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OMERACT Rheumatoid Arthritis Magnetic Resonance Imaging Studies. Core Set of MRI Acquisitions, Joint Pathology Definitions, and the OMERACT RA-MRI Scoring System

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ABSTRACT. This article describes the 2002 OMERACT rheumatoid arthritis magnetic resonance image scoring system (RAMRIS) for evaluation of inflammatory and destructive changes in RA hands and wrists, which was developed by an international MRI-OMERACT group. MRI definitions of important RA joint pathologies, and a "core set" of basic MRI sequences for use in RA are also suggested. (J Rheumatol 2003;30:1385–6)

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A working group was formed under the OMERACT banner at the 1999 American College of Rheumatology meeting as a consequence of the potential of magnetic resonance imaging (MRI) to assess activity and damage in rheumatoid arthritis (RA), combined with a wide variety of different MRI acquisition protocols and minimally validated assessment methods in published articles. Through exercises[1-3] and biannual meetings, a MRI scoring system for evaluation of inflammatory and destructive changes in RA hands and wrists was iteratively developed and validated by the group[4,5]. Further, the group reached consensus on definitions of important joint pathologies and a "core set" of basic MRI sequences to increase comparability of MRI studies of RA joints. At the OMERACT 6 meeting, held in Queensland in April 2002, currently available data[1-3,6,7] were presented and discussed at the MRI in RA Module, as described in detail by McQueen, *et al*[5]. Subsequently, OMERACT participants endorsed the OMERACT RA-MRI scoring system (RAMRIS) as a useful framework for further development of MRI assessment of RA, and suggested the system be used as a standard comparator for new/alternative MRI methods for RA assessment[5].

Data from individual exercises are given elsewhere[1-3,6,7], as are detailed reflections on reliability, advantages, and limitations of the OMERACT approach to MRI in RA[5]. The recommendations of the OMERACT MRI group are summarized below.

A Core Set of Basic MRI Sequences

It is suggested that future MRI studies to assess inflammatory as well as destructive changes in RA joints should

include at least the following: Imaging in 2 planes*, with T1-weighted images before and after intravenous gadolinium-contrast**; *plus* a T2-weighted fat saturated sequence or, if the latter is not available, a STIR sequence.

*Imaging in 2 planes can be acquired by obtaining a 2D sequence in 2 planes or a 3D sequence with isometrical voxels in one plane allowing reconstruction in other planes.

**IV gadolinium injection is probably not essential if destructive changes alone (bone erosions) are considered important.

Definitions of Important RA Joint Pathologies

Synovitis. An area in the synovial compartment that shows above normal post-gadolinium enhancement* of a thickness greater than the width of the normal synovium.

*Enhancement (signal intensity increase) judged by comparison of T1-weighted images, obtained before and after IV gadolinium contrast.

MRI bone erosion. A sharply marginated bone lesion, with correct juxtaarticular localization and typical signal characteristics*, which is visible in 2 planes with a cortical break seen in at least one plane**.

*On T1-weighted images: loss of normal low signal intensity of cortical bone and loss of normal high signal intensity of trabecular bone. Quick post-gadolinium enhancement suggests presence of active, hypervascularized pannus tissue in the erosion.

**Other focal bone lesions, including metastases, must obviously be considered, but are generally distinguishable with associated imaging and clinical findings.

MRI bone edema. A lesion* within the trabecular bone, with ill-defined margins and signal characteristics consistent with increased water content**.

*May occur alone or surrounding an erosion or other bone abnormalities.

**High signal intensity on T2-weighted fat-saturated and STIR images, and low signal intensity on T1-weighted images.

Scoring System (RAMRIS)

Bone erosions. Each bone (wrists: carpal bones, distal radius, distal ulna, metacarpal bases; metacarpophalangeal, MCP, joints: metacarpal head, phalangeal base) is scored separately. The scale is 0–10, based on the proportion of eroded bone compared to the "assessed bone volume," judged on all available images: 0: no erosion; 1: 1–10% of bone eroded; 2: 11–20%, etc. For long bones, the "assessed bone volume" is from the articular surface (or its best estimated position if absent) to a depth of 1 cm, while in carpal bones it is the whole bone.

Bone edema. Bone edema is scored 0–10 by the volume of edema: 0, no edema; 1, 1–33% of bone edematous; 2, 34–66%; 3, 67–100%.

Synovitis. Synovitis is assessed in 3 wrist regions (A. the distal radioulnar joint; B. the radiocarpal joint; C. the intercarpal and carpometacarpophalangeal, CMC, joints) and in each MCP joint. The 1st CMC joint and the 1st MCP joint are not scored. The scale is 0–3. A score of 0 is normal, while scores of 1 to 3 (mild, moderate, severe) increase by thirds of the presumed maximum volume of enhancing tissue in the synovial compartment.

Conclusion

The RAMRIS system for evaluation of inflammatory and destructive changes in RA hands and wrists was developed and validated by an international MRI-OMERACT group and endorsed by OMERACT 2002 participants as a standard comparator for new/alternative MRI methods for RA assessment. MRI definitions of important joint pathologies and a core set of basic MRI sequences have been suggested.

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