Volume 2, Issue 01, January 2024 ISSN (E): 2938-3765

THE ROLE OF ULTRASONOGRAPHY IN THE DIAGNOSIS OF INFLAMMATORY AND DEGENERATIVE DISEASES OF THE HIP JOINT

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Abstract
This article is devoted to the use of ultrasonography in the diagnosis of inflammatory and degenerative diseases of the hip joint. The article discusses the main indications for the use of ultrasound in the disease ostearthrosis (OA), the advantages and disadvantages of various methods of visualizing ultrasound used in OA of the thigh, performing an intra-articular injection of the hip joint under the supervision of an ultrasound. For a long time, a simple radiograph was considered the reference technique for osteoarthritis (OA). Recently, an innovative method of visualizing this disease is ultrasonography. The use of ultrasound identifies various anatomical structures in the smallest details and reveals small details of tissue changes.

Keywords: Osteoarthrosis, ultrasonography, scanning, hip joints.

Introduction

OA is a very common rheumatic disease affecting the synovial joints. The main pathological signs are progressive degeneration with cartilage loss and hypertrophy of the subchondral bone, articular margin and capsule [1]. The most common findings are synovial proliferation, joint effusion, and bursitis. OA usually appears and worsens with age. However, sometimes it can happen early in life. In these cases, disability and Dysfunction usually appears prematurely due to joint use-related pain, swelling, stiffness, deformity, and reduced joint movement [6].

A clinician's ability to evaluate the hip joint for OA pathology depends on having expert knowledge of the scanning technique, the different anatomical areas to be examined, and the equipment requirements. A standard scanning protocol that includes multiplanar, dynamic, and bilateral evaluation is recommended and should always be followed for a complete examination of the various anatomical structures around the hip joint [4].

Correct patient positioning is fundamental for the best possible visualization of the joint tissues. In particular, for the visualization of hyaline cartilage, the hip joint must be stored in well-defined and standardized positions to allow the beam to penetrate through the most suitable acoustic windows [3].

The general rules for assessing hip OA pathology include:

– Scans of hip pathology: OA is usually limited to the anterior surface of the joint;

Choice of low-frequency linear or curved probe for optimal penetration, allowing for visualization of deeper tissues;

– The patient lies in a supine position with the heels together and the hip turned outward. Place the transducer in an inclined longitudinal plane above the femoral neck to examine the anterior

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synovial notch, using the femoral head as a guide;
– Cranial to anterior notch, fibrocartilaginous anterior superior acetabulum can be found as a homogeneously hyperechoic triangular structure;
– The articular capsule should be traced from the acetabulum to the point of its fixation to the neck;
– Along the articular space and femoral head, the iliac muscle is revealed laterally from the femoral vascular bundle;
The ileal tendon is in a deep eccentric position in the posterior and medial part of the muscular abdomen and lies above the ilioptinal eminence;
— Iliopsoas bursa lies between the tendon and the anterior capsule of the hip joint: it is normally coagulated and cannot be detected by ultrasound.
In OA of the hip joint, as well as in inflammatory arthritis, Doppler techniques can demonstrate local hyperemia due to active synovial inflammation. However, it is difficult to rule out synovial tissue hyperemia arising from the hip joint due to the depth of the affected structures[2].
A fundamental aspect in the use of Doppler modalities is the application of optimal adjustments (image size and depth, gain, focus positioning), which markedly improves the ability of ultrasound to detect an increase in synovial fluid flow in inflammatory pathological conditions. In particular:
— Using the correct Doppler frequency (high frequencies for superficial tissues and low frequencies for deep structures)
— The lowest possible pulse repetition rate should be used without excessive artifact, which can be saved as a specific preset;
— Placing the focus on the area of interest and properly adjusting the size of the color frame represent all the main aspects to consider.
Main indications for the use of ultrasound in OA.
In hip OA, sonography has shown its ability to detect and evaluate a wide range of abnormalities affecting the anterior-upper articular cartilage, bone cortex, and synovial tissue. On examination, due to the depth of the hip joint, the physical examination does not reveal signs of inflammation, such as effusion in the joints. However, with sonography, even a small intra-articular effusion in the hip joint can be detected by measuring the distance between the femoral neck and the joint capsule. In addition, osteophytes appear as cortical protrusions at the edge of the joint [8].
Advantages and disadvantages of the different ultrasound imaging methods used in hip OA.
Simple radiography is the imaging technique most commonly used to assess collaborative engagement. However, simple radiographs have some limitations. They do not sufficiently visualize the hyaline cartilage and other soft tissues that are often involved in the progression of hip OA. In addition, simple radiographs have low sensitivity, demonstrating minimal cartilage involvement in early disease. Common radiographic signs are narrowing of the joint space, osteophytes, sclerosis, and deformity [5]. However, these signs are sometimes only present in moderate to advanced disease, and may also be present in elderly, asymptomatic individuals, raising doubts about their real role and significance as radiographic characteristics of the disease [3].
Among other imaging techniques, magnetic resonance imaging (MRI) has been demonstrated to be a sensitive and non-invasive method for the evaluation of musculoskeletal disease and has been used as a reference tool in assessing the validity criterion of ultrasound in hip OA, demonstrating with excellent soft tissue contrast. Several studies have shown its accuracy and reliability; however, the high cost and low availability of MRI equipment limit its day-to-day use.

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Arthroscopy is the gold standard for assessing most OA changes, especially for direct visualization of cartilage surface changes, but its invasiveness limits its use in routine clinical practice [1].

The main limitation of ultrasound in the evaluation of hip OA is its partial accessibility to the internal articular structures. This is due to the inability of the ultrasound beam to penetrate the bone cortex, which leads to frequent difficulties in fully visualizing the hyaline cartilage. In addition, ultrasound is seen as an operator-dependent imaging technique. This is due to the nature of obtaining and interpreting images in real-time ultrasound. However, recent technological developments in new high-end equipment have partially solved this particular problem by making it easier to visualize collaborative structures and detect their possible involvement.

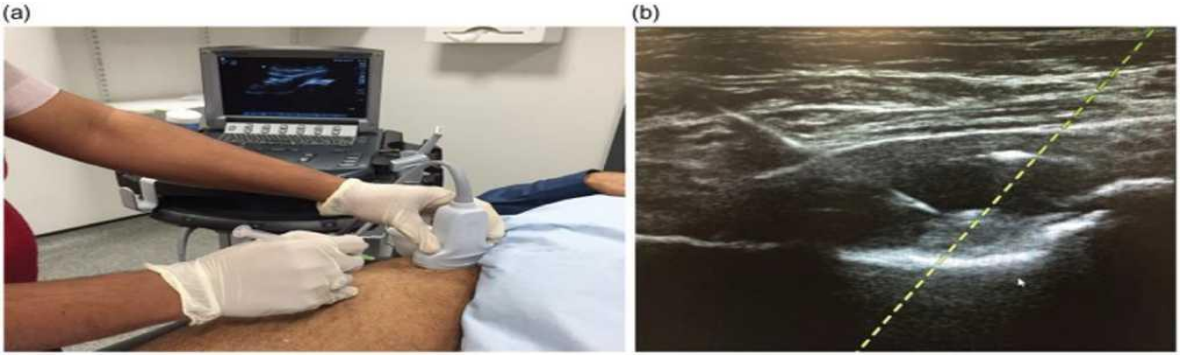
Intra-articular injections into the hip have been successfully used to diagnose and treat a wide range of hip pathologies, including OA. Hip injections are technically difficult due to the deep location of the joint and the proximity of the adjacent femoral vascular bundle. Needles placed using only landmarks accurately fit the hip joint only 52-80% of the time and can pass within 4.5 mm of the neurovascular structures, creating an excessive risk of injury or irritation. For the past few decades, fluoroscopy has been the most commonly used method of imaging for these injections, but it still doesn't visualize vessels or nerves. Injection-guided CT scans are expensive and time-consuming. These methods expose the patient and staff to radiation, iodinated contrast with associated reactions, and use bulky equipment.

Ultrasound is becoming an increasingly affordable imaging modality in many outpatient clinics, with several studies confirming the accuracy of U.S.-led intra-articular hip injections. Ultrasound provides safe, accurate, and inexpensive joint injection with real-time visualization of soft tissue structures.

Technique & Appearance

Performing an ultrasound-guided intra-articular hip injection requires a minimum level of skill. Several different approaches have been described for accessing the hip joint using ultrasound guidance.

The patient is on his back. The leg is held in place with a slight external rotation and abduction, thereby reducing stress on the capsular structures and moving the iliac tendon or bursa medially from the intended needle pathway. It is preferable to use a 5-3.5 MHz curved array transducer, which provides the required depth of penetration. Typically, a 9 cm long 21 gauge needle is used for an adult. A 23 cm diameter hypocutaneous needle may be used for young adults or children.



Intra-articular injection of the femur with ultrasound: the needle is advanced at a caudo-cranial angle along the long axis of the transducer, aiming for an anterior depression near the junction of the femoral neck with the femoral head.

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Inference

Ultrasonography is a valuable imaging technique in the diagnosis and treatment of hip OA. It shows various changes as a result of inflammation and structural damage. These changes mainly consist of the appearance of effusion in the joint and hypertrophy of the synovial membrane in the presence of inflammation and osteophytes. The application of this imaging methodology in the assessment and treatment of OA has improved the understanding of the disease process as well as the relationship between structure and symptoms, and may aid in the evaluation of future treatments. U.S.-led hip injections, with their excellent safety profile and reliability, are essential in patient management.

Emerging techniques to improve ultrasound imaging of coxoarthritis, such as 3D ultrasound, Doppler ultrasound, fusion imaging, and elastography, hope to improve the quality of sonography diagnostics by analyzing early and late diseases with greater accuracy.

In conclusion, this review demonstrates that there is sufficient evidence to support the use of ultrasound for diagnostic and therapeutic purposes, as it is a safe, non-invasive, low-cost method that supports the results of physical examination and clinical justification.

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