

Original Research Article

Ultrasound findings in knee of patients of osteoarthritis and their correlation with pain

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ABSTRACT

Background: Osteoarthritis (OA) is a common joint disorder, with the knee being one of the most frequently involved sites. Conventional radiography (CR), hitherto the primary imaging tool in OA, shows late and indirect findings. Ultrasound (US), on the other hand, offers the possibility to depict different structures within the knee. The main objectives of this study is to assess correlation of Ultrasonography (USG) findings of OA knees and pain assessed in each knee using a numerical rating scale (NRS) from 0 to 10.

Methods: This study was a single center cross sectional observational study. Patients presenting to rheumatology clinic between February 2017 to March 2017 and satisfying ACR clinical criteria for osteoarthritis of knees were taken. Pain assessed in each knee using NRS. USG evaluation of painful knee was done using standard protocols.

Results: In this study, 9 patients and 17 knees were examined. The mean age was 65.7 yrs with more females (66%) as compared to males (33.3%), mean disease duration was 6 yrs with majority of patients (88%) on pain reliever medications (NSAIDS). Ultrasound showed that synovitis and osteophytes has negative correlation with pain score ($r=-0.06$, $r=-.09$). Presence of cartilage loss had slightly higher correlation with pain score ($r=0.18$). The meniscal protrusion (r value 0.15) is associated slight correlation with pain score.

Conclusions: Ultrasound can assess many soft tissue pathologies which cannot be seen on conventional radiography, however the importance of these soft tissue pathologies is uncertain and remains to be determined. In this study we could not find any significant correlation between pain and ultrasound findings.

Keywords: Ultrasonography in osteoarthritis, Pain, Ultrasonography findings in osteoarthritis knees

INTRODUCTION

Osteoarthritis (OA) is a common joint disorder, with the knee being one of the most frequently involved sites. Knee OA causes pain and stiffness and can lead to considerable disability and consequently to a reduced quality of life. As the incidence of OA increases with age, this will become a major health issue and socio-economic problem in the coming decades.¹

The cause of pain in knee OA is not well understood. It is widely believed to be multifactorial with synovium, sub chondral bone, osteophytes, stretching of nerve roots, joint capsule muscle and neurogenic mechanisms thought to be some of the causes.²

As in other joints, conventional radiography (CR), hitherto the primary imaging tool in OA, shows late and indirect findings related to joint damage; what's more, it has been long recognized that clinical symptoms do not correlate with CR changes in OA.³

Joint space narrowing used in CR as a surrogate of cartilage thickness, probably reveals little about cartilage health in early stages of the disease. More to the point, cartilage is not the only anatomic structure involved in the disease: the capsule, ligaments, synovial membrane and bursae may show structural abnormalities that are invisible in CR. Thus, CR is far from an ideal assessment tool of disease status and outcome measure in OA.⁴

Ultrasound (US), on the other hand, offers the possibility to depict different structures within the knee in their nest details, including the synovium, synovial fluid, menisci, joint capsule, cartilage and bone cortex.⁵ This endows US with exciting possibilities in knee OA, from outcome assessment and monitoring therapeutic response, to understanding pathogenesis and the role of inflammation.⁶

So far, very few studies have addressed this relationship between US findings and pain in knee osteoarthritis with inconsistent findings.⁶⁻⁸ The main aim of this study is to assess correlation of USG findings of OA knees and pain assessed in each knee using a numerical rating scale (NRS) from 0 to 10.

METHODS

This study was a single center cross-sectional observational study done at Private Clinic among the patients with arthritis pain and at Rheumatology Clinic in Noida, India. All patients presenting to Rheumatology Clinic between February 2017 to March 2017 and satisfying the annual confidential report (ACR) criteria for osteoarthritis knees were taken.

Inclusion criteria

The ACR clinical classification criteria is a popular method of classifying knee OA. In this criterion the presence of knee pain along with at least three of the following criteria can classify the knee OA, i.e., patients with age >50 years, morning stiffness for about <30 minutes, crepitus on knee motion, bony tenderness, bony enlargement and no palpable warmth.⁹

Exclusion criteria

Patients were excluded if he or she had history of inflammatory arthritis, direct trauma to the knee within the past month prior to the study, intra-articular injection or aspiration within the month prior to the study, previous knee operation, declined to undergo either the US or X-ray knee examinations and declined to be included in the study.

Medication details were noted. Pain was assessed in each knee using a numerical rating scale (NRS) from 0 to 10.

USG was done using Alpinion E CUBE i7 machine with a high frequency (12 MHz) linear probe. Affected knees

were scanned using standard protocols in Ant Longitudinal, transverse (trochlear) for assessment of joint space and cartilage, medial and lateral scans for detection of osteophytes, meniscal protrusion, and posterior scans for baker's cyst.

Effusion

Hypoechoic or anechoic

Intra-articular material that is displaceable and compressible in the suprapatellar recess, evaluated using a longitudinal scan with the leg in passive full extension.

Synovial hypertrophy

Abnormal hypoechoic intra-articular tissue that is non-displaceable and poorly compressible of in the suprapatellar recess, measured with the leg in full extension with a longitudinal scan.

Meniscal protrusion

Protrusion of meniscal tissue out of the joint space >3 mm from the joint line, evaluated at the medial joint space with the knee in full extension with a longitudinal scan.

Infrapatellar bursitis

An enlarged infrapatellar bursa on both longitudinal and transverse scans with the knee in 45 flexion.

Baker's cyst

A hypo-anechoic area between the semimembranosus and medial gastrocnemius tendon examined with the patient in a prone position on the dorsal/medial side of the fully extended knee applying a transverse and longitudinal scan.

Cartilage thickness

An anechoic band with sharp hyperechoic margins, measured perpendicular to the surface at the intercondylar notch and at the medial and lateral condyle (5mm just medial or lateral from the top of the condyle), with the transducer immediately above the patella in a transverse plane and with the knee in maximum flexion.

A composite US inflammatory score was calculated by allocating one point for each of the inflammatory components (effusion, synovial hypertrophy and infrapatellar bursitis), resulting in a score ranging from 0 to 3. Regression analyses were performed with NRS pain as dependent variables and composite US inflammation score as an independent variable. Although it is supported by evidence, the same analysis was performed with a composite mechanical/structural score (combined Baker's cyst, osteophyte, meniscal protrusion score).

Statistical analysis

The data was entered in MS EXCEL spreadsheet and analysis was done using Statistical Package for Social Sciences (SPSS) version 21.0.

RESULTS

In this present study 9 patients and 17 knees were examined. The mean age was 65.7 yrs with more females (66%) as compared to males (33.3%), the mean disease duration was 6 yrs with majority of patients (88%) on pain reliever medications (NSAIDS). Most of the patients were obese (mean BMI-29.57). The mean numerical pain scale was 6.5/10 (Table 1).

Table 1: Demographics of study population.

Parameters	
No. of patients	9
No. of knees examined	17
Age (mean, yrs)	65.7
Sex (%)	
Male	3 (33.3)
Females	6 (66.6)
Disease duration (mean, yrs)	6
NSAIDS, N (%)	8 (88.8)
NRS pain (mean)	6.5
BMI pain (mean)	29.57

NSAIDS: nonsteroidal anti-inflammatory drugs; NRS: numerical pain scale; BMI: body mass index.

Table 2: USG findings.

USG findings	
Cartilage loss, N (%)	17 (100)
Cartilage loss grade (Mean value)	3
Osteophytes, N (%)	16 (94)
Meniscal protrusion, N (%)	14 (82)
Synovitis, N (%)	13 (76)
Baker's cyst, N (%)	6 (35)
Infrapatellar bursitis, N (%)	2 (11)



Figure 1: Right knee medial scan showing large osteophyte.

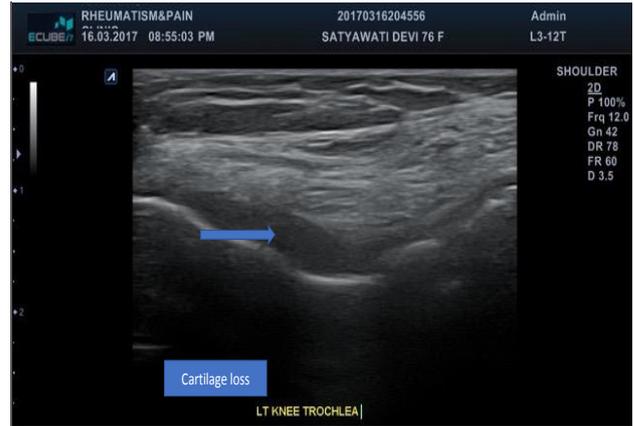


Figure 2: USG of left knee showing cartilage loss, an anechoic band with sharp hyperechoic margins, measured perpendicular to the surface at the intercondylar notch and at the medial and lateral condyle (5 mm just medial or lateral from the top of the condyle).



Image 3: USG of left knee posterior scan showing baker's cyst, a hypo-anechoic area between the semimembranosus and medial gastrocnemius tendon.

Cartilage loss was the most common and consistent finding seen in 100% of patients, the mean cartilage loss was grade 3 followed by osteophytes (94%), synovitis was seen in 76% of knees and bakers cyst and infrapatellar bursitis were the least common findings (35% and 11% respectively) (Table 2 and Figures 1-3).

Ultrasound showed that synovitis and osteophytes has negative correlation with pain score ($r=-0.06$, $r=-0.09$). Presence of cartilage loss had slightly higher correlation with pain score ($r=0.18$). The meniscal protrusion (r value 0.15) is associated slight correlation with pain score.

DISCUSSION

Numerous studies have established the role of ultrasound as one of the first-line modalities in detection of changes of knee osteoarthritis. With the benefits of being cheap,

safe, and widely available, providing high-resolution, multi-planar, real-time, and dynamic imaging, ultrasound possesses a high potential in knee OA assessment. Our study highlights several facts namely that most of the patients were women than men, and had a higher BMI which has been shown to be a risk and poor prognostic factor for osteoarthritis knees.

Cartilage loss and osteophytes were the most common findings as expected however several other soft tissue findings like synovitis, meniscal protrusion, baker's cyst and infrapatellar bursitis was seen in our patients, features that cannot be seen on a plain X-ray thus highlighting the completeness of ultrasound. Our study however failed to show any significant correlation between pain and several ultrasound findings.

Malas et al evaluated the association between the clinical features and radiographic/ultrasound findings of the knee joint in patients with OA and found that meniscal bulging measurements and K-L grades were positively correlated. Further, all WOMAC scores were also found to be positively correlated with meniscal bulging and K-L grades.¹¹ In this study, also presence of cartilage loss had slightly higher correlation with pain score ($r=0.18$). The meniscal protrusion (r value 0.15) is associated slight correlation with pain score as seen in above study. Our findings are in line with the limited previous data from smaller studies on the relation between levels of knee OA pain and US features.^{7,10}

As in our study ultrasound showed that synovitis and osteophytes has negative correlation with pain score ($r=-0.06$, $r=-0.09$). Agostino et al suggested that US detected synovitis and effusion are common in painful knee OA and confirmed previous reports of the lack of sensitivity of clinical features in predicting inflammation of the synovium. In particular, this study clearly emphasises that synovitis is more commonly seen in advanced radiographic disease than in early radiographic disease, suggesting that US may be more useful for detecting inflammation in early OA.²

Limitations of study

Study could have been influenced this namely the number of patients were less, there could have been a selection bias as only those patients were selected who had severe pain. The selection of the ultrasonographic features and the US protocol might also have influenced our results. We used a previously validated US protocol that consisted of widely used US features including both inflammatory and mechanic factors. Although many other candidate features can be considered, unfortunately, to date, there is no international consensus on which anatomical parts or US features might play the most important role in pain in knee OA. Also, the prevalence of some of these features is rather low, thus hampering the possible predictive value for pain.

CONCLUSION

Ultrasound can assess many soft tissue pathologies which cannot be seen on conventional radiography, however the importance of these soft tissue pathologies are uncertain and remain to be determined. In our study we could not find any significant correlation between pain and several ultrasound findings.

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Conflict of interest: None declared

Ethical approval: The study was approved by the institutional ethics committee

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