Ultrasound and psoriatic arthritis – Review of the literature and general considerations

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Abstract The authors review the recent literature on the use of ultrasonography in psoriatic arthropathy. The results are discussed in light of the authors' experience and with reference to technological advances and processes.

Sommario Gli autori presentano una revisione completa degli articoli, comparsi negli ultimi cinque anni in letteratura internazionale e riguardanti lo studio ecografico dell'artropatia psoriasica; successivamente, viene effettuata una discussione dei risultati della revisione, anche sulla base dell'esperienza del gruppo, con riferimento ai progressi e processi tecnologici.
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Introduction and general sonographic features

Psoriasis is a chronic skin disease that is manifested by patches of thickened, reddened skin covered with silvery, exfoliating scales. Nail involvement is also common. Among Caucasians, the incidence of psoriasis is 2–4% [1]. Onset generally occurs during adulthood although it has been reported in all age groups. Males and females are equally affected.

Involvement of the superficial soft tissues, including those of the genitals and the buccal mucosa, is fairly common.

In 10–15% of cases, inflammatory involvement of the joints occurs with symptoms of arthritis. The arthropathy

generally develops many years after the onset of the disease [2–4].

Psoriatic arthritis is a chronic, inflammatory arthritis that also involves periarticular structures, such as tendons or bursae, with periosteal neoformations. It is associated with psoriatic lesions of the skin and/or nails, and serological tests for rheumatoid arthritis are negative [5]. For many years, it was believed to produce limited structural damage to the involved joints, but relatively recent studies [6,7] have shown that psoriatic arthritis can in fact cause severe, radiologically detectable joint lesions.

In addition, while it is normally considered a benign condition, more recent studies have revealed that progression of the arthritis is associated with a moderate increase in morbidity. Disability (in some cases permanent) is not uncommon [8]. Since effective treatment is available, these findings underline the importance of early diagnosis.

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Radiographic demonstration of joint injury is still the gold standard for definitive diagnosis of psoriatic arthritis. However, an increasingly important role is being played by ultrasonography, in part because of its widespread availability and low costs. Sonographic examination of the joints that are potential targets of psoriasis can reveal structural alterations in the initial stages of the disease, before joint symptoms and clinically appreciable articular involvement are present [9].

Ultrasonography can identify alterations in the bone outline as well as soft-tissue lesions, such as synovitis [10,11]. It can also be useful for functional evaluations based on studies of vascularization and dynamic studies of the tendons and other elements of the joint.

In a study reported in 1999 [12], the sensitivity of ultrasonography in diagnosing psoriatic arthritis was shown to be similar to that of magnetic resonance imaging (MRI).

The aim of the present study was to review recent literature specifically related to the use of ultrasonography for the study of psoriatic arthritis. The first thing we noted was the paucity of published articles on this subject. Furthermore, those that have been published vary widely in both the methods used and the results obtained. Many are focused exclusively on diagnostic imaging of the involved joint segments; in some cases, sonographic findings are compared with those of conventional radiography or computed tomography (CT) or MRI. The conclusions reached are by no means univocal, and in some cases they are downright contradictory.

Ultrasonography has in any case been widely used for years in structural assessments of the musculoskeletal system in general and joint pathology in particular. Thanks to its ability to detect short-term changes in inflammation, it plays a key role in the evaluation of this aspect of psoriatic arthritis and other forms of arthritis as well, and it has the added advantages of safety, repeatability, non-invasiveness, and a relatively low cost.

The use of high-frequency transducers (10 MHz or more) ensures high spatial resolution of articular and periarticular structures.

In expert hands and with technologically advanced equipment, sonography can be used to evaluate synovial tissues and to measure their thickness – synovial thickening is in fact an important early sign of arthritis; it can also reveal joint effusions and bone erosions, and increasingly sophisticated and indispensable Doppler techniques (color and power) can be used to detect and quantify hyperemia of the synovial membranes and soft tissues in general. The latter has long been recognized as an early and important (albeit indirect) sign of inflammation.

Doppler studies are now an important part of the imaging work-up of patients with tenosynovitis and/or enthesitis.

For example, as reported in the literature [13], distal enthesitis of the Achilles tendon is diagnosed better, earlier, and more often with ultrasound than with clinical assessment alone. Nonetheless, it is important to note that the nonspecificity of the ultrasound findings in different forms of arthritis, this imaging modality alone is not sufficient for differential diagnosis, especially not for distinguishing rheumatoid and psoriatic forms of the disease.

Review of the literature

In an article published in 2002 [5], Frediani et al. compared the prevalence rates and the clinical and sonographic features of distal quadriceps enthesitis among patients with psoriatic versus rheumatoid arthritis. They examined 40 patients with each type of arthritis and a control group of 18 normal subjects. At the time of examination, only 17 of the 40 patients with psoriatic arthritis had psoriatic skin lesions; in the others, only the nails were involved. Findings considered to be pathognomonic of enthesitis included dishomogeneity and thickening of the tendon, gross irregularities of the patella with enthesophytes larger than 5 mm, and erosions. At least one of these features was required for diagnosis of enthesitis. The prevalence of the latter was markedly higher in the psoriatic arthritis group (45% vs. 7.5% in rheumatoid arthritis), but effusions in the suprapatellar recess were much more common in rheumatoid arthritis (95% vs. 60%). These findings confirm that quadriceps enthesitis may be the only manifestation of inflammation in knees affected by psoriatic arthritis, whereas it is never an isolated finding in rheumatoid arthritis. The changes observed in the two groups were also quite specific: in rheumatoid arthritis signs of inflammation were predominant (edema, thickening, focal hypoechogenicity), while osteophyte formation was much more typical of psoriatic joint disease.

In 2003, De Simone et al. [9] compared sonograms of the Achilles tendon in 59 patients with psoriatic plaques and 50 healthy subjects in an attempt to identify correlations between clinical and sonographic features. An analysis of their findings led these authors to conclude that Achilles tendon abnormalities cannot be excluded, even in the absence of clinical manifestations. Thirty-five of the 59 psoriasis patients (59.3%) had sonographic evidence of abnormalities involving this tendon, but well over half of these cases (22/35, 62.9%) were clinically silent. The other 13 had local symptoms, but only 11 had been diagnosed with psoriatic arthritis. The most common sonographic finding in the psoriasis patients was degenerative tendinitis, which was present in 76.9%. In the remaining patients, there was evidence of peritendinitis associated in 20 cases with retrocalcaneal bursitis. The authors concluded that sonographic studies of the Achilles tendon should be performed periodically in patients with psoriasis, even if there are no clinical signs of arthritis.

In a more extensive study by Falsetti published in 2003 [14], the sonographic features of the calcaneal entheses were compared in different forms of arthritis: erosive, nodal, rheumatoid, and psoriatic. The objective was to identify findings that be used to complement clinical data in establishing the diagnosis and prognosis of these diseases. The study examined a significant number of patients with arthritis of various types: erosive in 56, nodal in 209, rheumatoid in 158, and psoriatic in 125. These four conditions were essentially similar in terms of the frequency of osteophytosis. Achilles enthesitis, however, was found in 8% of the patients with psoriatic arthritis but only 2% of those with rheumatoid forms. In contrast, retrocalcaneal bursitis appeared to be more typical of rheumatoid arthritis (18% vs. only 6% of patients with psoriatic forms). There was an important, statistically significant increase in frequency of plantar fasciitis among patients with psoriatic arthritis (37%

vs. 26%, 15%, and 12%, respectively, in those with rheumatoid, nodal, and erosive forms of arthritis). In the end, the authors concluded that inflammatory lesions of the calcaneal entheses and the adjacent bursae are more frequent in rheumatoid and psoriatic forms of arthritis, whereas the four types of disease (with the possible exception of rheumatoid arthritis) are similar in terms of the frequency of enthesophytosis. They also stressed the excellent concordance between sonographic and conventional radiographic studies in the diagnosis of insertional abnormalities of the bone cortex.

More recently, Ozcakar et al. [15] obtained sonograms of the ankles of 30 patients with psoriasis and 20 healthy controls using a posterior approach on the Achilles tendon. The main finding that emerged from this study was the presence of more marked tendon thickening in the psoriasis patients although, as the authors stressed, findings in asymptomatic psoriasis patients were for all practical purposes identical to those in controls. The number of patients with sonographic evidence of tendon thickening was similar to that of patients with previous radiological demonstration of arthritis.

The authors conclude that sonographic assessment of the Achilles tendon be performed in patients with psoriasis as an adjunct method for evaluating arthritis.

In 2005 De Filippis et al. [16] reported their experience in a study of 24 patients with psoriasis and no joint-related symptoms. They examined the insertion of both Achilles tendons and all of the flexors and extensors of the fingers of both hands. As controls, they studied 14 patients with clearly evident, previously diagnosed psoriatic arthritis. The most important difference they observed was the presence of sonographic abnormalities involving the entheses in 33% of the psoriasis patients. Six asymptomatic patients had evidence of periextensor edema involving the first finger of the left hand and the third and fourth fingers of both hands. The high percentage of clinically silent disease led the authors to propose routine use of joint sonography in the assessment of psoriatic patients, including those with no joint-related symptoms.

The report by Milosavijevic [17], which was also published in 2005, focused on the ability of power Doppler to reveal psoriatic changes in the tendons and joints of the hands and wrists. The study included 36 patients with manifest psoriatic joint involvement that had been radiologically documented and 10 healthy control subjects. In 32/36 patients, there was evidence of synovial proliferation and/or tenosynovitis or tendinitis or joint effusion involving one or more joints; 22 patients had tendon changes, and only five presented joint edema. Doppler evidence of synovial and tendon abnormalities rated with an arbitrary semiquantitative score was clearly correlated with the involved joints. The authors concluded that ultrasonography, with and without the addition of power Doppler, is effective for detecting psoriatic involvement of the hand and wrist joints, and they recommend its use for staging and follow-up.

The most recent study was published in 2006 by Fournie [18]. It was a prospective comparison of power Doppler findings in 25 fingers with rheumatoid arthritis and the same number of fingers with psoriatic arthritis. They found that erosive synovitis and tenosynovitis were present in both groups. However, in 84% of the cases of psoriatic arthritis, there were also extrasynovial changes (enthesophytes, periosteal

reactions, flexor enthesopathies, soft-tissue thickening), which were not observed in any of the cases in the other group. All of these inflammatory changes were manifested on power Doppler by the classical signs of hyperemia. The authors concluded that Doppler sonographic evidence of inflammation involving the fibrous skeleton of the fingers can be used to differentiate psoriatic arthritis from rheumatoid forms; it should at least raise the suspicion of psoriatic joint involvement, which can then be evaluated with radiologic studies and laboratory analyses.

Conclusions

Based on the data reviewed above and our own experience, the following conclusions can be drawn:

1. Compared with other imaging modalities, including those that are more expensive, ultrasonography is a highly sensitive method for early detection of inflammatory joint changes. The absence of concordance among the results reported by various authors seems to confirm earlier conclusions that the method suffers from low specificity. A possible exception is the finding of enthesopathy, which is more suggestive of psoriatic arthritis than of other forms, but it is by no means pathognomonic. Particular difficulty is encountered in cases of arthritis with multiple causes, which, in our experience, are not exceptionally rare.
2. Fundamental requisites for sonographic diagnosis of psoriatic arthritis are operator expertise and technologically advanced equipment. The method is noninvasive and relatively low in cost although repeated long-term use of studies requiring a specialized radiologist and high-end equipment may not be particularly cost-effective in the final analysis.
3. Power Doppler seems to provide the key for accurate assessment of inflammation. This finding appears particularly important in the assessment of responses to the new biological drugs, which are costly and by no means free of adverse effects.
4. Contrast enhancement has been used for some time by our group and others. It appears to offer significant advantages, but this needs to be confirmed in larger studies. In any case, it renders the examination more invasive. To our knowledge, there are no articles in the literature on large case series studied with second-generation ultrasound contrast agents like SonoVue (Bracco, Italia), which we have been using for some time. In all probability, this gap is due in part to the obvious technical limitations of older scanners that are still being used.
5. Close collaboration is indispensable between the sonographer, who should also have experience in conventional radiology and in magnetic resonance imaging, and the staff dermatologist with clinical and therapeutic expertise in the field of psoriasis.
6. If these conditions are respected, we feel that the method is highly promising. It is important to recall, however, that in many of the studies reported in the literature the number of cases examined is quite small. In addition, there may well be enrolment errors caused by the high frequency of arthropathy with multiple etiologies.

Fig. 1 Longitudinal scan of the distal interphalangeal joint obtained with a 20 MHz ultrasound probe. The joint capsule is interrupted and surrounded by a fluid collection. Signs of osteoarthritis include osteophytes and a solid synovial reaction.

Fig. 2 (a) Transverse scan of the extensor retinaculum obtained with a 13 MHz linear probe: There is evidence of a strong synovial reaction characterized by the presence of solid tissue surrounding the tendons and a high-intensity power Doppler signal (b) indicative of inflammatory activity.

Fig. 3 Transverse scan of the Achilles tendon obtained with a 20 MHz probe: The tendon is clearly thickened, and the tendon bundles are partially ruptured. Fluid collections are apparent within the tendon.

Fig. 4 Axial scan of the Achilles tendon obtained with a 13 MHz probe: There is obvious tendon thickening associated with moderate structural damage and superficial soft-tissue swelling.

Fig. 5 Transverse section of the flexor tendon obtained with a 13 MHz linear probe reveals a peritendinous fluid collection associated with synovial reaction.

Fig. 6 Linear probe (10 MHz) ; sonographic longitudinal scan of the extensor tendon of the first ray of the hand made with a 10 MHz linear probe: The tendon is ruptured and the proximal stump is retracted (bell clapper sign). The small fluid collection reflects past inflammation. Irregularities of the proximal bone heads are also evident.

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