

Will sonography change the therapeutic algorithm in rheumatoid arthritis?

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Abstract

Rheumatoid arthritis (RA) is an invalidating disease, but its evolution can be stopped before permanent destructive injuries occur, if it is recognized in time and aggressively treated in its early stages, using the new drugs available.

Among the new imaging modalities, ultrasonography (US) allows detection, assessment and monitoring of inflammatory and destructive joint injuries in patients with early RA, being comparable with magnetic resonance imaging and more sensitive than conventional radiology or clinical examination. US assesses synovitis, joint effusion, bone erosions and changes in ligaments and tendons.

US contributes to differentiating transitory versus persistent arthritis, assists in establishing follow-up parameters and allows an optimised therapeutic decision.

Key words: early arthritis, rheumatoid arthritis, ultrasonography

Introduction

Rheumatoid arthritis (RA) is a chronic inflammatory autoimmune disease, of unknown origin, affecting approximately 1% of the world population [1]. RA is a debilitating disease, causing work absence, early retirement and important functional impairment.

Recently new classes of drugs have become available: disease-modifying antirheumatic drugs (DMARDs) and especially the biologicals (anti-tumour necrosis factor α or anti-interleukin 1). These drugs are expensive and may have side effects. The advantage consists in their ability to halt the disease or even cure it, when prescribed in the early stage of arthritis [2,3]. The risk-benefit and cost-efficiency reports have to be balanced whenever one recommends the new treatment. Thus, there is a real need to differentiate as soon as possible early RA from other types of arthritis [3,4].

The diagnosis of RA is currently based on the American College of Rheumatology (ACR) Classification revised

in 1987 [5]. These criteria are useful mainly in cases where RA has been already established. There are some limitations in the Classification, regarding the fact that approximately 15% of patients with persistent arthritis do not fulfil the criteria, not even in two years follow-up from baseline [6].

The clinical exam is variable and partially reproducible in detecting synovitis and the laboratory work-up is not entirely specific in RA. In this context there are real preoccupations in defining the role of the new imaging modalities, especially ultrasonography (US) and magnetic resonance imaging (MRI), in the diagnosis, evaluation and follow-up of early undifferentiated arthritis [7,8].

Imaging modalities

Conventional radiology has an important role in the diagnosis of established RA as it visualises bone erosions, which are part of the ACR 1987 criteria [5]. Conventional radiographs are not sensitive enough for detection of the modifications present in early undifferentiated arthritis [9]. Up to 70% of the patients may have normal radiographs of hands and feet in the early stages of RA [10]. Moreover, conventional radiology is not suited for the evaluation of soft

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tissues, nor for the detection of synovitis, information that is needed for an early diagnosis and a therapeutical decision.

Contrast-enhanced MRI is a sensitive method for detection of soft tissue lesions and early bone erosions in RA [9]. The volume of enhancing pannus is an indicator of the activity of the disease in RA [11]. The disadvantages of MRI are its high costs, limited accessibility and long duration. Prospective studies suggest that the lesions detectable using MRI are predictive for the bone erosions that later occur on radiographs [7]. For an improvement in diagnosis of RA, some authors suggest the inclusion of supplementary MR criteria in the ACR classification [12].

Due to recent technological progresses, US is more and more used in the assessment of joint inflammation [8,13]. For examining small, superficial joints, such as those in the hands and feet, one needs high-frequency (10-22 MHz), high-resolution, small linear probes. Gray-scale, colour Doppler and power Doppler US allow imaging of inflammatory and destructive processes in patients with RA: synovitis, joint effusions, bone erosions, and disorders of enthesal sites [13-16].

Synovitis (fig. 1) was defined as the “abnormal hypoechoic or anechoic (relative to subdermal fat, but sometimes may be isoechoic or hyperechoic) intraarticular material, that is not displaceable and poorly compressible and which may exhibit Doppler signal” [17]. Doppler US identifies (fig. 2) and quantifies the increased blood flow in the joints with inflammation [18,19]. A good correlation between Doppler US and enhanced MRI was found in the detection of synovitis in the wrist and small joints of hands in RA patients, suggesting that both imaging techniques visualise the same physiopathological phenomena [20,21]. Power Doppler US (fig. 3) allows both assessment of the activity of the disease, and follow-up of the therapeutical response [18,22].



Fig. 1. Synovitis in the MCP 2 joint.



Fig. 2. Color Doppler signal in the synovium.

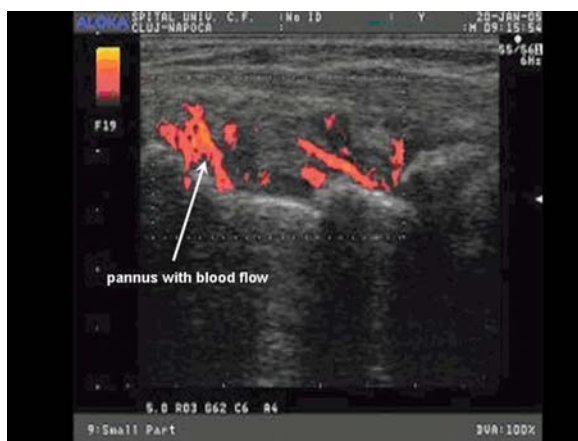


Fig. 3. Power Doppler signal in the synovium.

Recent studies sustain that specific contrast agents may increase the sensitivity of US in detecting synovitis by amplifying the weak power Doppler signals in the synovial membrane to a detectable level [23]. More research has demonstrated that US is able to visualise synovitis even in the early stages of the disease, suggesting its superiority in comparison to clinical exam for both small and large joints [24-27]. Moreover, US is a valuable imaging technique in the assessment of tendons in patients with RA; some authors consider it as the gold standard for enthesal pathology [28,29].

Joint effusions are the “abnormal hypoechoic or anechoic (relative to subdermal fat, but sometimes may be isoechoic or hyperechoic) intraarticular material, that is displaceable and compressible, but does not exhibit the Doppler signal” [17]. US visualizes intra- and periarticular effusions and also fluid in the bursa or tendons’ sheets [13]. Visualising fluid in such locations is considered to be a sign of inflammation. US allows aspiration of fluid and

guides the intraarticular injections of medicines in order to improve the symptoms [30]. The minimal volume of fluid detectable by US is 1-2 ml for the hip joint or ankle. The minimal detectable volume for the small joints of hands and feet is not yet known [13,31,32]. By guiding the invasive procedures in the metacarpophalangeal (MCP) joints and proximal interphalangeal (PIP) joints, US increases the successful rate of punctures to 96%, compared to 59% in the “blind” punctures [30]. There are some limitations regarding US: it cannot identify the type of fluid collection – inflammatory, infectious or hemorrhagic. However, it can estimate the consistence of the fluid, aiding in choosing the puncture needle and the optimal place to approach the collection. Some joint effusions (e.g. echoic, under pressure effusions) may be mistaken for synovitis, as they both appear as echoic, non-dispersible images [13].

Bone erosions (fig. 4) are detected by US as “an intraarticular discontinuity of the bone surface that is visible in 2 perpendicular planes” [17]. US is more sensitive than conventional radiology and comparable to MRI in detecting bone erosions in hand joints [15,33]. In other studies US was found to be less sensitive than MRI in detection and follow-up of bone erosions [8,34]. As ultrasound cannot penetrate the bone, the accuracy of US in visualising bone erosions depends on their location, meaning the existence of an acoustic window. Consequently, US is comparable to MRI for easy accessible joints (3-4 acoustic windows), such as MCP joints 2 and 5 or the PIP joints, less sensitive for MCP 3 and 4 (only 2 acoustic windows: palmar and dorsal) and limited for more complex joints, such as the wrist [8,15]. Bone erosions tend to occur with a high frequency in the MCP 2 and metatarsophalangeal 5 joints, which are easily accessible by US [35]. US allows visualising and evaluation of the vascularisation of the erosive synovial pannus [8,18].



Fig. 4. Bone erosion.

Conclusions

The advantages and limitations of imaging techniques as prognostic factors for early undifferentiated arthritis are still to be studied and clarified. There is a need of standardisation in acquiring and the interpretation of the images. Clinical exam, laboratory results and imaging criteria should be defined in order to make an early differential diagnosis between persistent and transitory arthritis, allowing the optimal treatment in the therapeutical window.

US is a non-invasive, inexpensive, relatively easy accessible, and sensitive imaging technique and shows an important potential as a predictive factor for early undifferentiated arthritis. Consequently it may aid in the therapeutical decision towards using the new available drugs (DMARDs, anti-TNF α , anti-IL 1) starting with the early stages of the disease.

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