

# Magnetic Resonance Imaging in Psoriatic Arthritis — Update on Current Status and Future Perspectives: A Report from the GRAPPA 2010 Annual Meeting

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**ABSTRACT.** The potential of magnetic resonance imaging (MRI) for use in clinical practice and research has gained increasing interest over the last decade. International collaborative initiatives from GRAPPA (Group for Research and Assessment of Psoriasis and Psoriatic Arthritis) and/or OMERACT (Outcome Measures in Rheumatology) may contribute to facilitating research, identifying appropriate areas for use, and reaching consensus on the optimal examination technique. Accordingly, GRAPPA, a primary driver of international research in psoriasis and psoriatic arthritis (PsA), has focused on the current use and future development of MRI and other modern imaging modalities in PsA. This review, presented at the GRAPPA 2010 annual meeting, describes the current status of MRI in PsA, with a focus on its use in diagnosis, monitoring, and prediction of the disease course and treatment response. Important areas for future research are also outlined. (J Rheumatol 2012;39:408–12; doi:10.3899/jrheum.111235)

## Key Indexing Terms:

PSORIATIC ARTHRITIS      MAGNETIC RESONANCE IMAGING      ARTHRITIS      GRAPPA

## MRI Findings in Psoriatic Arthritis

The clinical appearance of psoriatic arthritis (PsA) is varied, involving axial and peripheral joints and periarticular structures such as entheses. Similarly, magnetic resonance imaging (MRI) findings are diverse. PsA shares clinical manifestations with rheumatoid arthritis (RA) and spondyloarthritis (SpA), including MRI features<sup>1</sup>.

MRI can visualize peripheral and axial musculoskeletal anatomy as well as disease manifestations, including synovitis, enthesitis, tenosynovitis, tendonitis, peritendonitis, soft tissue edema, bone edema, bone erosion, and bone proliferation (Figures 1 and 2)<sup>2,3,4</sup>. MRI features like synovitis and erosions are not disease-specific to peripheral PsA, and MRI bone edema can involve any bone. In SpA, dactylitis has been shown on MRI to be due to tenosynovitis with effusion, sometimes associated with diffuse soft tissue edema and/or synovitis in nearby finger or toe joints<sup>5,6</sup>. There are few MRI studies in axial PsA, but findings are similar to those in ankylosing spondylitis, although more frequently asymmetric<sup>7</sup>. The enthesis has attracted attention as a possible primary location of disease<sup>8</sup>. Nail disease is common in PsA, and distal interphalangeal (DIP) joint inflammation on MRI has been described to extend to the nail bed<sup>9</sup>.

## How to Perform MRI in PsA?

General agreement on which joints to image to assess PsA activity and damage is not established and probably should be individualized based on disease pattern. Often the hand with the highest clinical disease activity is examined. Generally, T1-weighted sequences should be in 2 planes, supplemented by a T2-weighted fat-suppressed or short-tau inversion recovery sequence, preferably also in 2 planes. Intravenous contrast injection is optimal for assessment of synovitis and tenosynovitis, but can be omitted if the aim is purely to detect bone erosion, bone edema, and/or bone proliferation<sup>2</sup>.

## Differential Diagnostic Value of MRI

Most studies have compared patients with known diagnoses. MRI has generally not been able to distinguish between peripheral PsA and RA<sup>1</sup>, even though some findings (e.g., periostitis) are characteristic for PsA<sup>10</sup>, and dynamic contrast-enhanced MRI has shown similar patterns in PsA as in RA<sup>11,12</sup> and in osteoarthritis (OA)<sup>13</sup>.

Of note, no studies have documented that MRI in an early undifferentiated arthritis cohort can be used to differentiate PsA from other arthritides.

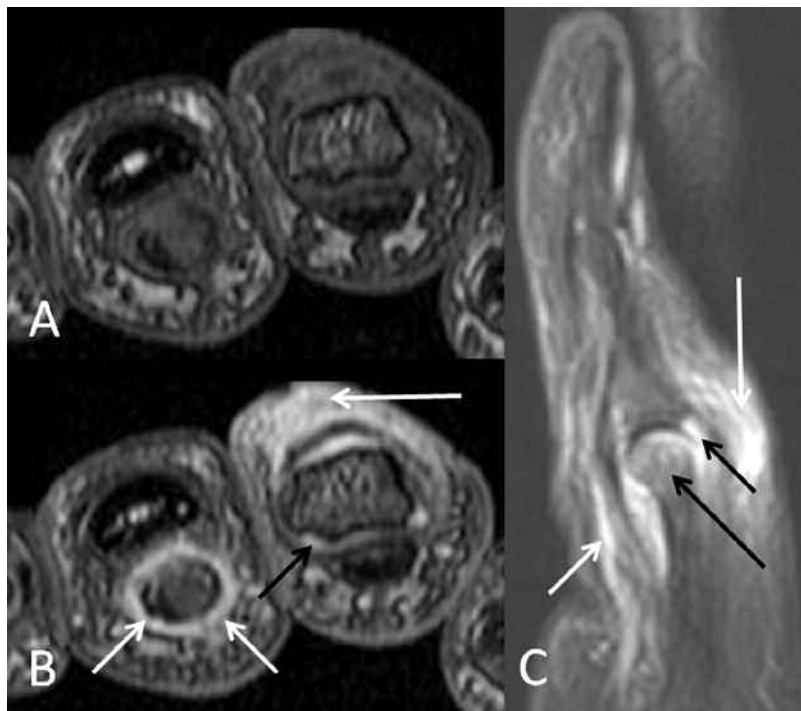
## MRI in Psoriasis without Clinical Signs of Arthritis

PsA can be clinically silent. In patients with psoriasis without arthritic signs or symptoms, pathological findings on MRI (including periarticular edema, tendon sheath effusion, intraarticular effusion, synovial pannus, bone erosion, bone cysts, subchondral changes, and joint subluxation) have been reported in more than two-thirds (68%–92%) versus 0–1 in 12 healthy controls<sup>14,15,16</sup>. The clinical importance of these find-

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**Figure 1.** Tenosynovitis, synovitis, bone marrow edema, and periarticular inflammation. Axial T1-weighted precontrast (A) and postcontrast (B) MR images of the 3rd (left) and 4th (right) finger at the level of the 4th proximal interphalangeal (PIP) joint; and sagittal STIR MR image (C) of the 4th finger. Tenosynovitis (short white arrows) is seen in the 3rd flexor tendon sheaths in (B) and more proximal in the 4th tendon sheath in (C). Synovitis (short black arrow), bone marrow edema (long black arrow), and considerable periarticular inflammation (long white arrows) around the 4th PIP are also seen.

ings, especially the predictive value regarding development of clinical PsA, is not yet clarified.

### Monitoring with MRI

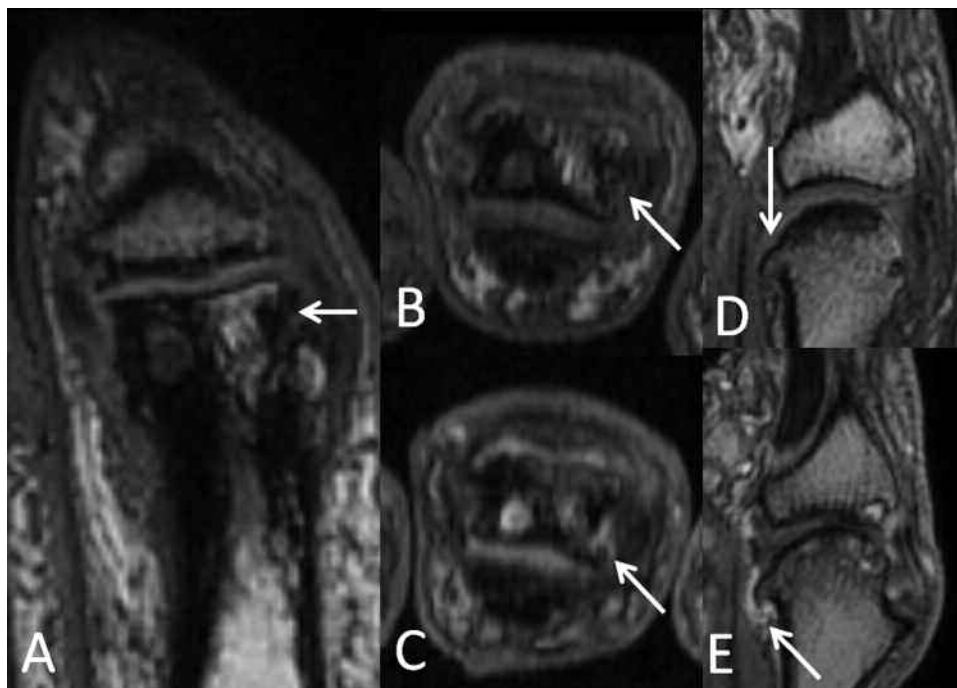
Most studies report only qualitative MRI assessments of the different pathologies of PsA<sup>1</sup>. Quantitative assessment of contrast enhancement has been reported<sup>13,17</sup>, but is insufficiently validated for clinical use. Several scoring systems for synovitis, bone marrow edema, and/or erosions have been described<sup>2,18,19</sup>, but most have been limited to a few patients. In a study of 11 patients with PsA treated with the anti-tumor necrosis factor (TNF) agent adalimumab for 24 weeks, MRI of a wrist or knee showed significant improvements from baseline at 24 weeks in both clinical measures of disease activity and in MRI bone marrow edema and effusion, but not in synovitis<sup>19</sup>. Therapy-induced decreases in dactylitis (clinical and MRI assessments) have also been observed<sup>20</sup>.

The international MRI in inflammatory arthritis group of OMERACT (Outcome Measures in Rheumatology) has developed the OMERACT Psoriatic Arthritis Magnetic Resonance Image Scoring System (PsAMRIS) for evaluation of inflammatory and destructive changes in PsA hands<sup>2,21,22</sup>. This system is the most validated assessment system available, and has a documented good intra- and inter-reader reliability

for status scores of all variables. For the inflammatory variables, the intra- and inter-reader reliability were high for change scores, and the sensitivity to change was moderate. The damage measures, i.e., bone erosion and bone proliferation, showed very limited change after 1 year of TNF inhibitor therapy<sup>22</sup>.

In a recent placebo-controlled trial, 22 patients with PsA were randomized to receive the bisphosphonate zoledronic acid or placebo. Bone edema scored according to PsAMRIS decreased significantly in the zoledronic acid group, but not in the placebo group. No differences in MRI bone proliferation or bone erosion progression could be identified<sup>23</sup>.

In another recent randomized controlled PsA trial, MRI synovitis, bone edema, and bone erosion scored according to the OMERACT RAMRIS (the RA equivalent of PsAMRIS, using similar definitions of pathologies<sup>24</sup>) were applied as exploratory endpoints in the comparison of treatment with abatacept and placebo<sup>25</sup>. Synovitis and bone edema decreased in the abatacept-treated patients, whereas it increased slightly in the placebo group<sup>25</sup>. These studies suggest that the OMERACT scoring systems could be useful as sensitive outcome measures in PsA clinical trials. Longitudinal, randomized MRI data similar to the abatacept study would be well suited for further validation of the PsAMRIS system, particularly the



**Figure 2.** Bone erosion and bone proliferation. A–C: coronal (A) and axial (B) precontrast T1-weighted MR images of a proximal interphalangeal joint show bone erosion (arrow) in the phalangeal head. Postcontrast image (C) shows mild enhancement in the erosion and the joint (synovitis). D–E: coronal precontrast (D) and postcontrast (E) T1-weighted MR images of metacarpophalangeal joint show bone proliferation (arrow) extending from the metacarpal head and small bone erosions. Postcontrast image (E) shows enhancement (inflammation) in the surrounding soft tissues.

sensitivity to change (standardized response mean and effect size) of its various components.

### Prognosticating with MRI

Based on a cross-sectional MRI study of 11 patients with the aggressive arthritis mutilans (AM) form of PsA and 17 patients without AM (erosive PsA without bony lysis), in which there was a close association between presence of erosion and bone edema, the authors suggest that MRI bone edema in PsA is a forerunner of structural joint damage<sup>4</sup>. Longitudinal studies are needed to clarify the prognostic significance of various MRI findings in PsA.

### Axial MRI in PsA

Information about MRI of axial involvement in PsA originates primarily from studies of spondyloarthritis (SpA) in general<sup>26,27</sup>. In patients with axial SpA, MRI can identify active disease (inflammation) and structural “chronic” lesions (erosion, fat infiltration, spurs/ankylosis) in the sacroiliac joints and spine. MRI permits early diagnosis of axial SpA<sup>28,29</sup>. The clinical value of MRI in the monitoring and prognostication of axial PsA requires further research.

### Whole-body MRI and Dynamic Contrast-enhanced MRI

Whole-body MRI can visualize the entire body at one MRI examination and will potentially allow simultaneous assess-

ment of peripheral and axial disease manifestations<sup>30</sup>. Disadvantages of whole-body MRI include a lower image resolution than conventional MRI and a suboptimal slice positioning for the individual joint regions. Validation in PsA is required.

Dynamic contrast-enhanced (DCE) MRI data from patients with PsA are scarce, but in a small study of wrists in PsA and RA patients, no difference in synovial dynamic contrast enhancement measures was observed between the PsA and RA patients (matched for disease activity), but all PsA patients had significantly higher enhancement than healthy controls<sup>11</sup>. In another comparative study of 10 PsA and 10 RA patients with at least 1 swollen metacarpophalangeal joint, conventional and DCE-MRI was unable to differentiate between the diagnoses, but more diffuse extracapsular enhancement/enthesal-based pathology was found in patients with PsA<sup>31</sup>. Two recent studies compared DCE-MRI in PsA versus OA<sup>13</sup> and RA<sup>12</sup> and found no statistically significant differences in the early enhancement rates. DCE-MRI has not yet been systematically investigated as an outcome measure of PsA disease activity.

### Conclusion

In summary, MRI is an excellent tool for evaluation of patients with PsA, because both peripheral and axial disease manifestations can be detected and monitored. However,

despite encouraging data, further scientific work needs to be done before the value of different MRI techniques in diagnosis, monitoring, and prognostication of PsA is clarified. Items suggested for a research agenda follow below. International collaborative research initiatives, e.g., from GRAPPA, may contribute to this process.

### MRI in PsA Research Agenda

- Study the differential diagnostic value of MRI in undifferentiated peripheral and axial arthritis
- Develop and validate MRI scoring systems (e.g., OMERACT PsAMRIS), including testing in randomized clinical trials and observational cohorts
- Develop and test alternative MRI techniques in axial and peripheral PsA, including whole-body MRI, diffusion-weighted MRI, and dynamic contrast-enhanced MRI with automated reading
- Develop and test MRI assessment systems for additional structures, including cartilage and nail bed
- Study the additional clinical benefit of following PsA patients with MRI compared to conventional clinical and radiographic examinations
- Assess the predictive value of MRI findings:
  - in psoriasis without signs or symptoms of PsA, regarding subsequent development of clinical PsA
  - in PsA for future structural damage, functional disability, and pain
  - for treatment response
- Explore the relationship between inflammatory changes (including therapy-resistant versus therapy-sensitive lesions) and subsequent progression of structural damage on MRI and radiography, pain, and longterm functional outcome.

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