

Ultrasound in Arthritis

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KEYWORDS

- Ultrasound • Imaging • Arthritis • Rheumatoid arthritis • Spondyloarthritis
- Connective tissue diseases

KEY POINTS

- Ultrasound is one of the most commonly used methods in the diagnosis of arthritis; to make an initial diagnosis, monitor treatment, and define remission.
- The most frequent findings in ultrasound in arthritis are synovitis, tenosynovitis, bursitis, enthesopathy, and erosions.
- Ultrasound is an excellent tool to guide diagnostic and therapeutic procedures.
- Quantitative methods of inflammation assessment, as well as criteria for differential diagnosis of arthropathies and remission, still remain to be elaborated.

INTRODUCTION

Conventional radiography remains an important diagnostic tool for the diagnosis and monitoring of treatment in arthritis. The importance of early diagnosis and the necessity for accurate monitoring of modern treatment in patients with rheumatic diseases are the main reasons ultrasound and MR imaging are being performed more and more often,^{1–4} because they can both visualize early inflammatory lesions within the soft tissues. MR imaging can also visualize subchondral bone marrow edema.

SPECTRUM OF PATHOLOGIES SEEN ON ULTRASOUND IN ARTHRITIS

In patients with rheumatological conditions, ultrasound is conducted mainly for the diagnosis of inflammatory lesions in peripheral joints, tendon sheaths, bursae, and entheses. The following

abnormalities in rheumatologic diseases can be seen on ultrasound^{2,4–10}:

- Effusions, synovitis, and bursitis
- Tendon pathology (also referred to as tendinopathy), including tendinosis, tenosynovitis, and tendon tears
- Cartilaginous, osseous, or osteochondral lesions (cartilage damage, cysts, erosions, fractures)
- Enthesopathy, encompassing pathologic changes at tendon, ligament, fascia, or joint capsule attachments
- Compression neuropathy
- Postoperative complications

The advantages of ultrasound include the following:

- Assessment of inflammation activity by detecting and measuring vascularity (eg, of the synovium or entheses)

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- Comparison of the target joint with the asymptomatic contralateral side
- Assessment of the tendons, joints by dynamic ultrasound
- Presentation of the pathologies to patients to increase their compliance
- Noninvasive character
- Invasive procedures guidance

The disadvantages of ultrasound include the following:

- Low specificity, because several arthropathies exhibit the same spectrum of features. This includes, among others, undifferentiated arthritis, in which neither imaging nor immunologic nor laboratory tests allow diagnosis
- Inability to assess the bone marrow
- Limited field of view
- Considerable dependence on the examiner's experience and equipment quality
- Steep learning curve

Inflammatory Features in the Peripheral Joints

Synovitis

Synovitis is the early sign of rheumatic diseases both inflammatory, such as connective tissue diseases and spondyloarthritis, and noninflammatory arthropathies, such as osteoarthritis and crystallopathies. It is visible as synovial thickening of various degrees in a joint capsule, tendon sheath, or bursa resulting from hyperplasia of the intima layer of the synovium and edema of the underlying subintima caused by its inflammatory infiltrates.¹¹ Inflamed synovium is of low echogenicity, similar to that of an effusion, which usually accompanies synovial pathology (Fig. 1).^{4,8–10,12} The

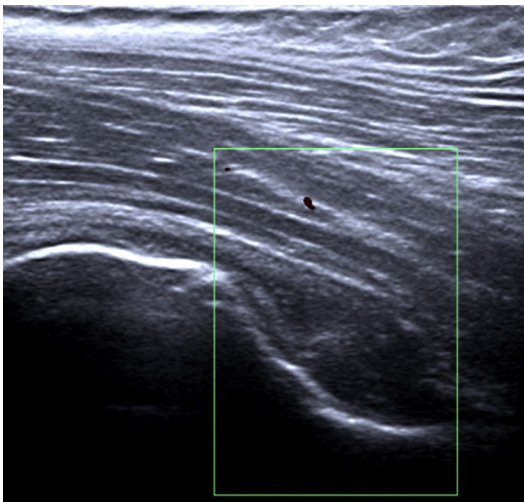


Fig. 1. Thickened synovium of the hip joint without increased vascularization.

differentiation between these 2 pathologies is possible by applying pressure with a transducer, which causes slight compression of the thickened synovium and movement or swirling of low-pressure effusions.^{2,4,8–10} Active synovitis is characterized by neoangiogenesis, and results in increased vascularity. As the disease progresses, Doppler ultrasound reveals blood flow in the synovium, the intensity of which (the number of vessels) correlates with the severity of inflammation (Fig. 2).^{2,13–15} In chronic conditions, synovial hypertrophy is observed and echogenicity of the synovium increases. This hypertrophied synovium assumes varied forms that may undergo fragmentation, which results in the appearance of so-called “rice bodies.”

Erosions, cartilage loss, and inflammatory cysts

Erosions, resulting from the destructive activity of the pannus, initially develop between the border of an articular surface covered with cartilage and the joint capsule attachment (the so-called *bare area* and the so-called *marginal erosions*). Subsequently, erosions develop in the subchondral bone of a joint, which is preceded by cartilage damage (so-called *subchondral erosions*). Erosions are visible on ultrasound as cortical bone defects of various sizes in 2 perpendicular planes, filled with the synovial membrane that is inactive or demonstrates features of blood flow (Fig. 3).^{2,4,8–10,12,16}

An analogous destructive process can occur in the bone marrow, where certain cytokines promote osteoclasts that destroy trabeculae. The result of this destructive process is the formation of inflammatory cysts, which become erosions when the cortical bone is disrupted^{11,14,17,18} (Fig. 4). The progressive erosional-destructive process leads to the destruction of joint surfaces, with subluxation of the joint. As on radiographs, an ultrasound examination does not enable the assessment of all joint surfaces. This is a potential disadvantage of ultrasound when compared with MR imaging.^{4,8}

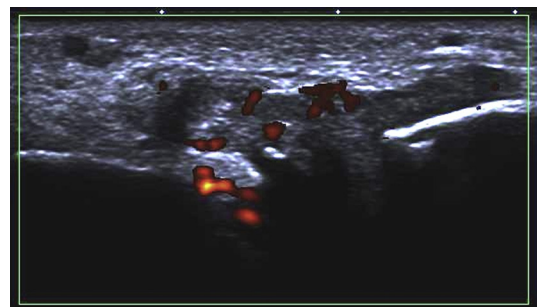


Fig. 2. Thickened, hyperemic synovium of the MTP 1 joint.

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