Ultrasound imaging for the rheumatologist XXX. Sonographic assessment of the painful knee

G. Meenagh[1], E. Filippucci[2], A. Delle Sedie[3], A. Iagnocco[4], C.A. Scirè[5], L. Riente[3], C. Montecucco[5], G. Valesini[4], S. Bombardieri[3], W. Grassi[2]

[1]*Department of Rheumatology, Antrim Hospital, Antrim, United Kingdom;*
[2]*Clinica Reumatologica, Università Politecnica delle Marche, Ancona, Italy;*
[3]*Unità Operativa di Reumatologia, Università di Pisa, Pisa, Italy;*
[4]*Cattedra di Reumatologia, Sapienza Università di Roma, Roma, Italy;*
[5]*Cattedra di Reumatologia, IRCCS Policlinico San Matteo, Università di Pavia, Pavia, Italy.*

Gary Meenagh, MD
Emilio Filippucci, MD
Andrea Delle Sedie, MD
Annamaria Iagnocco, MD
Carlo Alberto Scirè, MD
Lucrezia Riente, MD
Carlomaurizio Montecucco, MD, Professor of Rheumatology
Guido Valesini, MD, Professor of Rheumatology
Stefano Bombardieri, MD, Professor of Rheumatology
Walter Grassi, MD, Professor of Rheumatology

Please address correspondence to:
Prof. Walter Grassi,
Clinica Reumatologica,
Università Politecnica delle Marche,
Ospedale "A. Murri",
Via dei Colli 52, 60035 Jesi, Italy.
E-mail: walter.grassi@univpm.it

Received and accepted on November 29, 2010.

Clin Exp Rheumatol 2010; 28: 803-805.

Key words: knee, ultrasound, synovitis, effusion, enthesopathy

Competing interests: none declared.

ABSTRACT

The knee joint is a frequent focus of attention for rheumatologists when assessing patients presenting to a clinic and may represent underlying intra-articular inflammatory pathology or involvement of the surrounding soft tissues.
This study describes the correlation between clinical and ultrasound findings in patients presenting with a variety of rheumatic disorders and knee pain.
US imaging provides for a sensitive and detailed identification of different intra- and peri-articular pathology responsible for knee pain.

Introduction

The knee joint is a frequent focus of attention for rheumatologists when assessing patients presenting to a clinic and may represent underlying intra-articular inflammatory pathology or involvement of the surrounding soft tissues (1-12). It is now recognised that a rheumatologist may under-estimate the extent of the findings solely by performing a clinical assessment (13-15). Ultrasound (US) examination is increasingly being incorporated into these clinical assessments and it is clear that this modality has the potential to illuminate a broader extent of the presenting pathology to the rheumatologist.
The present study was aimed at investigating the value of US in the assessment of rheumatic patients presenting to clinic with knee pain.

Methods

The study was conducted according to the Declaration of Helsinki and local regulations, and informed consent was obtained from all patients.

Patients

Seventy patients with knee pain, attending the out-patient and the in-patient clinics of the Rheumatology Departments involved in this multicentre study were consecutively recruited in the study. Basic patient demographic and clinical data of the study population are reported in Table I.

Study design

All the patients underwent a complete clinical assessment by an expert rheumatologist who recorded the presence/absence of symptoms or signs indicative of knee joint inflammation, the presence/absence of knee joint effusion using the patella tap test and the presence/absence of tenderness elicited by compression at quadriceps insertion into the upper pole of the patella (2). Prior to beginning the study, sonographers reached a consensus on both the scanning technique to adopt and the pathological findings to detect. One sonographer for each centre performed the US examinations, blinded to the patients clinical and laboratory data.

US scanning technique

US examinations were carried out using a Logiq 9 (General Electrics Medical Systems, Milwaukee, WI) with a linear probe operating at 10 MHz for joints assessment and 14 MHz for tendons and enthesis evaluation, and a My Lab70 XVG (Esaote SpA, Genoa, Italy) equipped with a multifrequency linear probe (4-13 MHz).
All US examinations of the knee were performed using a multi-planar technique following the indications provided by the EULAR guidelines for musculoskeletal US in rheumatology (16). For the assessment of knee joint cartilage, entheses and peri-articular bursae, the same scanning protocol used in previous studies was used (3-5).

US image interpretation

Sonographic findings indicative of knee pathology were documented and reported. For the detection of synovial fluid, synovial hypertrophy, and enthesopathy the US definitions described by the OMERACT special interest group (17) were adopted. Hyperechoic enhancement of the chondro-synovial margin and intra-cartilaginous hyperechoic spots were considered indicative of the presence of monosodium urate and pyrophosphate crystal deposits, respectively (8). The presence of osteophytes was defined by the detection of characteristic irregularities of the bone profile (10).

Results

A total of 137 knee joints were examined in 70 patients with at least one painful knee (in 3 patients only one knee was investigated). Table II shows the relationship between clinical and US findings indicative of knee inflammation.

The presence of at least one US sign indicative of enthesopathy was found in 71 entheses (52 quadriceps insertions into the upper pole of the patella, 11 patellar insertions into the anterior tibial tuberosity and 8 patellar insertions into the lower pole of the patella) of 61 knees in 35 patients, respectively affected by osteoarthritis (OA, n=15), psoriatic arthritis (PsA, n=6), rheumatoid arthritis (RA, n=7), gout (n=3), calcium pyrophosphate dihydrate disease (CPPD, n=2), seronegative spondyloarthropathies (SpA, n=1), and without a defined diagnosis (n=1). The most frequent finding was the presence of enthesophytes detected in 52 (85%) out of 61 knees of 29 patients. Power Doppler signal at entheseal level was found in only 5 knees (3 at patellar insertion into the anterior tibial tuberosity and 2 at quadriceps insertion into the upper pole of the patella) of 4 patients (2 PsA, 1 gout and 1 OA).

Meniscal calcification was found in a total of 14 knees in 8 patients (5 with CPPD disease, 2 with OA and one with RA). In 10 knees of 6 patients (3 with CPPD disease, one with OA, and two with RA) hyperechoic spots within the hyaline cartilage were detected. In four

Table 1. Patient demographic and clinical data.

Number of patients	70
Gender (female/male)	43/27
Age in years (range)	60.5 (27-87)
Underlying diagnosis	29 OA; 14 RA; 7 PsA; 5 CPPD; 3 gout; 2 undifferentiated arthritis; 1 SpA; 1 systemic sclerosis; 8 diagnosis not defined.

OA: osteoarthritis; RA: rheumatoid arthritis; PsA: psoriatic arthritis; CPPD: calcium pyrophosphate dihydrate deposition disease; SpA: seronegative spondyloarthropathies.

Table II. Correlation between sonographic and clinical findings indicative of knee inflammatory involvement.

		Clinical findings indicative of knee inflammatory involvement		
US findings		Presence	Absence	Total
Joint effusion	Presence	27	34	61
	Absence	1	8	9
Synovial hypertrophy	Presence	18	18	36
	Absence	10	24	34
Intra-articular power Doppler	Presence	8	3	11
	Absence	20	39	59
Popliteal cyst	Presence	3	12	15
	Absence	25	30	55
Enthesopathy	Presence	13	20	33
	Absence	15	22	37
	Total	28	42	70

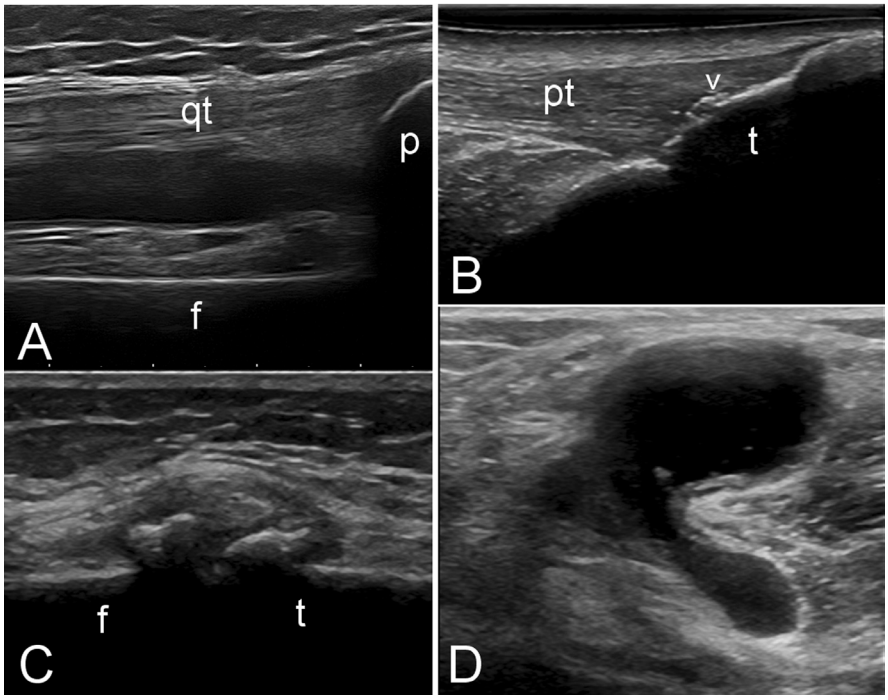

Fig. 1. A. Rheumatoid arthritis. Knee joint effusion. Anterior longitudinal suprapatellar scan showing anechoic enlargement of the suprapatellar pouch. **B**. Psoriatic arthritis. Enthesopathy. Anterior longitudinal scan showing enthesophytes (**arrowhead**) at the distal patellar tendon insertion into the anterior tibial tuberosity. **C**. Osteoarthritis. Medial longitudinal scan showing osteophytes. **D**. Osteoarthritis. Posterior transverse scan showing a popliteal cyst. **f**: femur; **qt**: quadriceps tendon; **p**: patella; **pt**: patellar tendon; **t**: tibia.

patients, two with diagnosis of OA and two with RA, US revealed findings indicative of unknown CPPD disease. In two of these patients, one with OA and one with RA both hyaline cartilage and menisci were calcified bilaterally. Urate deposits were found only in 3 knees of 2 patients with gout.

Osteophytes were found in 76 knees of 41 patients with different diagnosis (24 OA, 5 RA, 4 CPPD, 2 gout, 2 PsaA, 1 SpA, 1 undifferentiated arthritis, and 2 with diagnosis not defined).

Discussion

To date, the role of US in the assessment of patients with knee pain has yet to be fully defined and validated internationally. Several investigators, including our own group, have described the expected US findings in different rheumatic conditions involving the knee (1-12).

This observational multicentre study has demonstrated that US detected a higher number of inflamed knee joints than clinical assessment. There was poor correlation between the clinical impression of enthesopathy when compared to US confirmation.

There are some lessons that we could learn from single cases that were examined. In one patient with diagnosis of knee OA, US revealed meniscal calcifications and subsequent identification of pyrophosphate crystals was made by microscope assessment of knee synovial fluid aspired under sonographic guidance. In another patient with definite diagnosis of CPPD disease, the marked pain on the medial aspect of the knee was explained by US as the clinical manifestation of anserine bursitis. Conversely, US was not able to detect the presence of a meniscal tear in a patient who had such a diagnosis made by MRI performed one week before.

The important take-home messages from US assessment of knee pain are:

- perform an exhaustive search of both intra-articular and extra-articular structures when evaluating the knee
- US imaging provides for a sensitive and detailed identification of different intra- and peri-articular pathology responsible for knee pain.

It is inevitably the case that further observational and interventional studies will be required to enable US examination to become a conventional approach adopted by all rheumatologists when assessing patients with knee pain.

References

1. KARIM Z, WAKEFIELD RJ, QUINN M *et al*.: Validation and reproducibility of ultrasonography in the detection of synovitis in the knee: a comparison with arthroscopy and clinical examination. *Arthritis Rheum* 2004; 50: 387-94.
2. MEENAGH G, IAGNOCCO A, FILIPPUCCI E *et al*.: Ultrasound imaging for the rheumatologist. IV. Ultrasonography of the knee. *Clin Exp Rheumatol* 2006; 24: 357-60.
3. RIENTE L, DELLE SEDIE A, FILIPPUCCI E *et al*.:Ultrasound Imaging for the rheumatologist XXVII. Sonographic assessment of the knee in patients with rheumatoid arthritis. *Clin Exp Rheumatol* 2010; 28: 300-3.
4. DELLE SEDIE A, RIENTE L, FILIPPUCCI E *et al*.:Ultrasound imaging for the rheumatologist XXVI. Sonographic assessment of the knee in patients with psoriatic arthritis. *Clin Exp Rheumatol* 2010; 28: 147-52.
5. FILIPPUCCI E, SCIRÈ CA, DELLE SEDIE A *et al*.: Ultrasound imaging for the rheumatologist. XXV. Sonographic assessment of the knee in patients with gout and calcium pyrophosphate deposition disease. *Clin Exp Rheumatol* 2010; 28: 2-5.
6. MÖLLER I, BONG D, NAREDO E *et al*.: Ultrasound in the study and monitoring of osteoarthritis. *Osteoarthritis Cartilage* 2008; 16 (Suppl. 3): S4-7.
7. NAREDO E, ACEBES C, MÖLLER I *et al*.: Ultrasound validity in the measurement of knee cartilage thickness. *Ann Rheum Dis* 2009; 68: 1322-7.
8. FILIPPUCCI E, RIVEROS MG, GEORGESCU D, SALAFFI F, GRASSI W: Hyaline cartilage involvement in patients with gout and calcium pyrophosphate deposition disease. An ultrasound study. *Osteoarthritis Cartilage* 2009; 17: 178-81.
9. GRASSI W, MEENAGH G, PASCUAL E, FILIPPUCCI E: "Crystal clear"-sonographic assessment of gout and calcium pyrophosphate deposition disease. *Semin Arthritis Rheum* 2006; 36: 197-202.
10. NAREDO E, CABERO F, PALOP MJ, COLLADO P, CRUZ A, CRESPO M: Ultrasonographic findings in knee osteoarthritis: a comparative study with clinical and radiographic assessment. *Osteoarthritis Cartilage* 2005; 13: 568-74.
11. D'AGOSTINO MA, CONAGHAN P, LE BARS M, BARON G, GRASSI W, MARTIN-MOLA E: EULAR report on the use of ultrasonography in painful knee osteoarthritis. Part 1: prevalence of inflammation in osteoarthritis. *Ann Rheum Dis* 2005; 64: 1703-9.
12. CONAGHAN P, D'AGOSTINO MA, RAVAUD P, BARON G, LE BARS M, GRASSI W: EULAR report on the use of ultrasonography in painful knee osteoarthritis. Part 2: exploring decision rules for clinical utility. *Ann Rheum Dis* 2005; 64: 1710-4.
13. NAREDO E, AGUADO P, DE MIGUEL E *et al*.: Painful shoulder: comparison of physical examination and ultrasonographic findings. *Ann Rheum Dis* 2002; 61: 132-6.
14. NAREDO E, BONILLA G, GAMERO F, USON J, CARMONA L, LAFFON A: Assessment of inflammatory activity in rheumatoid arthritis: a comparative study of clinical evaluation with grey scale and power Doppler ultrasonography. *Ann Rheum Dis* 2005; 64: 375-81.
15. IAGNOCCO A, FILIPPUCCI E, MEENAGH G *et al*.: Ultrasound imaging for the rheumatologist XI. Ultrasound imaging in regional pain syndromes. *Clin Exp Rheumatol* 2007; 25: 672-5.
16. BACKHAUS M, BURMESTER GR, GERBER T, GRASSI W, MACHOLD KP, SWEN WA: Working Group for Musculoskeletal Ultrasound in the EULAR Standing Committee on International Clinical Studies including Therapeutic Trials. Guidelines for musculoskeletal ultrasound in rheumatology. *Ann Rheum Dis* 2001; 60: 641-9.
17. WAKEFIELD RJ, BALINT PV, SZKUDLAREK M, FILIPPUCCI E, BACKHAUS M, D'AGOSTINO MA; OMERACT 7 SPECIAL INTEREST GROUP: Musculoskeletal ultrasound including definitions for ultrasonographic pathology. *J Rheumatol* 2005; 32: 2485-7.