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Table 1. OMERACT MRI in RA group's updated 2016 recommendations of a "core set" of basic MRI sequences and MRI definitions of important RA joint pathologies for use in the RA MRI scoring system (OMERACT 2016 RAMRIS).

"Core set" of basic MRI sequences:

It is suggested that future MRI studies, which intend to assess inflammatory and destructive changes in RA joints, should include at least the following:

- T1-weighted images before and after IV gadolinium-contrast injection* that enable visualization in 2 planes**
 - T2-weighted fat-saturated or STIR images
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Definitions of important RA joint pathologies:

- Synovitis: An area in the synovial compartment that shows above-normal postgadolinium enhancement (signal intensity increase) of a thickness greater than the width of the normal synovium
 - 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 1 plane^{††}
 - MRI osteitis/bone marrow edema: A lesion[‡] within the trabecular bone, with ill-defined margins and signal characteristics consistent with increased water content^{‡‡}
 - MRI joint space narrowing: Reduced joint space width compared to normal, as assessed in a slice perpendicular to the joint surface
 - MRI tenosynovitis: Peritendinous effusion[#] and/or tenosynovial postcontrast enhancement^{##}, seen on axial sequences over ≥ 3 consecutive slices
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*IV gadolinium injection is particularly important if assessment of synovitis is considered important. **Bi-planar imaging can be achieved by a 2-dimensional sequence in 2 planes or a single 3-D acquisition with isometric voxels allowing reconstruction in multiple planes. A dedicated cartilage sequence, e.g., a fat-suppressed 3-D gradient echo sequence, will improve cartilage assessment. [†]On T1-weighted images: discontinuity of the signal void of cortical bone and loss of normal high signal intensity of bone marrow fat. Rapid post-gadolinium enhancement suggests presence of active, hypervascularized pannus tissue in the erosion. ^{††}Other focal bone lesions and variations of normal anatomy must obviously be considered, but are generally distinguishable with associated imaging and clinical findings. [‡]May occur alone or surrounding an erosion. ^{‡‡}High signal intensity on T2-weighted fat-saturation or STIR images, and low signal intensity on T1-weighted images. [#]High signal intensity on T2-weighted fat-saturated/STIR images. ^{##}Enhancement (signal intensity increase) is judged by comparison of T1-weighted images obtained before and after IV gadolinium-contrast. OMERACT: Outcome Measures in Rheumatology; MRI: magnetic resonance imaging; RA: rheumatoid arthritis; RAMRIS: Rheumatoid Arthritis Magnetic Resonance Imaging Scoring system; IV: intravenous; STIR: short-tau inversion recovery.

Table 2. The OMERACT MRI in Arthritis Working Group's updated 2016 recommendations of the OMERACT RA MRI scoring system (OMERACT 2016 RAMRIS).

Bone erosion	<ul style="list-style-type: none"> • Each bone (wrists: distal radius, distal ulna, carpal bones, metacarpal bases; MCP joints: metacarpal heads, phalangeal bases) 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 • In case a bone is fused with another bone, bone erosion is scored as 10 in the bone
Osteitis/bone marrow edema	<ul style="list-style-type: none"> • Each bone is scored separately (as for erosions) • The scale is 0–3 based on the proportion of bone with osteitis, as follows: 0 = no osteitis; 1 = 1–33% of bone with osteitis; 2 = 34–66%; 3 = 67–100%
Synovitis	<ul style="list-style-type: none"> • Synovitis is assessed in 3 wrist regions (1. the distal radioulnar joint; 2. the radiocarpal joint; 3. the intercarpal and carpometacarpal joints) and in each MCP joint. The first carpometacarpal joint is not scored • The scale is 0–3. Score 0 is normal, while 1–3 (mild, moderate, severe) are by thirds of the presumed maximum volume of enhancing tissue in the synovial compartment
Joint space narrowing	<ul style="list-style-type: none"> • Joint space narrowing is assessed at 17 locations in the wrist, between distal radius and carpal bones (2 sites), between the carpal bones (except the pisiform; 10 sites), and between carpal bones and each metacarpal bone (5 sites), and in each MCP joint • The scale is 0–4, as follows: 0 = no narrowing; 1 = focal or mild (< 33%) narrowing; 2 = moderate (34–66%) narrowing; 3 = moderate to severe (67–99%) narrowing; 4 = ankylosis
Tenosynovitis	<ul style="list-style-type: none"> • In the wrist, tenosynovitis is assessed at 6 extensor tendon compartments and 3 flexor tendon compartments, between the radioulnar joint and the hook of hamate. At the level of the MCP joints, flexor tendons are assessed in an area from 1 cm proximal to 1 cm distal to each joint • Tenosynovitis is scored based on the maximum width of the effusion and/or tenosynovial enhancement measured perpendicularly to the tendon • The scale is 0–3, as follows: 0 = no; 1 = < 1.5 mm; 2 = ≥ 1.5 mm but < 3 mm; 3 = ≥ 3 mm peritendinous effusion and/or postcontrast tenosynovial enhancement

OMERACT: Outcome Measures in Rheumatology; MRI: magnetic resonance imaging; RA: rheumatoid arthritis; RAMRIS: Rheumatoid Arthritis Magnetic Resonance Imaging Scoring system; MCP: metacarpophalangeal.

Table 3. Research agenda.

List of proposed areas for investigation* by the OMERACT MRI in Arthritis Working Group:

- Combined scores of inflammation (synovitis, osteitis, and tenosynovitis) and of damage (bone erosion and cartilage damage/JSN)
 - New sequences, e.g., MRI without intravenous contrast injection for assessment of synovitis, dedicated cartilage sequences, and diffusion-weighted MRI
 - Validation of RAMRIS in other joints, such as proximal interphalangeal joints (hands), first interphalangeal joints, and metatarsophalangeal joints
 - Whole-body MRI
 - Quantitative methods, including dynamic contrast-enhanced MRI, automated volume quantification (e.g., RAMRIQ)
 - Simplified RAMRIS, e.g., scoring of reduced amounts of anatomical areas, e.g., fewer sites for JSN assessment, first carpometacarpal joint, etc.
 - Development of an updated tool for training and calibration.
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*Including, but not limited to, assessment of reproducibility, sensitivity to change, and discriminatory ability. OMERACT: Outcome Measures in Rheumatology; MRI: magnetic resonance imaging; JSN: joint space narrowing; RAMRIS: Rheumatoid Arthritis Magnetic Resonance Imaging Scoring system; RAMRIQ: Rheumatoid Arthritis Magnetic Resonance Imaging Quantitative assessment system.