Standardizing the monitoring of outcome measures: imaging in psoriatic arthritis

The wide spectrum of manifestations of musculoskeletal inflammation in psoriatic arthritis makes standardized assessment of joint damage in psoriatic arthritis a challenge. Assessment of erosions and joint space narrowing on plain radiographs of the hands and feet has remained the benchmark for assessing damage in psoriatic arthritis. The methods used to assess damage have been mostly borrowed from those used in rheumatoid arthritis. Axial joint involvement has not been systematically addressed. Methods to assess spinal disease have been borrowed from those used in ankylosing spondylitis. Both ultrasound and MRI have demonstrated promise in the assessment of psoriatic arthritis. The Outcome Measures in Rheumatology Clinical Trials (OMERACT) group is involved in the development of valid, reliable and feasible methods for assessment of joint involvement in psoriatic arthritis.

KEYWORDS: inflammation ■ joint damage ■ MRI ■ psoriasis ■ radiography ■ spondylitis ■ ultrasonography ■ validation

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Psoriatic arthritis (PsA) is an inflammatory musculoskeletal disease associated with psoriasis [1]. Psoriasis is an inflammatory, immune-mediated skin disease that occurs in 2–3% of the worldwide population [2]. Up to 30% of patients with psoriasis may develop inflammatory musculoskeletal manifestations including synovitis of the peripheral joints (peripheral arthritis), which occurs in the majority of patients, inflammation of the joints of the spine (axial PsA), inflammation at the insertions of tendons and muscles into bone (enthesitis) and inflammation of the whole digit affecting fingers and toes (dactylitis) [3]. Although in the past PsA was considered a mild form of arthritis, over the past several decades it has become apparent that the arthritis is more common and more severe than previously appreciated. Some 20% of the patients develop a severe, destructive form of arthritis called arthritis mutilans, which in the past was thought to occur in only 5% of cases, and more than 55% of the patients develop at least five deformed joints over the 10-year follow-up period [4]. This results in a significant reduction in joint function and is associated with a reduced quality of life in patients with PsA [5].

The Group for Research and Assessment of Psoriasis and Psoriatic Arthritis (GRAPPA), an international collaborative group including rheumatologists, dermatologists, radiologists, methodologists and members of patient groups and industry, in collaboration with the Outcome Measures in Rheumatology Clinical Trials (OMERACT) group, which develops and validates outcome measures in rheumatology, identified several measures that should be assessed in patients with PsA [6]. These include the assessment of peripheral joints, skin and nail lesions, patient assessment of pain, patient assessment of function, patient and physician assessment of disease activity and patient assessment of quality of life. In addition, radiographic assessment was highly recommended, although not yet mandatory since the instruments to assess radiographs in PsA have not been validated. Moreover, other imaging modalities, such as ultrasound (US) and MRI were considered important and included in the research agenda.

In this article we review the imaging modalities used in the assessment of patients with psoriasis and PsA, discuss the controversies associated with their use, and recommend future approaches. The search was conducted in PubMed, using the keywords: PsA, spondylitis, imaging, radiography, MRI, ultrasound and scintigraphy. Articles relevant to PsA were selected.

Why should we use imaging to assess patients with PsA?

Psoriatic arthritis may be a very aggressive disease with rapid progression to joint damage. In a study of a cohort of patients with early PsA, who were presented to an early arthritis clinic within 5 months of the onset of symptoms, 27% of the 129 patients already had at least one joint erosion at presentation [7]. Over the first 2 years of follow-up 47% of these 129 patients had at least one erosion, and this is despite the

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fact that 56% of the patients had been treated with DMARDs. An observational study of 220 patients identified 67% of the patients with erosive disease at first visit, with an average disease duration of 9 years [8]. Another study of 71 patients who had no erosive disease at recruitment reported that 45% of the patients developed erosive disease over an average of 8 years [9]. Thus, the study with the early PsA cohort suggests that patients with PsA develop erosions early, whereas the observational cohorts demonstrate that patients with PsA sustain progression of damage over time. Some studies of progression of damage have used clinical damage (defined as the presence of deformities, limitation of movement of greater than 20% of the range not related to a joint effusion, flail joints, fused joints or joints that have undergone replacement) as the outcome measure, since it is an assessment that can be made at the bedside at each visit and does not require additional cost or radiation exposure [10,11]. However, it has been demonstrated that there is a strong relationship between clinical and radiological damage, as radiological damage often precedes the detection of clinical damage [12]. Moreover, it has been demonstrated that patient function, as determined by the Health Assessment Questionnaire Score, is related to clinical and radiological damage [13]. In addition, the presence of erosion at first visit was a risk factor for mortality among patients with PsA [14]. Thus, imaging of the joints is relevant in patients with PsA. In addition to radiographs, other imaging modalities include US and MRI. These techniques have higher sensitivity in the detection of synovitis and joint damage and may prove useful in early detection of joint damage. However, prospective studies using these modalities are not currently available.

Thus, it is important to assess patients with PsA using imaging in order to detect early changes and follow the progression of the disease. It is also important to determine response to therapy in terms of prevention of damage progression.

Imaging in PsA: current status

Plain radiographs are used to determine the presence of periostitis (a criterion for classification of PsA) assess damage (erosions, osteolysis, subluxation and ankylosis) in the peripheral joints, determine the extent of involvement in the sacroiliac joints and the joints of the spine, identify the presence of spurs at the entheses and record the presence of dactylitis.

Imaging peripheral joints in PsA

Several features can be identified by radiographic assessment of the peripheral joints in PsA [15]. Erosions, which can be marginal or nonmarginal, can be detected. Periostitis or a bony reaction at the sites of inflammation or tendon insertion may be noted. In PsA the periostitis is specifically 'fluffy'. Severe erosive disease leads to the 'pencil-in-cup' change that is typical for PsA. However, patients with PsA also demonstrate ankylosis, and at times one finds one joint totally destroyed with a pencil-in-cup change while the next joint in the same digit demonstrates total ankylosis. Recognizing these radiographic features is important, as they can help differentiate patients with PsA from those with rheumatoid arthritis (RA) and those with osteoarthritis or even gout.

To assess severity and progression over time and to compare across studies, a number of radiographic scoring methods have been used to record changes in the peripheral arthritis of PsA [16]. These include a modification of the Steinbrocker method, originally developed for RA [17]; a modification of the Sharp method, also originally developed for RA [18,19]; the van der Heijde (vdH) modification of the Sharp method [20]; the Larsen method [21] and the Ratingen method [22]. The Ratingen method is the only one specifically developed for PsA.

While the modified Steinbrocker and the Larsen methods assess each of the hand and foot joints globally, the Sharp and the vdH–Sharp methods record each site for erosion and joint space narrowing (JSN) separately. The original Sharp method includes only the hands and wrists while the vdH–Sharp includes the feet. The Ratingen method includes scores for bony proliferation. A comparison of these methods is given in Table 1. The Sharp and vdH–Sharp methods have been used to evaluate radiographic progression in randomized controlled trials with anti-TNF agents [19,23,24].

Modified Steinbrocker method

The original Steinbrocker classification scored a patient with RA according to their worst joint [25]. The modified Steinbrocker method scores the wrists, metacarpophalangeal (MCP), proximal and distal interphalangeal, metatarsophalangeal (MTP) joints as well as the interphalangeal joints of the first toes (total: 42 joints) on a 0–4 scale where 0 is normal, 1 represents juxta-articular osteopenia or soft tissue swelling, 2 represents erosion without JSN, 3 represents erosion and JSN and 4 means total joint destruction, either

Table 1. Comparison of scoring methods used to assess radiographic joint damage to peripheral joints in psoriatic arthritis.

Scoring method	Joints scored	Features scored	Subscores	Total score range
Modified Steinbrocker	Hands, wrists, feet; total number of sites scored: 42	Juxta-articular osteopenia, soft tissue swelling, erosion, JSN, joint destruction (either lysis or ankylosis) and surgery	None	0–168
Sharp	Hands, wrists, feet; total number of sites scored: 54 for erosions, 48 for JSN	Erosions (including osteolysis) and JSN	Erosions (0–378); JSN (0–192)	0–570
van der Heijde–Sharp	Hands, wrists, feet; total number of sites scored: 38 for erosions, 44 for JSN	Erosions (including osteolysis ankylosis) and JSN	Erosions (0–320); JSN (0–208)	0–528
PsA Ratingen score	Hands, wrists, feet; total number of sites scored: 40	Erosions (destruction) and proliferation (new bone formation)	Destruction score (0–200); proliferation score (0–126)	0–360

JSN: Joint space narrowing; PsA: Psoriatic arthritis.

lysis or ankylosis or surgery [17]. The total score ranges from 0 to 168. This method has face and content validity, and is reliable (intraclass correlation coefficient [ICC] for interobserver reliability = 0.86, intraobserver reliability = 0.80), sensitive to change and feasible for use in longitudinal cohorts. It has not been used in randomized clinical trials; however, in nested case–control studies this method has demonstrated that traditional DMARDs have not been able to prevent progression of joint damage in PsA [26–29].

Sharp scoring method for PsA

The Sharp scoring method was first developed for scoring radiologic abnormalities in the hands and wrists of patients with RA [18]. Based on this method, two groups of rheumatologists and radiologists developed a scoring method for PsA [16]. The method for scoring was reviewed by van der Heijde *et al.* [16]. This method was applied in at least two randomized trials in PsA. In the trial with etanercept, 21 joints of each hand and wrist were scored for erosions on a scale of 0–5, and 20 joints were scored for JSN on a scale of 0–4 [19]. The scores from each joint were totalled to determine erosion and JSN scores, and the erosion and JSN scores were added to determine the total Sharp score. Distal interphlangeal (DIP) joints were included in the analyses. Joints in the feet were excluded. This method was demonstrated to be reliable (ICC for interobserver reliability for status score was 0.81–0.88 for four readers; for annualized progression rate the interobserver ICC was 0.63) and sensitive to change. At 12 months, radiographic disease progression was significantly inhibited in the etanercept group compared with worsening of disease in the placebo group. In the Adalimumab Effectiveness in Psoriatic Arthritis Trial (ADEPT), a total of 54 sites on radiographs of the hands and feet were evaluated for erosions, and 48 sites were evaluated for JSN [24]. The maximum modified total Sharp score possible was 570 (378 Sharp units for joint erosions and 192 units for JSN). Although data on interobserver and intraobserver reliability were not reported, the effect of interobserver variance on the discriminatory power of the radiographic data was assessed by calculating the smallest detectable change. The scoring method used in the ADEPT trial demonstrated that adalimumab treatment reduced joint damage progression at weeks 24, 48 and 144 [30]. A modification of the Sharp score was also recently validated using data from a longitudinal cohort [31]. This modification of the Sharp score represents only hand joints and assigns maximum JSN score and erosion scores to ankylosis and joint space widening, respectively. The maximum score for erosions was 210 and for JSN was 176. This modification of the Sharp score was shown to have criterion validity and to be reliable and sensitive to change [31].

vdH–Sharp method for PsA

The vdH–Sharp scoring method was first developed for scoring radiologic abnormalities in the hands and feet of patients with RA [20]. The method was subsequently adapted for PsA (reviewed by van der Heijde *et al.* [16]). This method was used in the Infliximab Multinational Psoriatic Arthritis Controlled Trials (IMPACT) 1

and 2 [23,32]. In the IMPACT 2 trial, using the read data from two observers for all patients and the reread data for 10% of randomly selected patients, an interobserver ICC, and an intraobserver ICC for the total vdH–Sharp scores were estimated at baseline and at weeks 24 and 54. In order to assess reader consistency, changes from baseline in the total score at both week 24 and week 54 were compared between observers. The ICC of the interobserver and intraobserver reliability estimated at baseline, week 24 and week 54 ranged from 0.97 to 1. There was also agreement in treatment effect between the two observers, when change between baseline and week 24 and week 54 assessments was analyzed. At week 24 and at week 54, patients randomized to receive infliximab had less radiographic progression compared with patients randomized to receive placebo.

PsA Ratingen score

Of all the available methods used to assess peripheral PsA, the PsA Ratingen score was developed specifically for the PsA [22]. While scoring PsA Ratingen score, destructive and proliferative changes in 40 joints of the hands and feet are scored separately. The destruction score (0–200) and the proliferation score (0–160) are added to give a total score ranging from 0 to 360 for each patient. The method for scoring was reviewed by van der Heijde *et al.* [16]. The reliability and sensitivity to change were determined using radiographs of 20 patients with active PsA taken 3 years apart and were read twice in pairs, knowing the chronological order. There was good interobserver and intraobserver agreement with respect to the destruction score, and lower but still acceptable agreement with respect to proliferation score [22]. The reliability of the method to describe change over time was also good.

Thus, all the available radiographic scoring methods seem to have face validity, reasonable inter- and intra-observer reliability and sensitivity to change. The feasibility depends on the context; all methods are feasible in assessing severity and change in randomized trials. However, in longitudinal cohorts and routine clinical practice, it is our opinion that the modified Steinbrocker is the most feasible.

Imaging axial joints in PsA

Radiographic involvement of the axial joints is seen in 30–50% of patients with PsA [33]. Although radiographic features in the spine in axial PsA (AxPsA) are often indistinguishable from those of ankylosing spondylitis (AS), there are important differences [34,35]. Asymmetric sacroiliitis, nonmarginal asymmetric syndesmophytes, paravertebral ossification and more frequent involvement of cervical spine are features more often seen in AxPsA when compared with AS [35]. High frequency of fusion of the posterior elements (facet or zygoapophyseal joints) of the cervical spine in PsA has also been reported [36,37]. Atlanto-axial subluxation is also a feature [38]. Moreover, spondylitis may occur in AxPsA without radiologic evidence of sacroiliitis [39].

Radiographic assessment of the sacroiliac joints

The sacroiliac joints in PsA are assessed by the same method used to detect sacroiliitis in AS. On anteroposterior plain radiographs of the pelvis, the right and left sacroiliac joints are assessed for the presence of erosions, sclerosis and ankylosis. The New York criteria for AS are used to grade the severity of sacroiliitis: 0 is considered normal, 1 suspicious, 2 represents the presence of erosions and some sclerosis, 3 represents obvious sacroiliac changes with erosions, sclerosis and bony bridging and 4 reflects total ankylosing of the sacroiliac joint [40]. It has been recognized that in PsA sacroiliac involvement tends to be asymmetric, with occasional involvement of one sacroiliac joint but not the other, or with different grades in the two sacroiliac joints. This is in contrast to AS where the involvement of the sacroiliac joints tends to be symmetric [35].

Radiographic assessment of the spine

Given the lack of a clear definition of AxPsA, studies that have systematically evaluated the presence, severity and progression of AxPsA are few. No clinical trial has specifically evaluated treatments for AxPsA. In observational cohort studies, syndesmophytes, both marginal and paramarginal, atlanto-axial subluxation and paramarginal ossification are recorded as being present or absent [41]. The severity and extent of involvement may be assessed using methods developed for the assessment of AS. These methods include, the Bath AS Radiology Index (BASRI), the modified Stokes Ankylosing Spondylitis Spinal Score (mSASSS) and Radiographic AS Spinal Score (RASSS) [42–44]. However, the validity of these measurements in the assessment of AxPsA is not established.

Psoriatic Arthritis Spondylitis Radiology Index

The Psoriatic Arthritis Spondylitis Radiology Index (PASRI) was developed specifically to assess axial involvement in AxPsA [45]. The

PASRI scores the sacroiliac joints, the lumbar and cervical spine. Sacroiliac joints are scored individually from 0 to 4 (using the New York criteria) and added together to give a score range from 0 to 8. On both anteroposterior and lateral views of the lumbar spine, the lower border of T12 to the upper boarder of S1 is scored using the mSASSS grading: 0–3 (0: normal; 1: erosion, sclerosis and squaring; 2: syndesmophyte nonbridging; 3: bridging syndesmophyte) for each vertebral corner, giving a score range from 0 to 36. The lateral view cervical spine is scored similarly from the lower border of C2 to the upper border of C6. In addition, 1 point is awarded for every facet joint from C2 to C6 fused posteriorly (C2/C3, C3/C4, C4/C5 and C5/C6) to obtain a score range from 0 to 28. The total PASRI score thus ranges from 0 to 72 [45]. In the original study, PASRI was compared with BASRI and mSASSS. The PASRI also had fewer 0 scores than the mSASSS and the score range for the PASRI exceeded that of the mSASSS and the BASRI. Correlation with anthropometric and patient-reported outcomes was good for both the PASRI and BASRI [45].

We have explored the reliability of the various scoring methods in AxPsA. The interobserver reliability of PASRI, mSASSS, RASSS and BASRI spine was 0.88, 0.65, 0.68 and 0.52, respectively, and the intraobserver reliability was 0.92, 0.91, 0.9 and 0.77, respectively [46]. Thus, PASRI was the most reliable method used to assess AxPsA. Sensitivity to change over time is being determined.

Other radiographic features of PsA

In clinical trials, while scoring the radiographs, observers have recorded features characteristic of PsA. However, these were, not formally incorporated into any scoring system. Enthesitis may be recorded by the presence of spurs or erosions in the calcaneous either on the plantar aspect or at the Achilles insertion. There is no systematic method to assess those. Similarly, there is no systematic method to record dactylitis on radiographs. One may detect swelling of the whole digit, but it has not been evaluated for reliability, sensitivity or specificity. However, it has been demonstrated that the presence of dactylitis is associated with more severe radiographic changes in the affected digits, compared with digits not affected by dactylitis [47].

However, it should be noted that progression of radiographic damage in PsA is slow. While there is a chance a group of patients might progress very rapidly, the majority do so much slower, and there may be a group of patients who do not progress to radiographic damage at all. For that reason, other methods of imaging in PsA should be considered.

US assessment in PsA

Musculoskeletal US is being increasingly utilized for the assessment and quantification of joint inflammation and damage in inflammatory arthritides. In PsA, US is used to detect inflammatory and destructive changes in joints, tendons and entheses. However, the use of US in clinical trials has been hampered by a perception of observer dependence and lack of validity [48]. Although the US features of peripheral joint pathology in PsA have been described, there is limited information on validity and universally accepted semiquantitative scoring systems for outcome assessment [48]. In a recent study, 15 patients with PsA, five with RA and five healthy controls were examined using US, contrast-enhanced MRI, plain radiographs and clinical assessment [49]. Selected joints of the hands and feet were assessed with US for the presence of synovitis, bone erosions, bone proliferations and capsular/extracapsular power Doppler signal (only in the proximal interphalangeal [PIP] joints). The second–fifth flexor and extensor tendons of the fingers were assessed for the presence of insertional changes and tenosynovitis. US and MRI were more sensitive to inflammatory and destructive changes than plain radiographs and clinical examination, and US demonstrated a good interobserver agreement for bone changes (median 96% absolute agreement) and lower interobserver agreement for inflammatory changes (median 92% absolute agreement). A high absolute agreement (85–100%) for all destructive changes and a more moderate absolute agreement (73–100%) for the inflammatory pathologies were found between US and MRI [49]. In another study, hands and feet of 13 consecutive patients with PsA were examined using B-mode US using a 9- to 13-MHz transducer, MRI, scintigraphy and radiography [50]. As expected, US, MRI and scintigraphy had a higher sensitivity in the detection of overall joint pathology than radiography. US and radiography detected more erosions and osteoproliferations than MRI, with low agreement between the methods in the detection of erosions. Joint effusions and/or synovitis were more frequently detected by MRI than US. Agreement between both imaging methods was better in carpal joints, carpometacarpal joint I, and MCP and MTP joints I, II and V than in

MCP/MTP III, IV, PIP and DIP joints. The authors concluded that although the diagnostic sensitivity of US in the detection of PsA-related synovitis of hands and feet is lower than MRI and depends on the joint region, low cost and acceptable specificity suggest that US is a useful imaging method in addition to radiography in PsA of hands and feet [50].

Ultrasound has also been used to assess subclinical entheseal involvement in patients with psoriasis. Quantitative assessment of entheseal involvement was determined using the Glasgow Ultrasound Enthesitis Scoring System (GUESS) [51]. The GUESS was developed in a study of 35 patients with spondyloarthritis (including seven with PsA) who underwent independent clinical and ultrasonographic examination of both lower limbs at five entheseal sites: superior pole and inferior pole of patella, tibial tuberosity, Achilles tendon and plantar aponeurosis. A total of 18 features each given a score of 1 were scored on each lower limb, the maximum score being 36. The intraobserver κ value for analysis of all sites was 0.9. Interobserver error was not measured [51]. Using the GUESS score, it was demonstrated that the degree of entheseal abnormalities is higher in patients with psoriasis without clinical PsA [52,53]. US evaluation of dactylitis digits in patients with PsA has shown synovitis, tenosynovitis, periostitis, soft tissue thickening as well as diffuse inflammation of the digital soft tissues, termed pseudotenosynovitis [54,55].

MRI in PsA

MRI has a number of advantages over plain radiographs and US in assessing disease activity and damage in peripheral joints in PsA. MRI and anatomic studies have helped researchers develop the concept of synovio-entheseal complex in the pathogenesis of PsA [56]. Newer techniques such as ultrashort T2 echo for assessment of entheses will help in understanding the similarities and differences between mechanical and inflammatory entheseal changes [57]. Whole-body MRI may help to better determine the extent of inflammatory abnormalities in the joints and entheses as well as destructive bony changes [58].

A handful of studies have reported on the qualitative MRI changes in the peripheral joint of patients with PsA. MRI features of PsA include synovitis, dactylitis, tenosynovitis, erosions, bone edema and enthesitis. Although histopathological studies have demonstrated subtle differences between PsA and RA, PsA synovitis *per se* is indistinguishable from RA on MRI; both show nonspecific contrast enhancement of the synovial membrane [59,60]. Although, earlier studies using dynamic contrast-enhanced MRI demonstrated that rate of increase in enhancement after contrast injection did not differ between PsA and RA, a recent study suggests that differences in late enhancement may help differentiating PsA from RA [59]. PsA exhibits a more abrupt drop in contrast induced synovial signal intensity 15 min after contrast injection [61].

Erosions in PsA differ from those seen in RA since they often occur at sites of entheseal insertions and in joints such as the DIP, which are characteristically affected in PsA. However, erosions *per se* are as described in RA – a break in cortical bone overlying a region of altered signal intensity with definite margins that is visible in two planes with a cortical break seen in at least one plane [62]. Erosions begin at the lateral aspect of the joints and progress to central areas, ultimately leading to pencil-in-cup change or complete joint destruction [60]. Bone edema in PsA is more prominent, appears to begin at the corner of the phalanx at the insertion of the capsule or entheses and spreads to involve the entire bone [60]. Treatment with anti-TNF agents has been demonstrated to improve bone marrow edema and erosion scores in PsA [63–65]. MRI bone edema erosion and proliferation scores are higher in the arthritis mutilans form of PsA and are thus a marker of severity [66]. Bone edema at entheseal sites along with capsular and extracapsular inflammation spreading to involve neighboring soft tissue are characteristic features of PsA [59,60,67]. Digits with dactylitis show synovitis, circumferential soft-tissue edema, bone edema and flexor tenosynovitis [68]. None of the clinical indices of dactylitis showed a close relationship to the extent of MRI abnormalities [68]. Although features on MRI are characteristic and show evidence of enthesitis-associated pathology in the MCP joints, these were not found to be sufficiently common to be a diagnostic utility in differentiating early PsA from early RA [67]. There are no systematic studies of MRI on axial PsA; studies have found changes similar to that in AS, but with asymmetric sacroiliac involvement [69].

MRI has also been used to demonstrate subclinical joint disease in patients with psoriasis. In a study of 25 patients with psoriasis without joint symptoms, 68% of patients were found to have at least one arthritic sign using MRI, while plain radiographs detected abnormalities in only 32% [70].

To standardize the definitions of the key pathologies and to quantify MRI changes, the OMERACT MRI in inflammatory arthritis group has published the MRI definitions of the key pathologies in peripheral PsA as well as suggested appropriate MRI sequences for use in PsA hands [71]. Specifically, MRI definitions for synovitis, tenosynovitis, periarticular inflammation, bone edema, bone erosion, bone proliferation, peritendinitis, tendonitis and tendinopathy were described [71]. A new OMERACT PsA MRI scoring system (PsAMRIS) for scoring inflammation and damage in PsA fingers was developed and preliminary validation conducted [71,72]. In a cross-sectional study, the interobserver reliability of the scores for synovitis, tenosynovitis, bone edema, bone erosions and bone proliferation were excellent. However, for periarticular inflammation it was poor. In the longitudinal exercise, similar results were obtained for the status scores. However, while the change scores were moderately reliable for synovitis, tenosynovitis, periarticular inflammation and bone erosion, they were low/unmeasurable for bone edema and bone proliferation. When looking at individual joints, synovitis and tenosynovitis scores were comparable at MCP, PIP and DIP joint levels. However, for periarticular inflammation, bone edema, bone erosions, and bone proliferation, the reliability statistics were markedly higher at the MCP joints but low for PIP joints and often unobtainable for DIP joints [72]. The study demonstrates that overall PsAMRIS is a reliable instrument to assess PsA fingers. However, characteristic features of PsA, such as DIP joint involvement, periarticular inflammation, bone proliferation and bone edema were not scored reliably in this study. Therefore, further refinement and validation of PsAMRIS is required before it may be used widely as a PsA-specific instrument. Moreover, joints of the feet, as well as the spine and entheses will need to be included in an instrument that evaluates PsA disease burden.

Conclusion

Standardized assessment of musculoskeletal inflammation in PsA is difficult owing to the varied clinical manifestations. Plain radiographic assessment of the peripheral joints of the hands and feet are often the only methods used in the clinic as well as in clinical trials. Most of the methods used to assess damage use techniques developed for RA, although there are many differences in the clinical manifestations between PsA and RA. Ultrasonography and MRI show promise and their roles in disease assessment are being defined.

Executive summary

- Psoriatic arthritis (PsA) is a seronegative inflammatory musculoskeletal disease that affects the peripheral joints, axial joints (spine) and entheses of subjects with psoriasis.
- PsA may lead to progressive damage to peripheral joints and the spine that is occasionally rapid and severely destructive (arthritis mutilans).
- Erosive arthritis is a marker of disease severity and is a risk factor for mortality.
- Joint damage in PsA is typically assessed using plain radiographs of the hands and feet.
- Plain radiographs are used to determine the presence of periostitis, erosions, osteolysis, subluxation and ankylosis in the peripheral joints, determine the extent of involvement in the sacroiliac joints and the joints of the spine, identify the presence of spurs at the entheses and record the presence of dactylitis.
- Standardized assessment of damage to peripheral joints in PsA is carried out using the modified Steinbrocker method, the modified Sharp method, the van der Heijde–Sharp method or the PsA Ratingen score.
- Asymmetric sacroiliitis, nonmarginal asymmetric syndesmophytes, paravertebral ossification and more frequent involvement of cervical spine are features that differentiate axial PsA from ankylosing spondylitis.
- Standardized assessment of damage to axial joints in PsA may be performed using Bath Ankylosing Spondylitis Radiology Index, the modified Stokes Ankylosing Spondylitis Spinal Score, Radiographic Ankylosing Spondylitis Spinal Score or the PsA Spondylitis Radiology Index.
- The PsA Ratingen Score and the PsA Spondylitis Radiology Index were developed specifically to assess peripheral and axial joint damage in PsA, respectively.
- In clinical trials, joint damage to peripheral joints has been assessed using either the modified Sharp method or the van der Heijde–Sharp method; axial joints have not been assessed.
- Ultrasonography may be used to detect inflammatory and destructive changes in joints, tendons and entheses in PsA.
- MRI has many advantages over ultrasonography and plain radiography in assessing PsA.
- MRI definitions for synovitis, tenosynovitis, periarticular inflammation, bone edema, bone erosion, bone proliferation, peritendinitis, tendonitis and tendinopathy have been described and a new Outcome Measures in Rheumatology Clinical Trials (OMERACT) PsA MRI scoring system for scoring inflammation and damage in PsA fingers developed.
- Further research to develop valid, reliable and feasible methods for standardized assessment of axial and peripheral PsA using imaging is needed.

Future perspective

While there has been progress in the imaging of patients with PsA, there is still much to be done. Research into the most reliable and feasible method of assessing peripheral joints and axial disease is required. The latter is currently underway. Further studies are required before imaging modalities other than radiographs can be incorporated into routine clinical practice. It is important to evaluate which of the imaging modalities provides the earliest change in patients with PsA and whether changes such as bone edema result in future erosions. It is important to determine whether treating these early changes prevents the development of further joint destruction, and which drugs are the most efficient in doing so. One thing is clear – imaging is important in the assessment of all aspects of PsA and will likely be relevant for rationalizing therapy in patients with PsA.

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