



## ULTRASOUND DIAGNOSTICS OF THE HIP JOINT DISEASES

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<b>Received:</b> 6 <sup>th</sup> December 2023 <b>Accepted:</b> 4 <sup>th</sup> January 2024 <b>Published:</b> 7 <sup>th</sup> February 2024	This article is devoted to the application of ultrasonography in the diagnosis of inflammatory and degenerative diseases of the hip joint. The article discusses the relevance of the use of ultrasound in the disease of osteoarthritis (OA), rheumatoid arthritis and aseptic necrosis of the femoral head, as well as the differential assessment of inflammatory and degenerative processes based on ultrasound Doppler sonography. For a long time, a simple X-ray was considered the reference technique of osteoarthritis (OA). Recently, ultrasonography is an innovative method for visualizing this disease. The use of ultrasound highlights the various anatomical structures in great detail and detects intra- and extra-articular changes.

**Keywords:** Coxoarthrosis, coxitis, rheumatoid arthritis, aseptic necrosis, ultrasonography, hip joints.

### RELEVANCE

Hip joint disease is one of the most pressing problems of modern orthopedics, as it contributes to the rapid development of severe anatomical and functional impairment of the musculoskeletal system, in particular in the elderly. According to WHO, more than 10 per cent of the world's population suffers from joint diseases. In terms of frequency of injury, the first place is the hip joint (42.7%), the second - the knee (33.3%), the third - the shoulder (10.8%), the remaining joints account for 13.2% [1].

Differential diagnosis of hip joint lesions is difficult due to its deep formation and the presence of large muscle masses around the joint. Due to this external changes of the joint cannot be estimated and it is not possible to arthroscopy. It is especially difficult to differential diagnosis of coxatrosis and coxite in the early stage [2]. In this regard, the issue of differential diagnosis of hip joint diseases of dystrophic and inflammatory genesis is topical.

The ultrasonic method, being non-invasive, reproducible and relatively economically available, can be widely used to assess both the accumulation of fluid inside the joint, in the articular bags, and to estimate the thickness of the synovial membrane and erosion changes [3,4]. Modern ultrasonic equipment makes it possible to evaluate both surface periarticular and intraarticular tissue constituting the joint.

**PURPOSE OF THE STUDY:** Improvement of radiation diagnostics of inflammatory and degenerative diseases of the hip joint on the basis of ultrasound research method.

### MATERIALS AND RESEARCH METHODS.

The total number of patients examined was 138, of whom 15 (13.9%) were men and 93 (86.1%) were women. The patients were divided into groups and subgroups. The first group included patients with dystrophic diseases (stage I - stage III coxarthrosis) only 82 people. In Group II, 10 patients were identified with coxarthrosis, formed as a result of aseptic necrosis of the femoral head. Of these, 5 (50%) are men and 5 (50%) are women. The third group with inflammatory diseases included patients with rheumatoid arthritis, numbering 12 people. Of these, 4 (33.3%) were men and 8 (66.7%) were women.

All patients in the period from 2018 – 2020 were treated by an orthopedic doctor at the ASMI clinic, as well as an ultrasound examination was conducted in the radiation diagnostics department of the ASMI clinic in Andijan.

The ultrasonography was conducted on digital multifunctional scanners «Sonoscape S-22» (China) and «Mindray DC3» (China). For the clearest visualization, convex and linear sensors were used, in a frequency range 7-12 MHz.

The comprehensive ultrasonic examination included a grey scale examination of the hip joint, examination of the shape and contour of the femur head, determination of effusion, measurement of the articular capsule, thickness hypochogenic layer of hyaline cartilage, study the condition of muscles, ligaments and bones attached to the joint.

In assessing the structures of the hip joint according to the standard frontal access method, the bony reference points were the upper edge of the acetabulum cavity and the semi-circumference of the femur head, where hypochogenic hyalin cartilage, hip joint capsule were visualized (Figure 1).



*Fig. 1. Sonogram of hip structure is normal. The diagram shows the measurement of the thickness of the hypochogenic layer of hyalin cartilage. 2 - fibrous capsule.*

In patients of all groups, regional blood flow was assessed in the lateral circumferential femoral arteries. The blood flow was assessed using color Doppler mapping and pulse wave spectral dopplerography, with the following estimates: Blood Flow Peak Rate (POC), Final Diastolic Blood Flow Rate (DPR), Resistance Index (IR).

### **FINDINGS OF RESEARCH**

In the analysis of sonographic and dopplerographic diagnostic criteria of stages of pathological process, group I patients revealed that the thickness of the hypochogenic layer of hyaline cartilage decreases as the disease stages increase from normal values 2,4 mm to 1.3 mm in patients of IA subgroup, up to 0.9 mm in subgroup IB. At stage III of coxarthrosis the thickness of the hypochogenic layer of hyaline cartilage is 0.85 mm, and in coxarthrosis formed as a result of aseptic necrosis the femur head, the cartilage in the necrosis area is not visualized. For rheumatoid arthritis there was an increase in the thickness of the fibrous capsule, to 3.4 mm, as opposed to 2.23 mm for unaltered joints, and the identification of normal dimensions of hyalin cartilage was an important feature. At the same time, the size of the osteophytes increased as the stage of coxarthrosis increased from 4.2 mm to 10.1 mm. For example, at stage III, the size of the osteophytes was 8.3 mm, and for the coxarthrosis formed by aseptic necrosis of the femoral head, it increased to 15.0 mm.

In all patients with Stage I - III coxarthrosis reliable differences in the shape of the head of the hip joint were found, so if in Stage I disease almost all (96%) examined had a spherical shape of the head, in the second stage of the disease, only 58% of cases showed a spherical form, and in 42% of cases - moderately flattened form of the head.

In stage III, the trait was increasing and in 96% of cases it was significantly flattened (figure 2).



*Fig.2. Sonogram of hip joint in coxarthrosis (considerably flattened head shape).*

When examining the joint cavity in patients with stage I coxarthrosis, there was almost no effusion (1% of cases), in stage II this trait was already detected in 10% of cases, and in stage III patients the effusion was visualized in 37% of cases. That is, as the disease progresses, the likelihood of a discharge in the joint cavity increases.

With the ultrasonic dopplerography method, it is revealed that the accelerating decrease of blood flow rates in lateral circumferential femoral arteries increases as the stage of coxarthrosis, so the POC drops from 25.2 cm/s at the first stage of coxarthrosis to 16.6 cm/s at the third stage; DPR from 4.6 cm/s in the first stage to 2.1 cm/s in stage III coxarthrosis. In addition, if the POC at stage II is 22.4 cm/s, and in coxarthrosis formed by aseptic necrosis of the femoral head, it is significantly reduced on average to 17.8 cm/s. In rheumatoid arthritis, a decrease in blood flow rates in lateral circumferential arteries of the thigh as the stage increased, blood flow POC increased to an average of 28.0 cm/s, as well as an increase in blood flow DPR to 8.1 cm/s. and reducing the IR to 0.65, comparing the values of the groups with unaltered joints and stage II of coxarthrosis to 0.78 and 0.77, respectively.

### **DISCUSSION**

Thickness of hyalin cartilage and fibrous capsule, presence or absence of intraarticular effusion, shape of the hip head, size of osteophytes (if any) are the main structural parameters, based on the differential diagnosis of dystrophic and inflammatory diseases of the hip joint. In case of inflammatory lesion of the hip joint, the leading sonographic criteria are: increase of the POC to numbers - 32.0 cm/s. DPR to 10.3 cm/s. and a decrease in IR to 0.65, combined with an increase in the thickness of the fibrous capsule while maintaining the normal thickness of hyaline cartilage. And the signs of the presence of coxarthrosis are: progressive decrease in the rate of blood flow in the lateral circumferential femoral arteries and progressive thinning of hyaline cartilage, presence of edge osteophytes, impaired shape and contour of the femur head. Coxarthrosis, formed as a result of aseptic necrosis of the femur head, is characterized by

a significant decrease in the rate of blood flow in the lateral circumferential femoral arteries (POC to 17.8 cm/s, PDR to 3.7 cm/s.) in combination with early and fuller thinning of hyaline cartilage, larger sizes of osteophytes, significant deformation of the femur head, protrusion in the joint cavity.

### CONCLUSION

A number of undeniable advantages - non-invasivity (as opposed to arthroscopy), accessibility, simplicity, cost-effectiveness (compared to CT and MRI) - have ensured that the ultrasound method of the hip joint gives priority among other instrumental methods of joint and soft tissue examination [5]. Ultrasound is highly informative in the reflection of small details of the surface of the bones, ligament and tendon apparatus, and also allows the detection and control of inflammatory changes in the tissues. The advantage of ultrasound over the X-ray method is safety, polyposition and dynamic observation.

The most important capabilities of complex ultrasound examination of hip joints are: determination of the condition of the joint capsule, presence of discharge in the pelvic joint cavity, assessment of sphericity and contour of the head, determination of hyaline cartilage and periarticular tissues, as well as a dopplerographic method, evaluates blood flow in lateral circumferential femoral arteries, calculating POC blood flow, PDR and IR, which is quite important when differentiating inflammatory and degenerative processes.

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