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Review

Ultrasound and follow-up of rheumatoid arthritis

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ABSTRACT

Rheumatoid arthritis (RA) is chronic rheumatic disorder leading to joint inflammation and potential structural damages. This destruction occurs early in the disease outcome leading to the concept of window of opportunity. New diagnosis RA criteria have been proposed to allow an earlier diagnosis and subsequently a better management of the disease. Moreover, tight control of the disease was able to improve the prognosis of RA. For this, rheumatologists need routinely feasible tools and ultrasound (US) appears as the ideal imaging modality. US is superior to clinical exam for the detection of subclinical synovitis. US has a good correlation with clinical findings and markers of inflammation. US persistence of synovitis is associated with higher rate of relapse and more radiographic progression. However, standardization of scoring and settings procedures is necessary before being universally accepted as a marker of disease activity. Finally, US did not improve the tight control strategy and did not replace clinical exam for RA management.

1. Introduction

Rheumatoid arthritis (RA) is a chronic inflammatory disorder secondary to inflammation of joint synovial tissue. This joint inflammation can lead to structural damages and disability. It has been demonstrated that this joint destruction occurred mainly at the early stage of the disease leading to the concept of windows of opportunity [1]. This necessity of early diagnosis led to new RA diagnosis criteria and early treatment with disease modified anti-rheumatic drugs (DMARDs) [2]. The association of arthritis, presence of rheumatoid factor (RF) or Anti-Citrullinated Peptide Antibody (ACPA), and/or structural damages, makes the diagnosis. The main objective of RA treatment is to decrease joint inflammation to prevent joint damage. The concepts of "tight control" and "treat to target" have been developed for a decade to better manage RA [3,4]. Thus, rheumatologists need sensitive tools to detect RA at an early stage and evaluate disease activity. Musculoskeletal ultrasound (US) has gained an important role in the diagnosis and treatment monitoring of RA. Grey scale (GS) B-mode allows visualizing morphological information into joints and periarticular structures. Power Doppler (PD) identified the increased synovial micro-vascular blood flow, thus helping to differentiate active and inactive synovitis. US shows several advantages, high accessibility, low cost in comparison to magnetic resonance imaging (MRI) and safety with lack of ionizing radiation. The possibility of repetitive joint evaluation might allow tight control and monitor treatment efficacy. Despite being operator-dependent and relatively time-consuming, US appears as an easy tool to help the clinician to better manage RA patients. Indeed, European League against Rheumatology (EULAR) has also recently highlighted the role of US in RA for diagnosis, monitoring disease activity and treatment evaluation.

2. Ultrasound assessment

Common US features of RA were defined by OMERACT group in 2005 [5] (Table 1). GS examination are routinely applied in patients with RA and allow detect synovitis, bone erosion and tenosynovitis. Synovial hypertrophy is characterized by the presence of hypoechoic and poorly compressible intra-articular material. Synovitis is defined by synovial hypertrophy associated or not with hypervascularization detected by PD. Synovial hypertrophy and PD are usually graded using semi-quantitative score (0–3) [6] (Fig. 1). A composite (GS and PD) score has been proposed by OMERACT [7,8] (Box 1).

Erosion is defined by intra articular discontinuity of bone surface visible in two perpendicular planes (Fig. 2). Tenosynovitis is also a common feature in patients affected by RA and is defined in US as hypoechoic or anechoic thickened tissue with or without fluid within the tendon sheath, seen in two perpendicular planes. For US tenosynovitis an OMERACT score had also been proposed [9] (Table 1).

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Table 1
Definitions of US features of RA ([0,5]6).

US features of RA	Definitions
Synovial hypertrophy	Hypoechoic non displaceable and poorly compressible intra-articular material Grade: 0: absence of synovial thickening 1: mild synovial thickening 2: moderate synovial thickening 3: marked synovial thickening
Power Doppler	Grade: 0: no intra articular flow 1: single vessel signals 2: confluent vessel signals in <50% of the synovial area 3: vessel signals in >50% of the synovial aera
Synovitis	Abnormal presence of hypoechoic non displaceable and poorly compressible intra-articular material with or without PD
Effusion	Anechoic intra-articular displaceable and compressible material that does not exhibit PD
Bone erosions	Intra articular discontinuity of bone surface visible in two perpendicular planes
Tenosynovitis	Hypoechoic or anechoic thickened tissue with or without fluid within the tendon sheath, seen in two perpendicular planes

PD: power Doppler.

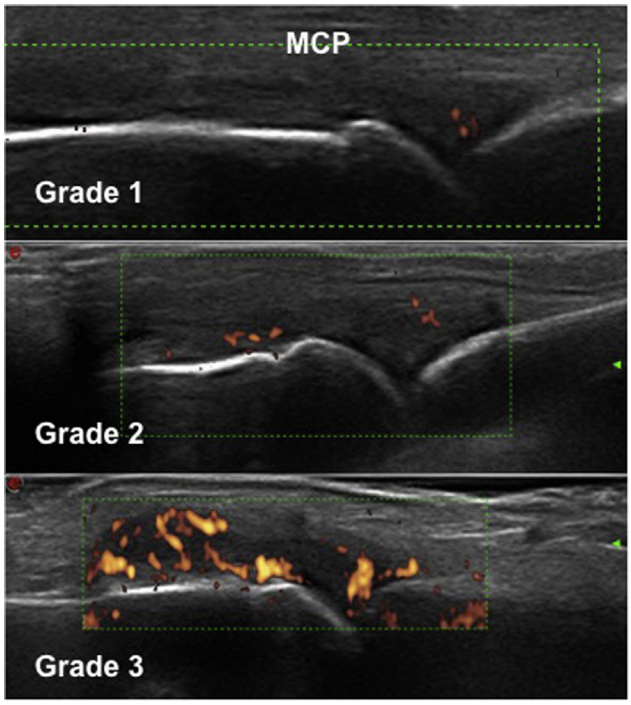

Fig. 1. Grading of Power Doppler signal according to Szkudlarek score [6].
Grading of Power Doppler signal in joint. Grade 1: single vessel signals. Grade 2: confluent vessel signals in less than 50% of the synovial area. Grade 3: vessel signals in more than 50% of the synovial aera.

Box 1: OMERACT-EULAR composite ultrasound synovitis score [7]

Grade 0 (normal joint): no greyscale-detected synovial hyperplasia and no PD signal

Grade 1 (minimal synovitis): grade 1 synovial hyperplasia and ≤ grade 1 PD signal

Grade 2 (moderate synovitis): grade 2 synovial hyperplasia and ≤ grade 2 PD signal; or grade 1 synovial hyperplasia and a grade 2 PD signal

Grade 3 (severe synovitis): grade 3 synovial hyperplasia and ≤ grade 3 PD signal; or grade 1 or 2 synovial hyperplasia and a grade 3 PD signal

PD: power Doppler.

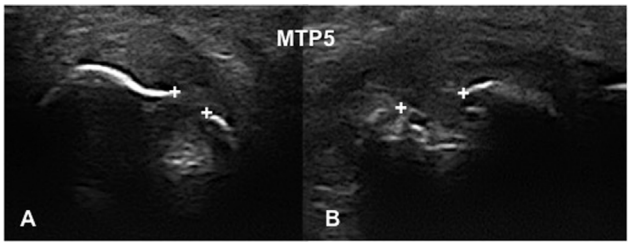

Fig. 2. Ultrasound erosion of MTP5th.
Erosion of the fifth MTP: discontinuity of bone surface (white cross) seen in transversal (A) and longitudinal view (B).

3. Ultrasound and diagnosis

The use of US is recommended to improve the diagnosis accuracy of RA when the diagnosis stays uncertain [10]. EULAR recommendations are supported by studies showing the superiority of US to clinical exam in up to 75% of patients [11], for RA diagnosis [12]. A study analyzing patients with early oligoarthritis had demonstrated that the proportion of patients with US-proven polyarthritis was higher that with clinical exam, leading to a better RA classification [13]. Among patients with undetermined early arthritis population, US involvement of metacarpophalangeals (MCP) improved the sensitivity to diagnose RA compared with clinical variables, and PD retained high specificity for RA [14]. Shoulders US assessment might contribute to differentiate RA and peripheral spondyloarthritis [15]. Bone erosions are commonly considered as the hallmark of RA and US is more sensitive than conventional radiography for detection of bone erosions [16]. US of MCPs is able to detect 6.5 times more erosions among 7.5 times more patients than radiographies [17]. In a recent study comparing RA with psoriatic arthritis, osteoarthritis, gout and healthy volunteers, the presence of at least two erosions in four target joints (2nd, 5th MCP, 5th metatarsophalangeal (MTP) joints and distal ulna) was found to be highly specific of RA (specificity 97.9% and sensitivity 41.4%). The localization of erosion in the 5th MTP was specific (85.4%) and more sensitive (68.6%) for RA diagnosis [18]. In a study, US evaluation of 122 patients with undifferentiated arthritis, PD ≥ 2 in at least one joint was associated with RA diagnosis (OR = 10.5 and 20.0 for seropositive and seronegative RA patients, respectively) [19]. A recent study, evaluating ACPA negative patients without clinical synovitis, demonstrated 25% of them had US synovitis and those synovitis was predictor for the evolution to RA [20]. Using 2010 American College of Rheumatology (ACR)/EULAR classification criteria, the presence of high PD and US bone erosions were suggestive of RA [21].

Thus, US appears to be more sensitive than clinical exam for RA diagnosis and the two main US features to research are bone erosions and PD+ synovitis.

4. Ultrasound and disease activity assessment

As US is more sensitive than clinical evaluation for detection of synovitis, it could be suggested that US is able to measure disease activity [22]. It is well known that tender joint count (TJC) and swollen joint count (SJC) do not entirely reflect active inflammation [23]. In contrast, PD is able to detect pathological synovial flow that could represent a marker of synovial inflammatory activity [24]. Indeed, the correlation between PD and synovial histopathology was demonstrated since 2001 [25]. In a recent study investigating early RA, GS and PD synovitis were shown to be associated with synovial inflammation. GS synovial thickness and synovial PD correlated with synovial density and blood vessel number