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The Role of MRI Diagnostics in the Early Stages of Aseptic Necrosis of the Femoral Head

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ABSTRACT

The osteonecrotic process is accompanied by the destruction of porous tissues and trabecular bone tissue, leading to ocular deformation of the femoral head. MRI tomography is a unique method of noninvasive assessment of the state of bone tissue. With a sequence of different pulses on MRI scans, the hematopoietic and fatty bone marrow are characterized by different illumination parameters, which allows them to be distinguished. As a rule, the bone cuticle consists of 80% adipose tissue, so on MRI scans it has a high intensity with T1-weighted images (T1-VI) and moderate intensity with T2-weighted images (T2-VI). The hematopoietic bone marrow contains 2 times less fat than water and protein. At T2-VI, its intensity varies from medium to high, and at T1-VI - from low to medium, depending on the age of the patient.As a result, T1-VI is the most informative for assessing the ratio of fat and hematopoietic bone marrow.

Relevance: aseptic necrosis (AN) - observed in the skull of the femur, is one of the most common types of pathologies of the musculoskeletal system.There is a clear trend towards a stable growth of this disease in the Sundive [4].In addition, the incidence of AN is most often detected in the axillary layer of young and middle age. Since the disease is of a chronic progressive nature, as a result, patients suffer from permanent disability at the final stage, in this regard, not only patients, but also the economic burden of society is constantly increasing [1].

To date, there is no consensus on the etiology of osteonecrosis and risk factors. In the latest International Classification of Diseases (ICTY-10), osteonecrosis is included in the following classification: idiopathic aseptic bone necrosis associated with isolation and secondary trauma (post-traumatic), medication and other causes [4]. The causes of AN are characterized by such causes as damage to hematopoietic cells, mineralization of bone tissue, and this often leads to a deterioration of blood supply.

Pathomorphological symptoms, regardless of the factors causing osteonecrosis, are very similar. When microcirculation is impaired, bone marrow damage and osteocyte death are recorded, which leads to the following. During reparative processes, the formation of cell-free lacunae, periocal hyperemia, granulation tissue with resorption, dead bone tissue and new bone

tissue occurs. This process is called creeping matter (replacement substance, restoration).

The osteonecrotic process is accompanied by the destruction of porous tissues and trabecular bone tissue, which leads to ocular deformation of the femoral head.

With severe osteonecrosis of the femoral head, protrusive damage to the pelvic bones can be observed at the same time. The process is maintained for a long time on the connection mount. As a result of osteonecrosis, secondary arthrosis is formed. Rapid progressive development with significant erosion of the femoral head, secondary changes of early manifestation, impaired joint function and 30-70% of patients lose their ability to work due to bilateral damage [3].

Recently, some progress has been made in the treatment of AN. However, a necessary condition for successful therapy is timely diagnosis of the pathological process and determination of its prevalence [2].

It is known that the method of X-ray examination in Ssbqan allows you to detect only changes that occur in the bone tissue. Meanwhile, changes in the era of AN occur in the bone marrow.[9]. In addition, fluid accumulates in the groin area of the thigh, and the image is not displayed during radiography.

Currently, magnetic resonance imaging (MRI) is used in the diagnosis of AN, which allows you to capture images of changes. MRI is the only diagnostic method that provides high quality not only of bone tissue, but also visualization of soft tissue structures of the bone marrow, muscle tissue and other systems of the musculoskeletal system.In addition, the bone has sensitivity and specificity in detecting edema and infiltration into the tissue. [6]. However, AN does not have the ability to detect MRI at certain early stages.

The purpose of this study is the possibility of MRI and X-ray diagnostics in assessing and clarifying the condition of the bone marrow, synovial membrane, articular cartilage, fibrous tissue, soft tissues of bones and bone circumference in AN.

Materials and methods:

Data from 54 patients were taken as the material for the study. Among them, 23 men and 31 women, aged 28-65 years, a total of 66 joints were damaged. When studying the anamnesis, only patients with idiopathic aseptic necrosis were included in the study; post-traumatic and drug-induced AN were not included. All patients underwent general clinical, X-ray examination and MRI tomography. Most patients complained of pelvic pain (38), less often they were bothered by pain in the gluteal cavity (7) and with pain in the hip joint (2). in (13) patients, there was an irrodiasive pain in the knee joint area. The pain was recorded during their physical malaise (35) and as a result of the disease, which significantly worsened due to the development, sometimes even when they stopped therapeutic measures (9). The specificity of pain, despite its treatment, constant pain (39), lameness (19), flexion of the foot (17) gradually developed with limited movements.

All 54 patients underwent a comprehensive X-ray and MRI tomography examination. During the X-ray examination, an X-ray of the pelvis was performed (directly in the posterior sections) using an internal circular X-ray. In some cases, additional X-ray examination was performed.

The MRI-tomographic study was carried out at Siemens (Germany), an MRI-tomograph was manufactured with a magnetic field strength of 1.0 Tl MAGNETOM EXPERT. Images were also obtained in a sequence of pulses with MRI examination, sagittal, coronal and axillary projections, suppression of the signal of adipose tissue and bone burial in T1 and T2 modes.

Results: the pathology of the femoral joints revealed by us on radiography is classified by stages, taking into account clinical manifestations and radiological signs.

In the initial boskich (zero) (5). Patients complained of intermittent pain and increased pain during physical exertion, the usual place of pain was observed in the hollow area. At this stage, the volume of movements in the joint is practically not disturbed. There were no signs of aseptic necrosis on the radiographs.

The first stage (5). Continued with a pronounced pain syndrome.

Circular movements are limited in the hip joint. Osteoporosis of the femoral head was recorded on radiographs.

The second stage (14). The presence of pains and night pains are characteristic when standing still.Movements in the hip joint are limited in all directions, especially

circular alignment. Radiographs show linear illumination of bone tissue (the "crescent" sign) in the subchondral region parallel to the joints.The femoral

head retained its spherical shape.

The third stage (12). Clinical manifestations coincided with the second stage, radiological - inflammation of the articular surface and the femoral head

with the loss of the spherical shape, the manifestation is suppressed. The joint lumen has not changed. there are no changes in the acetabulum. Almost all patients are diagnosed with significant lumbar lordosis due to contracture of the hip flexors. At the same time, turning towards the pelvis leads to the development of scoliosis of the affected leg.

The fourth stage (6). Obvious deformation of the femoral head and

A sharp narrowing of the articular lumen is completed

by changes in the acetabulum with its secondary absence.Acute fracture of the hip joint and

the harmony of the articular parts attracts attention. The femoral inguinal bone loses almost all functions not only because of the pronounced pain syndrome, but also because of the sharp restriction of movements in all directions. The reason for this flexor contracture was a contraction of the limb.

Thus, the X-ray is step 0, and often step 1

AN cannot be diagnosed due to the absence of radiological signs. MRI tomography is a unique method of noninvasive assessment of the state of bone tissue. With a sequence of different pulses on MRI scans, the hematopoietic and fatty bone marrow are characterized by different illumination parameters, which allows them to be distinguished. As a rule, the bone cuticle consists of 80% adipose tissue, so on MRI scans it has a high intensity with T1-weighted images (T1-VI) and moderate intensity with T2-weighted images (T2-VI). The hematopoietic bone marrow contains 2 times less fat than water and protein. At T2-VI, its intensity varies from medium to high, and at T1-VI - from low to medium, depending on the age of the patient.As a result, T1-VI is the most informative for assessing the ratio of fat and hematopoietic bone marrow.

Analysis of changes in MRI (66 joints) showed the following:

Bone marrow tumor was diagnosed in 6 patients, bone marrow necrosis in 20, and gross changes in 4. In 2022, types of fibrosis and osteosclerosis, changes in the acetabulum were detected in 19 patients. 20 patients had bilateral lesions, three of which showed early signs of necrosis in the second joint in the form of a tumor of the bone cuticle during MRI. MRI studies of these joints were previously considered healthy. It was found that the femoral head contains

fluid along the upper outer and lower inner parts and in the elongated pockets of the femoral steam capsule.

The main pathological syndromes in which AN is observed are bone tissue damage, edema and necrosis. MRI scans can detect damage to the bone cuticle individually or in combination with changes in bone tissue, subchondral and cortical layers of the periosteum.

In MRI, aseptic osteonecrosis is primarily manifested by the presence of the following: necrotic tissue in the subchondral part of the bone gives images of varying intensity in MRI signals. The periphery is bounded by a crescent-shaped low intensity T1-VI line and an intensity Mr signal on two lines (internal high intensity and external low intensity) T2-VI. this pattern is pathognomonic for osteonecrosis and is called a "double-line symptom".

Metaphysical bone marrow infarcts are characterized by a central zone of T1 - and T2-VI Mr signal of high density, 6 necrotized adipose tissue surrounded by a low-intensity shadow of "crawling" bone formation. The central zone with a low-intensity fibrovascular tissue line when the ossification ring is isolated has a high intensity at T1-VI and T2-VI. the bone marrow located on the periphery has a high intensity of the Mr signal at T2-VI due to edema.

Depending on the size and localization , the focus of bone necrosis may include

oval, ring-shaped, irregular geometric or linear shape. The first signs of aseptic necrosis are small tissue cysts with a low-intensity band of endosteal ossification of oval cavities of elongated shape, clearly separated from the surrounding bone. The structure of the cavities is homogeneous or cellular-trabecular or hemorrhagic, depending on the composition of the fluid. maybe. Depending on the distribution of the process

there are two forms of its cysts in the femoral head: scattered, numerous small cysts and single large cysts, depending on their formation and shape. With a large number of diffuse types of cysts, negative consequences were noted during AN. Cysts can form in the acetabulum, hams are observed. So, in the early stages of the disease (0-1 stage of AN), classical radiography does not provide information, therefore, magnetic resonance is the method of choice of tomography. The stage and spread of the AN process depend on the semiotics of MR tomography, while detection in the early stages of the disease is a method with the highest informativeness, which provides the principle.

Histological examination was performed in 5 patients.The procedure of total endoprosthesis of the inguinal region of the buhimi thigh was performed.

Conclusions:

1. In the clinical signs of the early stages of AN, the localization and nature of pain, their duration, restriction of movement and lameness come first, which requires the attending physician to take a responsible approach to the development of AN, especially in the presence of risk factors.

2. The leading method of diagnosis of AN, in particular, in the early stages of the disease, is MRI tomography, which allows you to determine the presence of a pathological process, its size and localization, tactics and scope of surgical intervention, as well as to evaluate its effectiveness.

3. One of the early MRI signs of AN is edema and necrosis of the bone cuticle.

4. MRI scan reveals early changes of AN in the contralateral joint in 50% of patients.

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