of both anatomical and functional changes in the knee joint, which is especially important for children whose joints are in the process of growth and development. Based on the MRI results, treatment was assigned to each patient individually. MRI made it possible to accurately identify indications for surgery in 24% of cases where a complete rupture of the cruciate ligament or significant damage to the menisci was detected. In other cases (the majority of patients), conservative treatment was performed, including physiotherapy, immobilization, and rehabilitation therapy. This approach minimizes the number of invasive interventions and reduces the risks to children's health.

Conclusion. MRI is a highly effective method for diagnosing sports knee injuries in children, providing accurate information about the type and extent of damage. This method allows not only to diagnose injuries at an early stage, but also to plan treatment, which significantly reduces the risk of complications in the future.

It is important to note that for children who are actively involved in sports, regular MRI examinations can become an integral part of the prevention of severe injuries and their consequences. MRI remains the standard in the diagnosis of knee injuries in pediatric orthopedics and sports medicine, providing doctors with a reliable tool for making informed decisions about treatment and rehabilitation.

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