

Role of ultrasound in the management of rheumatological conditions of the hands and feet

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Ultrasound has traditionally been utilized in the clinical setting for the evaluation of soft tissue structures (e.g., tendons and bursa) and the diagnosis and management of mechanical musculoskeletal problems, such as tendinosis and repetitive strain injuries. In recent years, the clinical role of ultrasound has evolved and the modality has gained increasing use by rheumatologists for the investigation and management of inflammatory arthritis.

This evolution has been fueled by a paradigm shift within rheumatology with respect to the diagnosis and management of inflammatory arthritis. Adequate treatment of erosive inflammatory arthropathies demands early detection and diagnosis so that aggressive management with disease-modifying therapies can be started early enough in the disease course to achieve remission and prevent progression. In addition, there is increasing recognition that clinical remission may not be sufficient in all patients to halt disease progression, and that monitoring for radiological changes is also an important measure.

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These new goals of therapy cannot be met with the use of clinical parameters or radiography. This is particularly evident in the evaluation of the small joints of the hands and feet, where it is challenging to detect subtle evidence of synovitis or detect erosions on radiographs. Therefore, clinicians require a tool with sufficient sensitivity to detect ongoing subclinical inflammation with which they can track resolution and tailor therapy accordingly.

Ultrasound is well suited to address these needs. The modality has many advantages; it is safe, noninvasive and relatively inexpensive.

It allows for dynamic evaluation of joints in multiple regions in a single evaluation. It can readily be adapted to clinical settings and individual practices. As a result, ultrasound is being widely adopted by rheumatologists in their routine evaluation of patients with inflammatory arthritis and is becoming increasingly involved in important diagnostic, prognostic and therapeutic decisions.

Ultrasound as a diagnostic tool

Identification of early erosive disease is paramount in the treatment of inflammatory arthritis. Compared with radiography, ultrasound is more sensitive in establishing the presence of erosions during the initial presentation with arthritis. Importantly, ultrasound appears to be as sensitive as MRI for the detection of erosions in the small joints of the hands and feet [1-3]. Ultrasound also enhances the detection of synovitis, particularly in the hands and feet, which may be missed by physical examination [4,5].

In patients with undifferentiated inflammatory arthritis, ultrasound findings are useful in distinguishing between specific disease entities. For example, patients presenting with psoriatic arthropathy typically have more involvement noted in distal interphalangeal joints and inflammation present at entheses, while rheumatoid arthritis patients exhibit higher burden of synovial disease in the metacarpophalangeal joints [6].

The presence or absence of specific features (e.g., subclinical synovitis and erosions or the pattern of joint involvement) has an important influence on the diagnostic confidence of clinicians. Ultrasound evaluation of the hands and feet in 'real-world settings' alters diagnosis and can therefore have a significant impact on therapeutic decision making [7-9]. The pivotal role of ultrasound is not limited to early detection of subclinical synovitis so that disease-modifying antirheumatic drug (DMARD) therapy could be



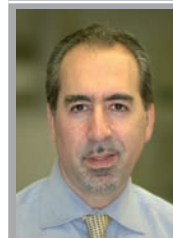
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initiated early, but also in excluding active synovitis in those joints that are difficult to examine clinically in the setting of suspected arthritis. This can cause a significant shift away from DMARD towards NSAID therapy [7]. Ultrasound studies that are negative for active synovitis enhance rheumatologists' confidence in the diagnosis of noninflammatory arthritis.

Ultrasound as a prognostic tool

Patients meeting criteria for clinical remission of disease (e.g., Disease Activity Score 28) have been found to have ongoing evidence of synovitis in the small joints when assessed by ultrasonography. This finding suggests that conventional remission criteria cannot truly reflect an absence of inflammation and may provide an inaccurate prognosis of a patient's disease. The presence of subclinical synovitis found by ultrasound has been postulated as an explanation for further radiographic progression of erosive arthropathy in patients on DMARD therapy and with a paucity of signs of disease activity on physical examination [10]. Therefore, ultrasound has an important role in aiding clinicians to prognosticate future burden of erosive disease. Erosions detected by ultrasound progress to radiographic lesions within 1–2 years of detection [11]. Thus, the identification of ongoing inflammation in a patient with otherwise minimal clinical disease activity necessitates the addition of further disease-modifying therapy to improve long-term prognosis.

Ultrasound as an efficacy-of-therapy tool

The addition of Doppler examination to the gray-scale presentation of ultrasonography adds another level of utility for the modality. The ability to detect and measure vascularity of the synovial proliferation (typically increased in the acute inflammatory setting) not only improves the ability to detect synovitis, but also provides a parameter by which the effects of disease-modifying treatment can be assessed dynamically over a period of time.

A clinician's ability to determine the response to treatment is limited to monitoring disease activity by physical examination or radiographs. With the use of these outcome measures, the period of time necessary to note a clinically significant difference is measured in months (for traditional DMARDs and biologics), or even in years when tracking erosive changes on radiographs of the hands and feet. This requirement for long periods of monitoring in order to assess

effects of treatment can lead to slower administration or switching to DMARDs in nonresponders, and potentiate further destructive disease owing to an inability to be more responsive to lack of efficacy.

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With the use of Doppler ultrasound, changes in the vascularity of synovial tissue shortly after the use of an agent can provide an indication of real-time effectiveness of therapy. A reduction in vascularity, and thus inflammation, has been documented in the short term following treatment with anti-TNF and corticosteroid therapy [12]. This ability to determine the effectiveness of a therapy, without having to wait weeks to see a corresponding improvement (or lack thereof) in a physical examination, is a significant development for clinicians; it may provide the ability to quickly identify those patients who are nonresponders to a specific therapy and enable therapy changes at shorter time intervals, thus allowing for adequate control of synovitis and better long-term outcomes.

Controversies

The concept of treating patients to achieve not only clinical remission but also 'radiological remission' is a current source of debate. It remains to be determined whether patients benefit from such an approach to therapy over the long term. A definition for such remission is also unresolved, as is what imaging modality, plain film, ultrasonography or MRI should be utilized. Ultrasound is well positioned to be used for this purpose given its widespread availability, low cost (compared with MRI), sensitivity and ability to monitor effects of therapy via changes to vascularity. However, it is uncertain whether short-term changes, with respect to vascularity following steroid or biologic treatment, are sustained over a long duration of therapy, and whether decreased vascularity equals a reduction in radiographic and clinical progression in the long term.

A thorough ultrasound examination of the joints of the hands and feet can be a protracted process. To improve efficiency, one possible approach would be to examine the joints in a targeted fashion as deemed necessary by clinical examination [7]. As ultrasound becomes more widely utilized as an outcome measure,

particularly when performed by clinicians outside of traditional radiology settings, issues of interpretation may arise. There has been debate over the accuracy and variability of ultrasound assessment performed in different settings due to concerns regarding interobserver reliability related to training, exposure to small joint ultrasound cases, equipment and imaging technique. These variables can affect the reliability and validity of results and impact the assessment of disease activity and reliability of ultrasound as a long-term outcome measure. Issues of quality assurance and standardization of training with respect to imaging techniques and interpretation will need to be addressed before this modality can be effectively utilized for these purposes.

Conclusion

The role of ultrasound will continue to evolve as it becomes more widely adopted for the routine assessment of patients with inflammatory

arthropathies affecting the joints of the hands and feet. Already an important diagnostic tool, clinicians will find this modality a valuable tool in the future to help determine prognosis in patients with inflammatory arthritis, monitoring disease activity and evaluating response to therapies. Ultrasound could play a significant role in aiding rheumatologists to decide if disease-modifying therapies would be valuable in patients who are difficult to assess clinically.

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- ■ **Excellent scholarly review of the current status of ultrasound imaging of rheumatological disorders of the hands and feet.**