Brief Communication

Consistency of the Sonographic Image (Double Contour Sign) in Patients with Gout after Ambulation

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Abstract

The aim of this study was to know whether or not any crystal shedding occurs after ambulation in patients with gout and how it affects the consistency of the sonographic image of crystal deposition on hyaline cartilage. A total of 18 consecutive patients (29 knees), 11 with early gout (17 knees) and seven with chondrocalcinosis (12 knees), were prospectively scanned by ultrasound. Examination at rest and after ambulation was performed in each patient. Crystal aggregates were measured in a transverse view. Crystal shedding after ambulation was noted in two patients (two knees) with gout. However, crystal deposits on the surface of the articular cartilage in gout kept invariable size. In patients with chondrocalcinosis, crystal shedding by ambulation was absent. The conclusion of this study is that the size of crystal deposits on the hyaline cartilage in gout and chondrocalcinosis assessed by ultrasound is not modifiable by ambulation.

Keywords: Chondrocalcinosis, crystal shedding, crystal-induced arthritis, diagnostic ultrasound, gout

Introduction

Sonographic diagnosis of gout and chondrocalcinosis is based on the appearance and location of the crystal aggregates, either on the surface or within of the articular cartilage. The crystal deposits seen in gout called double contour is characterized by a linear hyperechoic enhancement on the surface of the articular cartilage, while in chondrocalcinosis, calcium deposits appear as hyperechoic foci within the intermediate layer of the cartilage.[1]

Arthroscopic observations, on the other hand, demonstrate that crystals in gout in addition to the superficial fashion noted ultrasonographically appear poorly adhered to the hyaline cartilage.[2,3] Therefore, it is very intriguing whether or not ambulation might affect the consistency of the sonographic image of monosodium urate (MSU) deposition, particularly on the hyaline cartilage.

Two concerns regarding a mechanical shedding of crystal deposits by ambulation might be raised from the aforementioned arthroscopic findings. First, it is about a true diagnostic accuracy of ultrasound in gout. Second, it is concerning the possibility to get equivocal measurements of MSU deposition on hyaline cartilage and attribute these changes to a treatment efficacy.

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Materials and Methods

The aim of this study was to know whether or not any crystal shedding occurs after ambulation and how it affects the consistency of the sonographic image of crystal deposition on hyaline cartilage in patients with gout and chondrocalcinosis, with particular interest in patients with gout. A total of 18 consecutive patients (29 knees), 11 with early gout (17 knees) and seven with chondrocalcinosis (12 knees), were prospectively recruited. All of them were scanned by ultrasound using a machine equipped with a 7.5-MHz linear transducer. All patients were instructed to avoid walking and use a wheelchair once they arrived at the clinic. A first sonographic examination was performed after the arrival to the clinic and resting for at least 30 min,

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followed by a second examination after walking 200 m around the clinic.

Following standard protocols for ultrasound examination of the knee,[4] a transverse sonographic view with the knee fully flexed and the transducer placed perpendicularly at the suprapatellar area as close as to the superior pole of the patella was performed. This view was feasible to measure long and width of the cartilage deposits of MSU and calcium pyrophosphate dihydrate (CPPD) in patients with gout and chondrocalcinosis, respectively. Furthermore, it was utilized in the assessment of the hyaline cartilage width at the lateral and medial femoral condyles.

Cartilage was measured using two electronic calipers, which included from the subchondral bone side of the articular cartilage to the hyperechoic chondrosynovial margins at the point of maximal naked eye thickness. The average value of two measurements was considered as a final hyaline cartilage thickness in each knee. All measurements were performed by a single operator.

Five knees in patients with gout and one in chondrocalcinosis were excluded due to a decreased range of motion and poor acoustic window. Another knee in a patient with chondrocalcinosis was excluded due to a total knee replacement.

Results

In all patients included in this study, except one with chondrocalcinosis, a diagnosis of crystal-induced arthritis was confirmed by synovial fluid analysis. In addition, those with chondrocalcinosis showed characteristic deposits of calcium on conventional radiographies and on ultrasound. One patient with chondrocalcinosis and hyperuricemia attributable to a kidney failure showed only CPPD crystals in the analysis of synovial fluid under polarizing microscopy. High levels of serum uric acid (mean 9.81 mg/dl) were encountered in all patients with gout ranged between 8.6 and 11.3 mg/dl.

The sonographic measurement of crystal deposits on the articular cartilage at rest and after ambulation showed no changes in any of the patients included in this study. Crystal shedding, considered by the presence of hyperechoic dots within the synovial effusion in knees after ambulation and absence of this pictorial feature at rest, was noted in two patients (two knees) with gout. None of the patients with chondrocalcinosis revealed crystals release by ambulation. However, seven (73%) knees of this group presented severe loss of cartilage and crystal exposure on the articular cartilage surface.

Discussion

Sonographic diagnosis of gout and chondrocalcinosis in this study was based on the appearance and location of the crystal aggregates, either on the surface or within of the articular cartilage [Figure 1]. Crystal deposition in gout has been described as a linear hyperechoic enhancement on the superficial margin of the hyaline cartilage, while in chondrocalcinosis, calcium deposits showed hyperechoic foci within the intermediate layer of the cartilage.[1]

Hyperechogenic foci within the synovial effusion after ambulation observed in knees from two patients with gout with 8-month disease duration could have been consequent to a less adherent MSU deposits at early stages of the disease [Figure 2]. Elsaman *et al*.,[5] in a cross-sectional study, found echogenic foci within the effusion among cases with gout with median disease duration of 2 years, while it was not detected in those with a disease duration longer than 5 years.

Considering the predominant appearance of MSU deposits at the surface of intra-articular tissues, the "mechanical shedding" after ambulation observed in those participants with gout, which showed an invariable size of the double contour sign by ultrasound, could have been caused by crystals releasing from the synovial membrane, cruciate ligaments, and menisci, rather from the articular cartilage.

The absence of crystal shedding in patients with chondrocalcinosis might explained by its deeper location and a firm attachment within the articular cartilage and menisci.[6,7] On the other hand, synovial membrane is probably an uncommon source for mechanical shedding because crystal deposits in chondrocalcinosis have been identified subsynovially.[7]

Structural changes on the cartilage were not the main goal in this study; nonetheless, a smaller width of the femoral hyaline cartilage [Table 1] was observed in chondrocalcinosis (mean 1.6 mm) compared with gout (mean 2.0 mm, $P = 0.056$). Although osteoarthritis is a well-recognized finding in chondrocalcinosis, evidence of severe knee osteoarthritis and a prediction for progressive joint damage have been described in gout and in nongout participants with elevated urates.[8-10]

While a poor adherence of crystal deposits in gout has been described by arthroscopy, no changes of the size of crystal deposits under ultrasound seem to occur by the ambulation. As a result, this consistency on the sonographic image supports that an assessment of patients with gout under urate-lowering therapy can rely on this diagnostic modality.

Main limitations of this study are related to the small number of patients and the absence of controlled groups with early

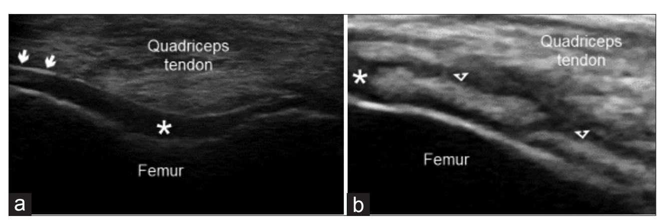

Figure 1: Sonographic transverse views of the knee joint. (a) A characteristic sonographic appearance of crystal deposits (arrows) on the surface of the hyaline cartilage (*) in gout ("double contour" sign) is noted. (b) It discloses typical hyperechoic material consistent with calcium-containing crystal deposition (arrow heads) within the articular cartilage (*) in a patient with chondrocalcinosis

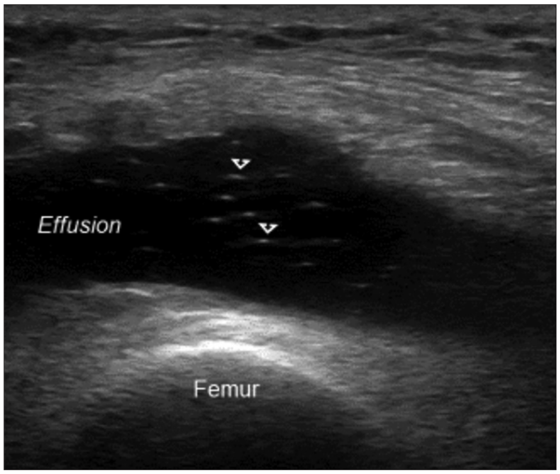

Figure 2: Sonographic image of the suprapatellar pouch in short axis. This picture shows multiple hyperechoic dots within a moderate effusion ("snowstorm") in a patient with gout after ambulation

Table 1: Demographic, clinical, and sonographic findings

	Gout	Chondrocalcinosis	*P*
Age (years-old), mean (range)	57 (47-54)	66 (46-73)	
Male, *n* (%)	10 (91)	3 (43)	
Female, *n* (%)	1 (9)	4 (57)	
BMI (kg^2/M), mean±SD	29.4±3.0	29.5±2.4	0.93
Disease duration (months), mean±SD	7.9±4.5	11.4±6.0	0.18
Number scanned knees	17	12	
Cartilage width mean in mm (SD)	2.0±0.51	1.6±0.53	0.056
Measurement crystal deposits at rest (mm), mean±SD	7.80±3.6	5.53±1.5	
Measurement crystal deposits after ambulation (mm), mean±SD	7.87±3.8	5.55±1.5	

SD: Standard deviation, BMI: Body mass index

and late stage gout. On the other hand, the results can be influenced by the fact that all measurements were performed by a single operator.

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Conflicts of interest

There are no conflicts of interest.

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