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Recent advances in imaging in psoriatic arthritis

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***Abstract*:** The recent introduction of effective therapies in psoriatic arthritis (PsA) has increased the demand for efficient tools for diagnosis, monitoring and prognostication of PsA, and has caused an increased research effort within imaging in this disease. The clinical appearance of PsA is very diverse, involving the spine, sacroiliac joints, peripheral joints and/or entheses, and accordingly imaging findings vary. In the present paper, we present a review of the recent advances in imaging in PsA, focusing primarily on ultrasonography and magnetic resonance imaging of peripheral disease manifestations.

***Keywords*:** magnetic resonance imaging, psoriatic arthritis, ultrasonography

Introduction

Psoriatic arthritis (PsA) is an inflammatory arthritis, which is associated with psoriasis, and characterized by inflammation in axial and peripheral joints and entheses. Furthermore joint damage, i.e. bone erosion, and new bone formation are frequently seen. Reliable tools for diagnosing, monitoring and prognosticating PsA have become more important in recent years due to the appearance of potent treatment options. The specific pathologies of PsA as well as the extent of disease can be visualized by different imaging modalities [Ory *et al.* 2005].

Conventional radiography has been the mainstay in imaging in inflammatory joint diseases, but is not able to detect the inflammatory changes, i.e. the earliest disease manifestations in PsA and other inflammatory joint diseases. In contrast, magnetic resonance imaging (MRI) and ultrasonography (US) allow direct visualization of early inflammatory and destructive joint changes [Østergaard *et al.* 2008], and the technical and scientific developments within MRI and US in inflammatory joint diseases have been tremendous in the last decade. Consequently, in this review we primarily focus on recent advances in MRI and US in peripheral PsA, particularly within approximately the last 5 years. Other imaging modalities, such as bone scintigraphy, computed tomography and single positron emission computed tomography, are also available, but their role in the diagnosis and management of PsA is very limited [Tan and McGonagle, 2008], and they will not be described further.

Conventional radiography

Conventional radiography is the most widely used imaging method in PsA. Radiographs comprise a record of the cumulative joint damage caused by the disease [van der Heijde and Østergaard, 2009], but do not visualize inflammatory changes. Although there are similarities with rheumatoid arthritis (RA) there are also major differences in, for example, the type and site of lesions as well as the joints involved. While RA is characterized by mainly osteodestructive lesions, in PsA there are both osteodestructive and osteoproliferative manifestations, which may even coexist not only in the same patient, but also in the same joint [van der Heijde and Østergaard, 2009]. In particular, the osteoproliferative lesions on radiography are characteristic, and are included in the new classification criteria (CASPAR) for PsA [Taylor *et al.* 2006].

Structural joint damage on conventional radiography is an important outcome measure in PsA. Different radiographic scoring methods have been developed, e.g. the Sharp–van der Heijde modified scoring method for PsA, which is a detailed scoring system for evaluating erosions and joint space narrowing, while osteolysis and pencil in cup phenomena are assessed separately [van der Heijde *et al.* 2005]. Scoring systems are

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primarily used in clinical trials [van der Heijde *et al.* 2005]. No major recent advances have been observed in this field.

Ultrasonography

Ultrasonography in psoriatic arthritis

In recent years, it has been highlighted that US is a highly sensitive tool for both clinical and research purposes in rheumatology [Brown *et al.* 2007; Grassi *et al.* 2005]. US is able to evaluate both structural changes and changes in perfusion in joints, tendons and other soft tissues. The main focus has been on RA, but in recent years an increasing attention has been given the use of US in spondyloarthritis (SpA), including PsA. US examinations have mainly been performed using greyscale (B-mode) US, but newer US techniques include the use of colour or power Doppler US. In Doppler US colour information is superimposed on the greyscale image displaying the reflection of the ultrasound by the moving erythrocytes thereby providing information about perfusion. Doppler US is used in the assessment of changes in tissue vascularization that may occur in inflammatory conditions.

Consensus definitions for ultrasound-related pathologies independent of disease were published in the *Journal of Rheumatology* in 2005 including definitions for synovitis, erosions and enthesopathy [Wakefield *et al.* 2005]. For PsA, peripheral joint involvement has received little attention and focus has mainly been on entheseal involvement.

What can be visualized with ultrasonography?

The US findings in peripheral joints are nonspecific for PsA as they may occur also in patients with other inflammatory conditions. These findings include synovitis, effusion, bone erosions and osteophytes (see Figure 1) and extra-articular pathologies such as bursitis, tenosynovitis and enthesitis. The distributions of joint involvement in patients with PsA are different from those in RA, and there is a predominance of synovitis in distal interphalangeal (DIP) joints compared with patients with RA [Wiell *et al.* 2007].

There are diverging reports regarding the sensitivity of US compared with MRI in diagnosing synovitis. One study with greyscale US reported that MRI is more sensitive in diagnosing synovitis when evaluating metatarsophalangeal (MTP) joints [Weiner *et al.* 2008], but in a study using Doppler US, MRI and Doppler US was found to be equally sensitive in diagnosing inflammatory changes in MTP, metacarpophalangeal (MCP) and proximal interphalangeal (PIP) joints and Doppler US even more sensitive than MRI in DIP joints [Wiell *et al.* 2007].

US contrast agents in the form of microbubbles are used to enhance the scattering reflection of erythrocytes by amplifying the Doppler signal in order to increase the sensitivity of the Doppler examination to low-velocity flow. A single study found that contrast enhancement improved the correlation to MRI synovitis of peripheral joint affection compared with Doppler US alone [Solivetti *et al.* 2010].

Concerning structural bone changes, i.e. bone erosions and osteophytes, results from different studies are ambiguous. In one study, conventional radiography was superior to both MRI and US in the detection of bony changes [Weiner *et al.* 2008], whereas another study found that both US and MRI detect more erosions in MCP joints than radiography, and US detects more osteophytes in MCP and PIP joints than conventional radiography. Furthermore, US was even more sensitive than MRI in detecting bony changes in PIP joints [Wiell *et al.* 2007]. Bone changes in the DIP joints have been reported to be found only in PsA patients, not in RA patients [Wiell *et al.* 2007; Fournie *et al.* 2006]. However, they are difficult to differentiate from osteoarthritis changes, and further studies are warranted in this area.

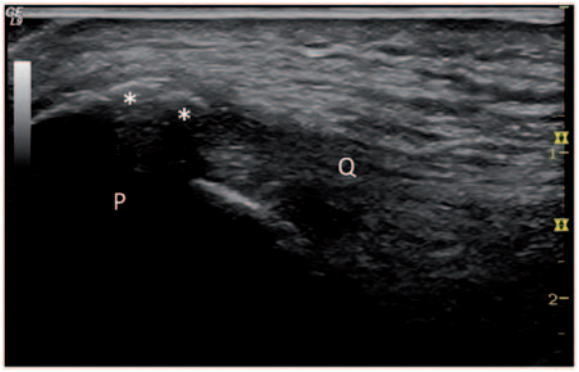

Figure 1. Ultrasonography of calcification and bone spur (*) in the quadriceps tendon (Q) at insertion at the patella (P).

Even though tenosynovitis in PsA is reported with a lower frequency than in RA patients [Wiell *et al.* 2007], flexor tenosynovitis partly explains dactylitis [Gutierrez *et al.* 2010a; Kane *et al.* 1999] and subclinical tenosynovitis may be seen in relation to the extensor tendons of the hand [De Filippis *et al.* 2005]. Entheses are the insertion sites of ligaments, tendons and capsules into the bone. Enthesitis is a characteristic feature of SpA patients. Although enthesitis is not only found in PsA entheses [Frediani *et al.* 2002], sonographic signs of enthesitis are found more frequently in patients with SpA than in controls or in RA patients [D'Agostino *et al.* 2003].

There is some diversity in the description of elementary lesions in enthesitis and the following features are described: presence of increasing thickness and hypoechogenicity of the entheses, presence of enthesophytes, calcifications and erosions at the insertion site and finally bursitis or cortical irregularities [Gutierrez *et al.* 2010a; Alcalde *et al.* 2007; Falsetti *et al.* 2003; Balint *et al.* 2002].

In recent years, Doppler US has been applied to evaluate signs of hyperaemia at the insertion site [de Miguel *et al.* 2009; D'Agostino *et al.* 2003]. Despite an increasing number of studies there is a lack of consensus regarding the US definitions for enthesitis both relating to the structural/degenerative changes seen in greyscale, and the inflammatory changes seen by Doppler ultrasound [D'Agostino *et al.* 2009, 2003; de Miguel *et al.* 2009; Alcalde *et al.* 2007; Balint *et al.* 2002].

Diagnosis by ultrasonography

Like in the RA studies US also appears to be more sensitive than clinical examination for the detection of synovitis, tenosynovitis and enthesitis in patients with PsA [Delle *et al.* 2010; Milosavljevic *et al.* 2005; Galluzzo *et al.* 2000]. There are diverging reports on the occurrence of synovitis in PsA patients compared with RA patients in PIP and MCP joints. Some report an increased frequency of synovitis findings in MCP and PIP joints in PsA patients compared with RA patients [Wiell *et al.* 2007] while others state that synovitis occur with equally frequency in the two diseases [Fournie *et al.* 2006]. There are no reports on the differences in synovitis appearance and distribution in PsA compared with RA.

Since enthesitis is a prominent feature in patients with SpA and may precede joint symptoms, it has been of interest to evaluate the entheses by use of US, as a means of diagnosing SpA and therefore also PsA. Studies have found that enthesitis changes may be found in patients with psoriasis and no joint involvements [Gutierrez *et al.* 2010b; Gisondi *et al.* 2008]. Likewise, Doppler activity in greyscale enthesitis changes is reported in patients with SpA, but not in RA patients and patients with mechanical low back pain [D'Agostino *et al.* 2003]. Despite promising reports it is currently not possible to diagnose PsA solely on the sonographic appearances. Further work is needed to clarify the role of US in the diagnosis of PsA.

What joint and entheses to assess with ultrasonography?

There is no general agreement on which joints or entheses to include in the evaluation of patients with PsA. The main focus on entheseal involvement has primarily been on the lower limb [Alcalde *et al.* 2007; D'Agostino *et al.* 2003; Balint *et al.* 2002].

Monitoring with ultrasonography

Most studies which aim to monitor treatment response have applied semi-quantitative scoring systems for grey-scale and/or Doppler changes. The scoring systems used are either those used in monitoring RA treatment [Szkudlarek *et al.* 2003], or similarly semi-quantitative scores developed by the respective authors [Solivetti *et al.* 2010; Fiocco *et al.* 2005]. In a study with TNF-alpha blocker treatment, it was determined that disease-modifying antirheumatic drug (DMARD)-resistant knee arthritis, in both RA and PsA, responded well to treatment with a significant reduction in both greyscale and Doppler semiquantitative scores at 12 months follow up. There was no significant difference in treatment response between the RA and the PsA patients [Fiocco *et al.* 2005]. We are not aware of a scoring system developed only for PsA.

More attention has been given to the scoring of entheseal involvement. The first to propose a greyscale scoring system of lower limb enthesitis were Balint and colleagues [Balint *et al.* 2002], and since then several other scoring systems have been proposed also including Doppler US [de Miguel *et al.* 2009; D'Agostino *et al.* 2003]. None of the scoring systems have been validated for monitoring PsA or other spondyloarthritides,

and the sensitivity to change has not been assessed. More work to develop standardized and responsive US outcome measures in PsA is needed.

Prognostication with ultrasonography

There are no studies evaluating the role of US for prognosticating PsA. Entheseal involvement in patients with psoriasis, but without clinical PsA indicate that enthesitis may be a predictor of development of PsA [Gisondi *et al.* 2008]. However, longitudinal studies are required to clarify this [Szkudlarek *et al.* 2003].

Axial ultrasonography

There are no studies involving US in the evaluation of spinal inflammation in patients with PsA. The sacroiliac (SI) joints are often involved in PsA, but US can only visualize the superficial part of the joint and the surrounding soft tissue structures. Furthermore, the image quality may be considerably impaired in obese patients.

Very few studies involve US in the evaluation of the SI joints in PsA. A recent study evaluated SI joints in SpA patients compared to healthy controls and found that US detected a significantly higher degree of effusion in patients with SpA compared with controls, and that US detected effusion was associated with low back pain in SpA patients [Spadaro *et al.* 2009]. There are no US scoring systems for inflammation of the spine and SI joints.

New techniques in ultrasonography

Within the last 5 years there has been a great technological development with high-frequency probes and high-frequency Doppler, which have made it possible to improve the resolution of the greyscale image and the sensitivity to low-velocity flow. Some of the new probes allow three-dimensional (3D) US, a new ultrasound modality which seems promising in the assessment of joint pathology in inflammatory diseases. One of the advantages may be related to the virtual operator independence due to image acquisition of infinite 3D data sets obtained by transducer automated sweeping.

3D US has been shown to demonstrate enthesitis pathology well [Iagnocco *et al.* 2009], and appears to improve interobserver reliability in the assessment of synovitis and bony erosions [Naredo *et al.* 2010]. Further studies are needed to validate this technique in PsA.

Magnetic resonance imaging

MRI in psoriatic arthritis

The clinical appearance of PsA is very diverse, involving the spine, SI joints, peripheral joints and/or entheses, and accordingly MRI findings vary. MRI in PsA has received less research scrutiny than in RA and ankylosing spondylitis, but this is likely to change, as MRI outcome measures are increasingly being used in clinical trials of new therapeutic agents. Only a few studies have been published where the focus was specifically on PsA, and most of the current knowledge is from studies of groups of patients with different spondyloarthritides [McQueen *et al.* 2006].

Relevant reviews of the status of MRI in PsA in recent years have been published [Cimmino *et al.* 2009; McQueen *et al.* 2008, 2006]. MRI findings, e.g. synovitis, tenosynovitis, periosteal post-contrast enhancement and bone oedema are very frequent in symptomatic PsA [Ghanem *et al.* 2007; Wiell *et al.* 2007].

What can be visualized with MRI?

MRI can visualize both peripheral and axial musculoskeletal anatomy and PsA disease manifestations. Findings include synovitis, tenosynovitis (Figure 2), periarticular inflammation (Figure 3), enthesitis, bone oedema (Figure 4), bone erosion and bone proliferation [Østergaard *et al.* 2009].

In a retrospective study of 10 patients with the clinical diagnosis of PsA, MRI of 13 hands and 10 wrists were analysed for involvement of bones, joints, tendons and other soft tissues [Tehranzadeh *et al.* 2008]. Synovitis was found in all wrists and hands. Bone marrow oedema, erosions and soft tissue involvement were more prevalent in the wrist than in the hand. No hypertrophic bone changes were detected, which may be due to the fact that only patients with normal radiographs were included.

MRI is highly sensitive for active enthesitis [Eshed *et al.* 2007]. It has been reported that the bone marrow oedema in PsA is often located close to the entheses, in contrast to the situation in RA, where bone marrow oedema often is located close to the capsular attachments, and to osteoarthritis where it is mainly located in subchondral areas [Totterman, 2004].

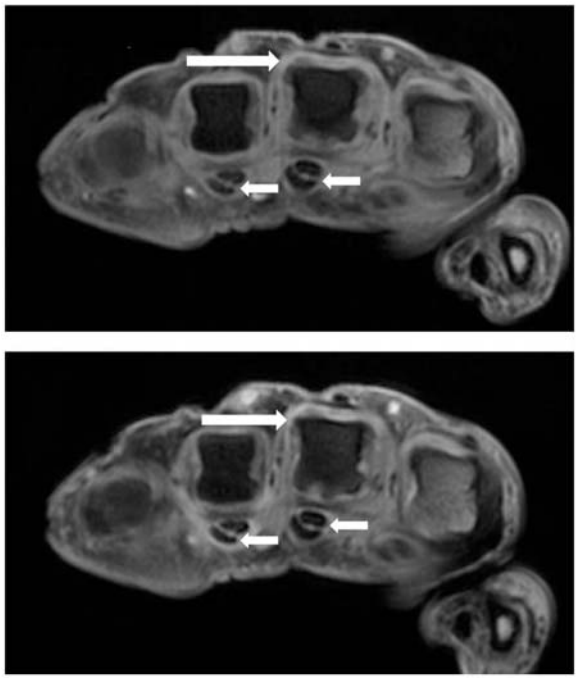

Figure 2. Axial T1-weighted magnetic resonance images of the metacarpophalangeal joints, obtained before (upper image) and after (lower image) intravenous contrast injection in a patient with PsA. Synovitis is seen in the third MCP joint (long arrows). Flexor tenosynovitis in the third and fourth flexor tendons are also seen (short arrows).

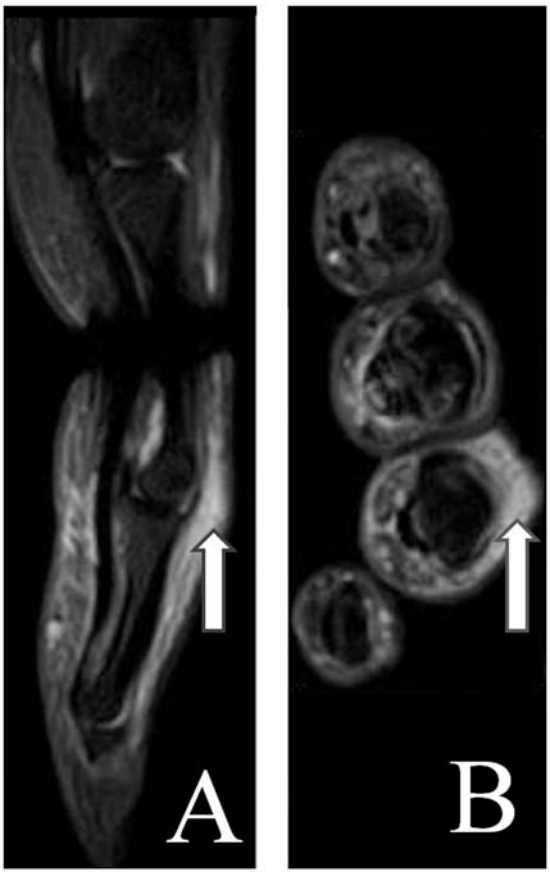

Figure 3. Sagittal (A) and axial (B) short tau inversion recovery (STIR) magnetic resonance images of the 4th finger. Arrows mark periarticular inflammation.

The entheses has attracted attention, as a possible primary location of disease. McGonagle has reported that perientheseal bone oedema is an integral feature of enthesitis, and suggest that synovitis is a secondary feature [McGonagle, 2005]. Another MRI study of 6 PsA patients with dactylitic fingers concluded that dactylitis is mainly due to flexor tenosynovitis, whereas no bone oedema was found at the insertions of extensor or flexor tendons, or at other sites in the phalanges, suggesting that enthesitis has no key role in PsA dactylitis [Olivieri *et al.* 2002].

Nail disease is common in PsA. The relationship between extensor tendon enthesitis in the PsA DIP joint and the nail bed has been studied by Tan, McGonagle and coworkers, e.g. in a study of 10 patients, in which diffuse DIP joint inflammation on MRI was found to extend to the nail bed [Tan *et al.* 2007]. However, as it was a cross-sectional observational study, it was not possible to draw any conclusions on the sequence of events. A later MRI study of nails in patients with skin psoriasis found characteristic nail involvement in all patients, and the authors suggested that onychopathy is preceding DIP joint damage in PsA, and that MRI of nails is of diagnostic value in undifferentiated SpA [Soscia *et al.* 2009].

PsA can be clinically silent, which was shown in a study of 25 patients with active nummular and/or plaque psoriasis, where clinical arthropathy was ruled out by a rheumatologist. It was found that 68% was positive for at least one arthritic sign [periarticular oedema, tendon sheath effusion, intra-articular effusion, synovial pannus, bone erosion, bone cysts, subchondral changes or joint (sub)luxation] using MRI of the hand, and 32% using a conventional X-ray of the hand [Offidani *et al.* 1998]. Only in one of 12 examined healthy controls significant pathology (a bone cyst) was found.

Another study of 26 patients with skin psoriasis without arthritic signs or symptoms and

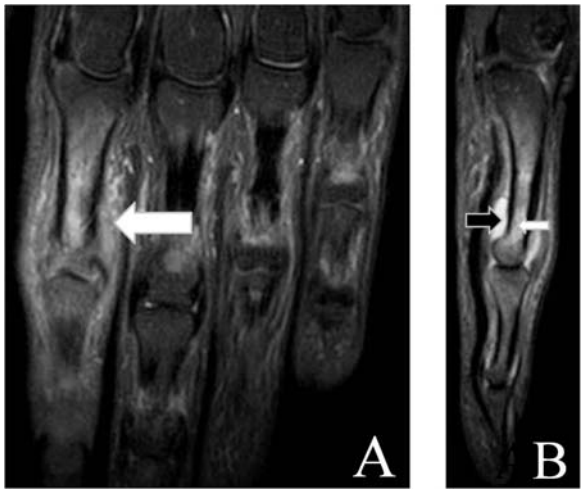

Figure 4. Coronal (A) and sagittal (B) short tau inversion recovery (STIR) magnetic resonance images showing synovitis (black arrow), bone marrow oedema (small white arrow) and periarticular oedema (big white arrow) of the second proximal interphalangeal joint region.

10 healthy controls, describes that pathologic changes were identified by MRI of the feet in 24 patients (92%), whereas no abnormalities were found in the control group [Erdem *et al.* 2008]. Similarly, MRI of the knees detected enthesitis at the patellar tendon insertion in five out of six skin psoriasis patients, without clinical joint involvement, and were absent in 20 healthy controls [Emad *et al.* 2010]. The result described above illustrates the potential of MRI for assessing subclinical disease. The fact that subclinical joint inflammation may occur in psoriasis is supported by a bone scintigraphy study of 50 patients with psoriasis without clinical arthropathy. The study found 35 (70%) patients with axial and/or peripheral joint involvement, compared with 4 (16%) of 25 controls referred to scintigraphy for unrelated problems [Raza *et al.* 2008].

Which joints to assess with MRI?

PsA affects both axial and peripheral joints and entheses, and a general agreement on which joints to image to assess PsA activity and damage is not established, and possibly needs to be individualized, based on the disease pattern. It is generally suggested that T1-weighted (T1w) sequences are in two planes, supplemented by a T2-weighted (T2w) fat-suppressed or short tau inversion recovery (STIR) sequence, preferable also in two 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 oedema and bone proliferation [Østergaard *et al.* 2009].

Diagnosis with MRI

As described above, MRI can detect the different pathologies involved in PsA. However, there are no studies that have documented that MRI in an early undifferentiated arthritis cohort can be used to differentiate PsA from other arthritides. Most studies have compared patients with known diagnoses: in a study by McQueen and colleagues, MRI could not distinguish between peripheral PsA and RA when synovitis and erosions were evaluated [McQueen *et al.* 2006].

In another study, MRI of the hand and wrist was reported to be able to differentiate between established disease in PsA and RA [Schoellnast *et al.* 2006]. This was a retrospective analysis of 18 PsA and 21 RA patients with arthralgia. Significant differences were found in the frequency of bone erosions (86% of RA and only 17% of PsA patients) and periostitis (0% of RA and 78% of PsA patients), and they also found that PIP joints were more frequently affected in PsA patients. A limitation of the study was that the DIP joints were not scanned [McGonagle *et al.* 1999].

Monitoring with MRI

Most studies only report qualitative MRI assessments of the different pathologies of PsA (see McQueen *et al.* [2006] for a summary up to 2005). Quantitative assessment of contrast enhancement has been reported [Cimmino *et al.* 2005; Antoni *et al.* 2002]. In an early study of anti-TNF agents in PsA, treatment response to infliximab was monitored with MRI at baseline, and after 10 weeks [Antoni *et al.* 2002]. Eight patients were imaged with a dynamic MRI sequence, and time-dependent signal intensity increase, reflecting synovitis, was substantially and significantly reduced after 10 weeks.

Some authors have described scoring systems for bone marrow oedema, erosions and/or synovitis [e.g. Anandarajah *et al.* 2010; Tehranzadeh *et al.* 2008], but these have only been used in a few patients and not outside the introducing centre. In one of these studies, a study of 11 PsA patients treated with the anti-TNF agent adalimumab for

24 weeks, MRI of a wrist or knee at baseline and follow up showed significant improvements at 24 weeks in both clinical measures of disease activity and in MRI bone marrow oedema and effusion, but not synovitis [Anandarajah *et al.* 2010]. Furthermore, Healy and colleagues have found therapy-induced decreases in both clinical and MRI assessments of dactylitis [Healy *et al.* 2008].

To be able to compare the results of different MRI studies of PsA, it is of major importance to have a standardized system for scoring the pathologies. The international OMERACT MRI in inflammatory arthritis group has developed the OMERACT Psoriatic Arthritis Magnetic Resonance Image Scoring System (PsAMRIS) for the evaluation of inflammatory and destructive changes in PsA hands [Østergaard *et al.* 2009; McQueen *et al.* 2007]. The last version of the PsAMRIS system (Table 1) has very good reliability for assessment of inflammatory changes (synovitis,

Table 1. The OMERACT MRI in inflammatory arthritis task force recommendations for MRI definitions of important pathologies in peripheral psoriatic arthritis (PsA) and a PsA MRI scoring system [Østergaard *et al.* 2009].

A. Definitions of important PsA joint pathologies

Synovitis: An area in the synovial compartment that shows increased postgadolinium (post-Gd) enhancement* of a thickness greater than the width of the normal synovium.
**Enhancement* (*signal intensity increase*) *is judged by comparison between T1-weighted* (*T1w*) *images obtained before and after intravenous* (*IV*) *gadolinium* (*Gd*) *contrast.*
Tenosynovitis: Signal characteristics consistent with increased water content* or abnormal post-Gd enhancement** adjacent to a tendon, in an area with a tendon sheath.
**High signal intensity on T2-weighted* (*T2w*) *fat-saturated* (*FS*) *and short tau inversion recovery* (*STIR*) *images, and low signal intensity on T1w images.*
***Enhancement is judged by comparison between T1w images obtained before and after IV Gd contrast.*
Periarticular inflammation: Signal characteristics consistent with increased water content* or abnormal post-Gd enhancement** at extraarticular sites including the periosteum ('periostitis') and the entheses ('enthesitis'), but not the tendon sheaths***.
**High signal intensity on T2w FS and STIR images.1w images, obtained before and after IV Gd contrast.*
***Enhancement is judged by comparison between T1w images, obtained before and after IV Gd contrast.*
****Defined as tenosynovitis.*
Bone marrow oedema: A lesion* within trabecular bone, with signal characteristics consistent with increased water content** and often with ill-defined margins.
**May occur alone or surrounding an erosion or other bone abnormalities.*
***High signal intensity on T2w FS and STIR images, and low signal intensity on T1w images.*
Bone erosion: A sharply marginated bone lesion, with typical signal characteristics*, which is visible in two planes with a cortical break seen in at least one plane**.
**On T1w images: loss of normal low signal intensity of cortical bone and loss of normal high signal intensity of marrow fat.*
***This appearance is nonspecific for focal bone loss. Other lesions such as bone cysts may mimic erosions.*
Bone proliferation: Abnormal bone formation in the periarticular region, such as at the entheses (enthesophytes) and across the joint (ankylosis).

B. Scoring system (OMERACT PsAMRIS) for hands

Regions to score: Regions are delimited at the midpoint of phalangeal bones. D: Distal interphalangeal (DIP) joint region; P: Proximal interphalangeal joint (PIP) region; M: Metacarpophalangeal (MCP) joint region. Each region is subdivided into two sub regions (D1, D2, P1, P2, M1 and M2) by a transverse line through the joint space.
Synovitis: To be scored 0–3 per M, P and D region. Grading scale: Score 0: normal; 1: mild; 2: moderate; 3: severe (by thirds of the maximum potential volume of enhancing tissue in the synovial compartment).
Flexor tenosynovitis: To be scored 0–3 per M, P and D region. Grading scale: Per maximal thickness of enhancing/bright signal on T1w postcontrast/STIR or T2w FS images, as follows: Grading scale: 0: none; 1: $<$½ tendon thickness; 2: $\geq$½ and $<$1 tendon thickness; 3: $\geq$1 tendon thickness.
Periarticular inflammation: To be scored 0–1 in the dorsal part and 0–1 in the palmar part of each M, P and D region. Grading scale: 0: absent; 1: present.
Bone oedema: To be scored 0–3 per M1, M2, P1, P2, D1 and D2 regions. Grading scale: The scale is 0–3 based on the proportion of bone with oedema, compared with the 'assessed bone volume', judged on all available images: 0: no oedema; 1: 1–33% of bone oedematous; 2: 34–66%; 3: 67–100%
Bone erosion: To be scored 0–10 per M1, M2, P1, P2, D1 and D2 regions. Grading scale: The scale is 0–10, based on the proportion of eroded bone compared with the 'assessed bone volume', judged on all available images: 0: no erosion; 1: 1–10% of bone eroded, 2; 11–20% etc. The 'assessed bone volume' is from the articular surface (or its best estimated position if absent) to a depth of 1 cm.
Bone proliferation: To be scored 0–1 in each M, P and D region. Grading scale: 0: absent; 1: present.

PsAMRIS, Psoriatic Arthritis Magnetic Resonance Image Scoring System.

tenosynovitis, periarticular inflammation), as the interobserver intraclass correlation coefficients for both status and change scores were all >0.85 [Bøyesen *et al.* 2010a]. Furthermore, the reliability was good for damage (bone erosion and bone proliferation) status scores (0.77–0.97), while only moderate for changes in bone erosions (0.44). The sensitivity to change was good for inflammatory parameters (standardized response means all >0.80) [Bøyesen *et al.* 2010b]. The usefulness of the OMERACT PsAMRIS in clinical trials and practice needs further testing.

Prognosticating with MRI

In RA, bone marrow oedema is an important predictor of subsequent progressive radiographic joint damage [Hetland *et al.* 2009; Haavardsholm *et al.* 2008; McQueen *et al.* 1999]. No formal studies of the prognostic value of MRI findings in PsA are available. Based on a cross-sectional MRI study of 11 patients with the aggressive arthritis mutilans (AM) form of PsA, and 17 non-AM patients (erosive PsA without bony lysis), in which there was close relation between presence of erosion and bone oedema, the authors suggest that MRI bone oedema is also in PsA a 'forerunner' of structural joint damage [Tan *et al.* 2009]. Further longitudinal studies are needed to clarify this.

Axial MRI in psoriatic arthritis

The knowledge about MRI of axial involvement in PsA mainly originates from studies including various spondyloarthritides, and axial disease is not the topic of this paper. However, MRI is very sensitive for detection of sacroiliitis and spondylitis in SpA [Østergaard *et al.* 2010; Weber *et al.* 2009].

New MRI techniques

Whole-body MRI [Weckbach *et al.* 2009; Althoff *et al.* 2007; Appel *et al.* 2007] potentially allows simultaneous assessment of both peripheral and axial disease manifestations in PsA, and if the methodology is further refined and proves successful in future studies, it may constitute a major step forward for the monitoring of the overall disease status in clinical trials and practice in PsA.

With a dynamic, gadolinium-enhanced MRI technique it is possible to evaluate the inflammatory activity, as assessed by histology, in RA joints [Østergaard *et al.* 1998; Gaffney *et al.* 1995]. By dynamic MRI it may be possible to differentiate active disease from remission in RA [Cimmino *et al.* 2003]. There are very limited data from PsA patients, but in a small study of wrists in PsA and RA, no difference in dynamic contrast enhancement in the synovium was found between the PsA and RA patients, when matched for disease activity, but all PsA patients had significant higher enhancement than healthy controls [Cimmino *et al.* 2005].

In another comparative study of 10 PsA and 10 RA patients with at least one swollen MCP joint, conventional and dynamic contrast-enhanced MRI was not able to differentiate between the diagnoses, but more diffuse extracapsular enhancement/entheseal-based pathology was found in patients with PsA [Marzo-Ortega *et al.* 2009]. Thus, the diagnostic utility of dynamic MRI has so far proved limited, but this technique may constitute an improved method for monitoring inflammatory activity in PsA. However, further studies are needed.

Conclusions

MRI and ultrasonography are excellent tools for the evaluation of patients with PsA, because both peripheral and axial (only MRI) pathology can be visualized. However, a lot of scientific work to determine their potential value for diagnosis, monitoring and prognostication is still to be done.

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Conflict of interest statement

None declared.

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