Ultrasound imaging for the rheumatologist XI. Ultrasound imaging in regional pain syndromes

A. Iagnocco[1], E. Filippucci[2], G. Meenagh[3], L. Riente[4], A. Delle Sedie[4], S. Bombardieri[4], W. Grassi[2], G. Valesini[1]

[1]*Cattedra di Reumatologia, Sapienza - Università di Roma, Roma, Italy;*
[2]*Cattedra di Reumatologia, Università Politecnica delle Marche, Jesi, Italy;*
[3]*Antrim Area Hospital, Antrim, Northern Ireland, United Kingdom;*
[4]*Unità Operativa di Reumatologia, Università di Pisa, Pisa, Italy.*

Annamaria Iagnocco, MD; Emilio Filippucci, MD; Gary Meenagh, MD; Lucrezia Riente, MD; Andrea Delle Sedie, MD; Stefano Bombardieri, MD, Professor of Rheumatology; Walter Grassi, MD, Professor of Rheumatology; Guido Valesini, MD, Professor of Rheumatology.

Please address correspondence to:
Dr. Annamaria Iagnocco, Cattedra di Reumatologia, Sapienza - Università di Roma, Viale del Policlinico 155, Roma 00161, Italy.
E-mail: annamaria.iagnocco@uniroma1.it

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ABSTRACT

Regional pain syndromes (RPS) are common complaints in clinical rheumatological practice. Ultrasound (US) allows a detailed assessment of soft tissue involvement and its use may have considerable impact on the management of RPS. The present review provides an update of the available data about US imaging in RPS together with research issues relating to periarticular soft tissue pathology. The research agenda covers: definition of standard scanning protocols for US examination of the most common RPS assessed by the rheumatologist and the clinical impact of US findings in the management of patients with RPS.

Introduction

Regional pain syndromes (RPS) account for a substantial quantity of rheumatic disease and are frequent reasons for new patient consultations in rheumatology units. Pain and restriction of movement are common denominators in all these conditions which are usually linked to local inflammation and/or tissue damage (1, 2). Different peri-articular soft tissues may be involved including tendon sheaths, tendons, bursae, aponeuroses, ligaments and nerves.

Ultrasound (US) has become increasingly relevant in the imaging of soft tissue pathology in clinical rheumatological practice in recent years (3, 4). Furthermore, the specific characteristics of US: noninvasiveness, low-cost, acceptance by patients and portability have led to its use as a bedside investigation performed by rheumatologists (5, 6). In experienced hands, US can be an accurate and reliable imaging tool for the assessment of a wide range of soft tissue pathologies in patients with RPS (7, 8).

In the present review, an update of the available data about US imaging in RPS is provided and the research agenda relating to US imaging of local soft tissue rheumatism is discussed.

Clinical applications

A list of the most common RPS together with the corresponding pathological conditions that may be revealed by US is presented in Table I. Different pathological conditions may manifest with similar clinical features and US assessment may be critical for the identification of the involved tissue and its pathology (9). In cases with tendon pathology, for example, US can demonstrate tenosynovitis, calcific tendinopathy, partial or complete tears and tendon dislocation. Moreover, in the clinical setting of a suspected tendon rupture, US can provide quantitative findings which may direct the rheumatologist in the management approach. Furthermore, power Doppler permits the detection of active inflammation with the demonstration of local increased perfusion. US is also useful for needle guidance during fluid aspirations, biopsies and intra or periarticular injections. Finally, US can be used for monitoring the effects of specific local therapeutic approaches including intra and periarticular injections or 'eccentric loading' training programmes for treating Achilles tendinopathy (10-13).

There are some limitations to the use of US in RPS that must be born in mind. US findings are strongly dependent on both the operator experience and the quality of the equipment. Furthermore, some pathological lesions, especially those related to trauma, may not be detectable by US due to an inadequate acoustic window (*i.e.* cruciate ligaments and, anterior part of the glenoid labrum).

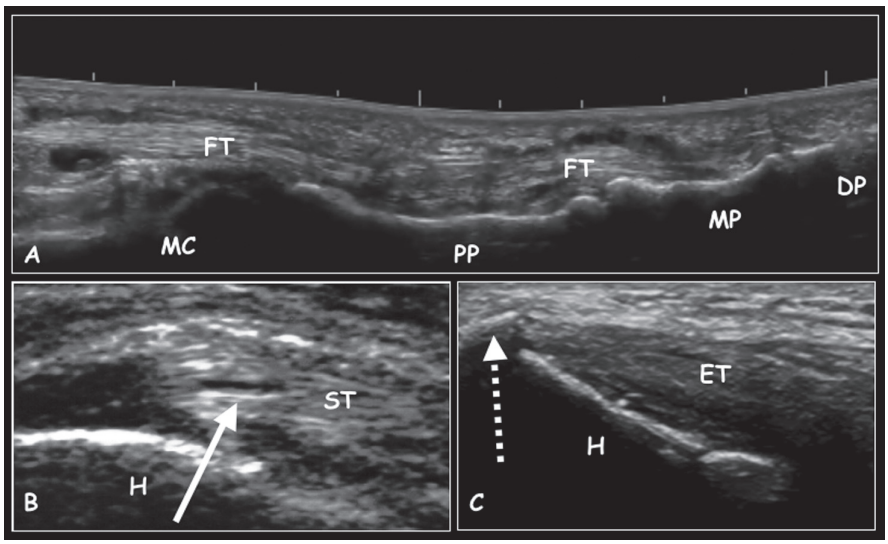

Fig. 1. A. Dactylitis due to tenosynovitis of the finger flexor tendons (FT) involving the 3rd finger of the hand. MC: metacarpal bone; PP: proximal phalanx; MP: middle phalanx; DP: distal phalanx.
B. Painful shoulder with partial thickness tear (arrow) of the subscapularis tendon (ST). H: humerus.
C. Lateral epicondylitis: enthesopathy of the common extensor tendon (ET) with tendon thickening and hypoechogenicity, presence of calcifications and enthesophyte (arrow). H: humerus.
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Table I. Regional pain syndromes and pathological conditions detectable by ultrasonography.

Regional pain syndrome	Pathological conditions detectable by ultrasonography
Carpal tunnel syndrome (9, 22-26)	Median nerve pathology Tenosynovitis of the finger flexor tendons Synovitis of the wrist Tophaceous deposits Aberrant muscle
Painful shoulder (2, 9, 15-21)	Long head of the biceps tendon pathology (*i.e.* complete or partial tear, tenosynovitis, tendon dislocation) Rotator cuff pathology (*i.e.* complete or partial tear, calcification) Subdeltoid bursitis Gleno-humeral joint pathology (*i.e.* joint effusion, synovitis, osteophytes) Acromio- clavicular joint pathology (*i.e.* joint effusion, synovitis, osteophytes) Humeral head fractures (*i.e.* greater tuberosity fracture, Hill-Sachs impaction fracture)
Heel pain (3, 30-33)	Achilles tendinopathy (*i.e.* complete or partial tear, calcification, intratendinous xanthomas or tophi) Calcaneal enthesopathy Retrocalcaneal bursitis Plantar fasciitis
Wrist pain (9, 22, 34-36)	Radio-ulnar, radio-carpal and intercarpal joint pathology (*i.e.* joint effusion, synovitis, arthrogenic cyst) Carpo-metacarpal joint pathology (*i.e.* joint effusion, synovitis, osteophytes) Tenosynovitis of the finger extensor tendons, including De Quervain's tenosynovitis Tenosynovitis of the flexor carpi radialis tendon Calcification of the triangular fibrocartilage complex
Anterior knee pain (9, 37-39)	Patellar tendon pathology (*i.e.* calcification, partial tear, tophaceous deposits) Prepatellar bursitis Infrapatellar bursitis Enthesopathy of both the upper and lower poles of the patella Pes anserine bursitis Pes anserine tendinopathy
Sausage finger (9, 22,40)	Finger flexor tendons (*i.e.* tenosynovitis, tendon tear) Proximal interphalangeal joint inflammation Oedema of the subcutaneous soft tissues
Lateral and medial epicondylitis (41)	Humeral enthesopathy Calcific tendinopathy

Literature review

Since the earliest US investigations of popliteal cysts, the indications for US have steadily increased.Currently the literature to date would strongly support the use of US in the assessment of several types of RPS, including painful shoulder, carpal tunnel syndrome, heel pain, wrist pain, sausage finger, anterior knee pain and lateral and medial epicondylitis (Table I) (14-41). US can sensitively identify the anatomical structure involved and assess the extent of the lesion.

The shoulder has been the subject of multiple US investigations to date. In experienced hands US is a reliable imaging modality for assessing shoulder abnormalities such as bicipital tendon involvement, rotator cuff tears, bursitis, gleno-humeral joint inflammation and humeral head fractures (15-21). When compared to physical examination, US demonstrates higher accuracy in the diagnosis of peri-articular shoulder lesions (15). Using US as the gold standard, sensitivity of physical examination was low (less than 20%) for the detection of supraspinatus tendon tears and other studies show that it can vary between 33% to 100% (16). Physical examination does, however, have a specificity of 100% for the recognition of supraspinatus tendon tears but is unable to differentiate partial from full thickness tears. This can be explained by the specific experience of the operator, the variable quality of the equipment and the gold standard (*i.e.* arthrography, surgical intervention, MRI) used to confirm the US findings.

In patients with carpal tunnel syndrome, US has been proposed as first step in the diagnostic work-up after clinical examination. US provides information on both median nerve and carpal tunnel pathology. Cross-sectional studies using electromyography as the gold standard, demonstrated the efficacy of US in detecting median nerve neuropathy (22-25). US measurement of median nerve cross-sectional area correlates well with EMG findings.

Normal value has been determined as less than 10 mm^2 while an area higher than 15 mm^2 is an indicator for surgical intervention in some centres (22-26).

US assessment of the carpal tunnel can reveal different pathological conditions which may be targets for specific treatment (9, 10, 22).

US guidance for synovial fluid aspiration and intra and periarticular injections improves accuracy and reduces the risk of tissue damage (27-29). In a study aimed at comparing the success rate of conventional and US guided joint aspiration, the use of US resulted in an improvement of the rate of successful aspiration from 32% to 97% (29).

Moreover, using US for guiding corticosteroid injections may improve therapeutic effectiveness both at shoulder and ankle level (11, 12).

Research agenda

The most important topics for future research activity in the assessment of RPS are listed in Table II. In particular, this agenda should concentrate on the development of standard scanning protocols for the assessment of patients with the most frequent RPS seen in rheumatological practice. Further studies are needed to provide evidence of the US impact on both making diagnosis and choosing therapy of patients with RPS.

Table II. US imaging in RPS: research agenda.

To develop standard scanning protocols for the US examination of patients with RPS frequently assessed by the rheumatologist, including painful shoulder carpal tunnel syndrome and anterior knee pain.
To compare physical examination and US findings and evaluate the impact of US findings in the management of patients with RPS.
To investigate the value of power Doppler in the assessment of the soft tissues involvement including: chronic tendinopathy and enthesopathy, tendon tear, tophaceal deposits.
To use US as tool for assessing the benefits provided by different therapeutic choices in the management of the most common RPS.

Link

For further ultrasound images, go to www.clinexprheumatol.org/ultrasound

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