Magnetic resonance imaging for diagnosing, monitoring and prognostication in psoriatic arthritis

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ABSTRACT

Psoriatic arthritis (PsA) is a chronic systemic, inflammatory disease associated with skin psoriasis. PsA may be difficult to assess with clinical examination and blood tests because of its complex and multifaceted clinical presentation. Magnetic resonance imaging (MRI) can visualise all peripheral and axial joints and entheses involved in PsA, and allow the rheumatologist to assess inflammation and structural damage in detail. In the present paper, we provide a brief overview of MRI to diagnose, monitor and prognosticate in PsA in clinical care.

Introduction

Magnetic resonance imaging (MRI) can visualise all joints, entheses and spinal structures involved in psoriatic arthritis (PsA). Reliable assessment of a disease activity is essential, but traditional methods of evaluating PsA are often a subject of clinical uncertainty. Although blood markers of inflammation can be elevated and radiography may reveal joint damage, objective findings in early PsA may be subtle or even absent. Since the introduction of potent biologic agents to treat PsA, sensitive measures have become increasingly needed. In PsA (as in other inflammatory rheumatic diseases), the quality of life decreases without treatment, due to joint damage, irreversible pain, and functional disability. There is evidence that biologic agents can not only improve status to reduce these undesirable outcomes, but also maintain productivity at paid work and participate in household activities (1). As biological treatment is expensive and has the potential for serious side effects, it is important to identify the patients who will benefit from intensive medication, and to repeatedly evaluate whether the treatment strategy should be altered. To address these issues the rheumatologist needs reliable tools to diagnose, monitor and prognosticate PsA. In this paper, we will provide a brief updated overview of MRI to assess peripheral and axial inflammation and structural damage in clinical practice.

How can magnetic resonance imaging be used to diagnose psoriatic arthritis?

When suspicion is raised that PsA may be present, the time to diagnosis should not be delayed. PsA patients profit from early treatment in order to prevent disability and damage and increase survival (2). Conventional MRI allows high-resolution visualisation of all structures involved in arthritis, and is sensitive to recognise peripheral and axial disease manifestations. MRI in PsA has received less attention than in rheumatoid arthritis (RA) and most knowledge is derived from studies of broader groups of spondyloarthritis (SpA) patients, including limited number of patients with PsA (3).

Signs of inflammation may be detected by MRI in PsA, and findings such as synovitis, tenosynovitis and bone marrow oedema (BMO) document the presence of an inflammatory process, although not specific for PsA (4-6). Studies concerning the possible diagnostic value to discriminate between PsA and RA have led to different conclusions. In one comparative study, MRI could not distinguish between peripheral PsA and RA, when synovitis and bone erosions were assessed (7). In contrast, a MRI study of the hand and wrist in PsA and RA patients found bone erosions were more frequent in RA, and periostitis more frequent in PsA (8). In the later study no subgroup analysis of PsA phenotypes were reported.

In early disease, MRI of wrists and hands detected diaphyseal BMO and/or enthesitis in more than 70% of PsA patients, whereas these features were ab-

sent in a matched group of RA patients (9). BMO is not specific for PsA, and it has been reported that in PsA, BMO is often located close to the entheses, in contrast to RA, where BMO often is located close to the capsular attachments (10). Compared to osteoarthritis (OA), in which bone erosions are more often located centrally, bone erosions in PsA are more often seen adjacent to collateral ligament insertions (11).

PsA may be seen in some patients as axial involvement in the spine and sacroiliac joints, indistinguishable from SpA (12). Few studies are available in axial PsA, but findings are overall similar to MRI findings in ankylosing spondylitis (AS). MRI in PsA is sensitive for detection of sacroiliitis and spondylitis, although more frequently asymmetric than in AS, and clinical findings in PsA are overall only weakly associated with sacroiliitis on MRI (13-15). The presence of restricted spinal movements (specifically, a positive modified Schober test) has been reported to be the strongest clinical indicator of MRI-diagnosed sacroiliitis (14). The first sign of PsA can be an erosive discovertebral lesion (Andersson lesion), which is seen in approximately 6% of PsA and AS patients (16). One study of a broad group of PsA patients attending a rheumatology out-patient clinic found sacroiliitis on MRI in 38% (14). Axial inflammation on MRI is significantly related to HLA-B27 positivity in PsA (17).

In RA, MRI is part of the American College of Rheumatology/European League against Rheumatism (EULAR) 2010 classification criteria, and can be used to enumerate the number of involved joints (18, 19). Future studies are needed to clarify the role of MRI in classifying PsA, and in DMARD-treated MRI-positive early axial PsA, as recommended by EULAR (20).

Although only few psoriasis patients without arthritis have been studied by MRI, higher frequency of arthritic and entheseal changes are reported compared to healthy subjects (21-23) as in ultrasound (24). These findings suggest that MRI may detect PsA before it becomes clinically apparent, but may detect some self-limited and clinically unimportant phenomena. As MRI is highly sensitive and may occasionally reveal mild MRI changes in controls (25, 26), future imaging studies need to define the threshold for clinically significant inflammatory findings.

PsA is heterogeneous and characterised by widespread joint inflammation, and conventional MRI of the most symptomatic region may not capture all relevant disease activity. Whole-body MRI is a novel imaging method, which allows MRI of the whole body in one scanning session, but at the cost of lower image resolution than conventional MRI. In a proof of concept whole-body MRI study, the scans were well tolerated by PsA patients. The examination time was 45 minutes, and the most often visible pathology that was detected was enthesitis (27).

Recently, seven clinical enthesitis indices were examined by whole-body MRI in patients with PsA, axial SpA and controls. (28). Moderate agreement was seen between MRI enthesitis and clinical examination, suggesting a role for whole-body MRI in detecting subclinical inflammation. An exciting possibility of whole-body MRI is the assessment of the distribution of inflammation and structural damage in the entire body, and evaluation of the global inflammatory burden. Compared to controls, PsA patients have significantly higher global BMO scores as assessed by whole-body MRI, which validates this technique, encouraging further development and longitudinal testing (26).

Can magnetic resonance imaging be used to monitor inflammation and structural damage in psoriatic arthritis?

As described above, MRI is sensitive to detect inflammation and structural damage, but it is important to know the responsiveness of the applied measures in order to assess the capacity to monitoring disease progression and treatment response.

Several semi-quantitative scoring systems for synovitis, BMO, and/or erosions have been introduced (6, 29, 30), but most of these have been used in only a few patients. In a study of 11 PsA patients treated with the biologic agent adalimumab for 24 weeks, significant improvements in MRI of a wrist or knee from baseline at 24 weeks were documented in both clinical measures of disease activity and in MRI BMO and effusion, but not in synovitis (30).

The Outcome Measures In Rheumatology (OMERACT) MRI Working Group has developed the Psoriatic Arthritis Magnetic Resonance Image Score (PsAMRIS) to evaluate inflammatory and destructive changes in PsA hands (29, 31, 32). This index is the most validated assessment system available, and has a documented good intra- and inter-reader reliability. For inflammatory parameters, the reliability is high for change scores and the sensitivity to change was moderate. Bone erosion and proliferation showed very limited change after 1 year in patients treated with tumour necrosis factor (TNF) inhibitors (31).

In a recent 48-week longitudinal study of 41 PsA patients who initiated adalimumab therapy, MRIs were acquired of the hand most clinically involved at baseline, and scored according to the PsAMRIS. In patients who met modified PsA Response Criteria (PsARC) at follow-up, a statistically significant improvement was seen for all inflammatory parameters (synovitis, tenosynovitis and BMO), except for periarticular inflammation. Bone damage showed very little change over time, confirmed by computed tomography (CT) (33).

In a placebo-controlled trial, 22 PsA patients were randomised to receive zoledronic acid/placebo and compared with a 'test-alone' group. Bone oedema scored according to PsAMRIS decreased significantly in the zoledronic acid group, but not in the control group. No differences could be identified between the groups in MRI bone damage progression (34).

In a subgroup of patients from another randomised controlled PsA trial (35), MRIs of abatacept treated patients has recently been assessed (36). Three readers from the OMERACT MRI Arthritis Working Group applied the PsAMRIS to MRIs from 40 patients, 20 of the foot and 20 of the hand, initiating either abatacept or control treatment. In the abatacept group, a statistically significant improvement in synovitis score

was seen in the metatarsophalangeal joint of the foot and for the summed synovitis score of the hands and feet at 6 months follow-up. All other inflammatory parameters improved numerical, but not statistically significantly, in the abatacept group, but not in the placebo group. The bone damage parameters did overall not change over 6 months. Intra- and inter-reader intra-class correlation coefficients were generally high. The responsiveness of the PsAMRIS was excellent for tenosynovitis (hand), synovitis (foot), and periarticular inflammation (hand and foot) (36). Further application of the PsAMRIS in other MRI data sets from longitudinal randomised controlled trials would be highly relevant.

What is the prognostic value of magnetic resonance imaging?

Studies are warranted on the prognostic value of MRI findings in PsA. Studies in RA have established that BMO is a predictor of erosive progression (37), and some data indicate a similar mechanism in PsA. A close relation between erosions and BMO was found in a cross-sectional MRI study of erosive PsA patients; these data suggest that BMO is a 'forerunner' of structural joint damage in PsA (38). In a 48-week longitudinal study of PsA patients, BMO detected by MRI predicted subsequent erosive progression as detected by CT (33).

In RA, some data indicate that a "window of opportunity" exists in the initial weeks or months for long-term drug-free remission (39). Longitudinal MRI studies in very early PsA are relevant. In a small study of PsA patients in remission who stopped treatment, the presence of synovial hypertrophy by ultrasonographic examination at baseline decreased the likelihood for drug-free remission (40), at least over a 6 month period. This indicates that imaging methods may detect subclinical disease; however, more studies are needed to examine whether the concept of "imaging remission" is feasible in PsA.

Conclusion

MRI is highly sensitive to detect pathology in joints, spine and enthuses. An MRI can be valuable in diagnosing PsA when clinical findings are inconclusive by visualisation of characteristic inflammatory and structural features, and patterns of involvement. MRI is responsive to detect changes in inflammation to evaluate treatment efficacy and disease progression. Longitudinal MRI studies on structural damages are sparse, but support that biologic treatment is effective in PsA, although long-term placebo-controlled data are lacking. Baseline MRI findings have been associated with erosive progression, indicating a prognostic value of MRI. Future research in established and new MRI methods, including whole-body MRI, will increase the value of MRI to diagnose, monitor, and establish a prognosis in PsA.

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