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Musculoskeletal Ultrasound Including Definitions for Ultrasonographic Pathology

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ABSTRACT. Ultrasound (US) has great potential as an outcome in rheumatoid arthritis trials for detecting bone erosions, synovitis, tendon disease, and enthesopathy. It has a number of distinct advantages over magnetic resonance imaging, including good patient tolerability and ability to scan multiple joints in a short period of time. However, there are scarce data regarding its validity, reproducibility, and responsiveness to change, making interpretation and comparison of studies difficult. In particular, there are limited data describing standardized scanning methodology and standardized definitions of US pathologies. This article presents the first report from the OMERACT ultrasound special interest group, which has compared US against the criteria of the OMERACT filter. Also proposed for the first time are consensus US definitions for common pathological lesions seen in patients with inflammatory arthritis. (J Rheumatol 2005;32:2485–7)

Key Indexing Terms:
ULTRASOUND EROSIONS SYNOVITIS TENOSYNOVITIS ENTHESOPATHY

Ultrasound (US) has been used for the investigation and management of patients with musculoskeletal disease for at least 30 years[1]. Its initial use was limited to investigating larger joints and soft tissue structures such as Baker's cysts. Technological improvements in the early 1990s, however, greatly improved image resolution and tissue contrast and

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allowed access to the smaller joints[2]. In rheumatology, its use has recently been directed towards the assessment of patients with inflammatory arthritis[3]. This includes the detection of bone erosions, synovitis, tendon disease, and enthesopathy. US has a number of distinct advantages over magnetic resonance imaging (MRI), including its ability to scan multiple joints in a brief period of time. Additionally, patient tolerability is good, and the rheumatologist with clinical understanding of the patient's problem can scan in the clinic (rather than sending the patient for another appointment), thereby allowing rapid interpretation of the images and immediate decision-making.

US, however, is often perceived as an imperfect and operator-dependent tool. This is compounded by a lack of data regarding its validity, reproducibility, and responsiveness to change, making interpretation and comparison of studies difficult. In particular, there are limited data describing standardized scanning methodology[4] and standardized definitions of US pathologies. As a result of these difficulties, a group of interested international ultrasonographers came together under the auspices of OMERACT.

Prior to OMERACT 7

Support for a future OMERACT group was decided at the EULAR Working Party for Ultrasound meeting held at the 2003 EULAR conference in Lisbon. A subsequent meeting was held in Orlando in October 2003 during the American College of Rheumatology meeting. There was general agreement that in the first instance, the focus of the group should be on those features commonly measured by ultrasonographers in inflammatory arthritis. In order to address US issues using the OMERACT filter, it was further decided that 2 preliminary exercises would be performed prior to the OMERACT 7 meeting.

Exercise 1. To conduct a systematic literature review, similar to that performed by members of the OMERACT MRI group[5], focusing on erosions, synovitis, tenosynovitis, and enthesopathy at specific anatomical regions. Leaders were nominated to coordinate a multicenter group for each literature search. The following anatomical areas were considered most important: shoulder, hand, wrist, elbow, knee, forefoot, ankle, and hindfoot. Pubmed and Medline searches between 1980 and April 2004 were used for the majority of searches. Exclusions included non-English language articles, reviews, letters, and pediatric publications.

Exercise 2. To achieve consensus on pathological US definitions. A questionnaire was distributed to the group asking for individual definitions of common pathological lesions seen in patients with inflammatory arthritis. These were coordinated at one site and draft consensus definitions obtained.

At OMERACT 7

The US special interest group (SIG) offered the opportunity for presentation of the results of the different anatomical site literature reviews as well as the draft definitions obtained from the questionnaires. The group then met on 2 further occasions during the meeting to discuss the results of the exercises (including review of methodologies), achieve consensus on the definitions, and plan the future research agenda.

Exercise 1. Literature reviews. A large amount of literature was reviewed and it is intended that the results will be published separately. The following general comments can be made:

1. The hand was the most studied area and synovitis most studied pathology.
2. There was a paucity of validity data in terms of comparison with histology and MRI, although these data are increasing.
3. There was a paucity of reliability data. Interobserver reliability was the most investigated area, with scarce data relating to intraobserver, and virtually none relating to intermachine reliability. Reliability exercises were also often performed on different joints within the same study, making interpretation difficult.
4. Data on normal joint structures are scarce.
5. Longitudinal and blinded studies assessing responsiveness to therapies are scarce.

Exercise 2. Questions on definitions and methods of scoring for erosions, synovitis, tenosynovitis, and enthesopathy. These definitions served as a basis for the 2 further meetings held at OMERACT 7 to form a consensus. As some colleagues were unable to attend, the definitions were recirculated to all members for their comments. The following definitions were agreed on.

RA Bone Erosion

An intraarticular discontinuity of the bone surface that is visible in 2 perpendicular planes.

Synovial Fluid

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 Doppler signal.

Synovial Hypertrophy

Abnormal hypoechoic (relative to subdermal fat, but sometimes may be isoechoic or hyperechoic) intraarticular tissue that is nondisplaceable and poorly compressible and which may exhibit Doppler signal.

Tenosynovitis

Hypoechoic or anechoic thickened tissue with or without fluid within the tendon sheath, which is seen in 2 perpendicular planes and which may exhibit Doppler signal.

Enthesopathy

Abnormally hypoechoic (loss of normal fibrillar architecture) and/or thickened tendon or ligament at its bony attachment (may occasionally contain hyperechoic foci consistent with calcification), seen in 2 perpendicular planes that may exhibit Doppler signal and/or bony changes including enthesophytes, erosions, or irregularity.

Summary and Future Directions

US has many characteristics that make it potentially valuable for the investigation of the musculoskeletal system and in particular as a hands-on clinical tool. However, scarce data regarding important methodological and measurement issues need to be augmented before US will gain wider acceptance. Issues include lack of validation and reliability data, in addition to the role of US in assessing responsiveness to change. The group meeting at OMERACT 7 achieved a consensus on broad descriptive US definitions. It is possible, however, that as new data become available and technologies advance these may have to be modified.

A detailed research agenda includes testing the reliability of image acquisition and static image interpretation using the new OMERACT definitions, and testing intermachine reliability.

Although there is much work to be done, the OMERACT process has provided an excellent framework for ongoing collaborative studies on measurement issues.

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