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## Usefulness of high resolution US in the evaluation of effusion in osteoarthritic first carpometacarpal joint

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**Objective:** The aim of this study is to provide a reproducible and quantitative sonographic method for evaluation of effusion in the first carpometacarpal joint in osteoarthritis.

**Methods:** High resolution sonography of the carpometacarpal joint of the thumb was carried out in 20 normal joints and in 57 joints from patients with osteoarthritis. A 10 MHz transducer was used.

**Results:** The articular cavity appeared as a hypoechoic triangular area. In normal joints the mean values obtained by measuring the distance between the apex and the base of the triangle was 2.89 mm (SD 0.22). In osteoarthritic joints it was significantly increased ( $p < 0.001$ ). The authors assert that the presence of effusion is very likely if the value is  $\geq 3.33$  mm (mean + 2 SD).

**Conclusions:** Sonography provides useful, reproducible, and quantitative data for detection of effusion within the first carpometacarpal joint.

**Key words:** sonography, first carpometacarpal joint, effusion, osteoarthritis

The carpometacarpal joint of the thumb is a saddle-shaped articulation between the trapezium and the base of the first metacarpal bone. It has its own, very relaxed synovial membrane and a large capsule which allows a great articular mobility (1, 2). Thanks to its morphological characteristics, the first carpometacarpal joint has a large movability; in fact five different movements can be performed: flexion, extension, adduction, abduction, and circling. Moreover, even opposition of the thumb is possible, due to the combination of adduction, flexion, and partial rotation.

Osteoarthritis of the carpometacarpal joint of the thumb is very frequent, especially in females. In the hand it represents the second site of localization of the disease, after the distal interphalangeal joints. From the clinical point of view, pain, swelling, redness of the overlying skin, crepitus on moving the thumb, and limitation of motion may occur. Those symptoms are transitory and inconstant during the early phases, but become firm and fixed, after a variable period of time, with the increasing seriousness of the disease. Local deformity, appearance of squaring of the thumb, and signs of articular instability are even possible (3). In a few cases hyperextension of the proximal phalanx can be present. Radiographic findings show the typical changes of osteoarthritis: usually a sequence of

different alterations is present, with appearance of sclerosis, cysts, joint space narrowing, osteophytes formation, subluxation of the first metacarpal bone, rare erosions.

Sonography has been applied for many years to the study of articular (4-9) and periarticular (10-21) soft tissues in the course of rheumatic diseases. In fact, thanks to its technical characteristics of non-invasiveness, low costs, and easy repeatability, sonography is actually considered one of the best imaging techniques for the evaluation and follow up of changes of articular soft tissues in rheumatic pathologies (22, 23). Particularly the recent presence of high frequency transducers allow the use of ultrasound technique even for the examination of the hand (24, 25), wrist (26-28) and foot (29, 30).

The aim of the present study was to evaluate the usefulness of ultrasonography for detection of effusion and evaluation of the amount of synovial fluid in the first carpometacarpal joint in osteoarthritis.

### Materials and methods

Sonography of the first carpometacarpal joint was performed in 57 patients with clinical involvement of the base of the thumb. Pain was always present, while redness of the overlying skin, tenderness, swelling, limitation of motion were inconstantly found. Squaring of the base of the thumb and crepitus appeared in a few cases. The diagnosis of osteoarthritis had been confirmed using the American College of Rheumatology criteria of 1990 (31).

The patients were 43 females and 14 males. Their mean age was 61.4 years (range 57-71 years) and

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the mean duration of symptoms was 1.1 years (range 0.1–2.6 years). In all cases radiographs showed the different types of osteoarthritic changes of the first carpometacarpal joint.

Twenty healthy subjects whose mean age was 63.1 years (range 58–70 years) and who had no signs of involvement of the thumb were examined as controls.

High resolution sonography was performed with a 10 MHz sector transducer, using acoustic gel. The first carpometacarpal joint was examined with anterior, lateral, and posterior longitudinal scans. The wrist was kept in neutral position. Articular space appeared as a triangular hypoechoic area with the apex direct to articular cavity and the base bounded by the joint capsule (Figure 1). Measurements of joint space were carried out in lateral longitudinal scan and the distance between the apex and the base of the triangle was evaluated. In this way it was possible to detect effusion and determine the amount of synovial fluid. The same measurement was repeated twice and the mean value of the results was calculated. The lateral scan was chosen for measurements because in that site the joint capsule has higher distensibility and consequently effusion may be easier detected.

The accuracy of the measurements was 0.1 mm.

Arthrocentesis was carried out in 18 joints with sonographic demonstration of effusion and ultrasonography was repeated later, to verify the findings of reduction or disappearance of effusion.

Moreover intra-articular infusion of sterile physiological saline solution (0.4 ml) was made in 3 normal joints of healthy volunteers and a sonographic examination was repeated as reported above, to verify the finding of appearance of joint effusion. T-Student test was used for statistical analysis.



Fig. 1. Articular cavity appears as a triangular hypoechoic area. ↑ Trapezium; ■ First metacarpal bone.

## Results

Sonography of all normal joints scanned showed that, as well as all bony structures, the surface of trapezium and of the base of the first metacarpal bone appeared as two hyperechoic strips. The capsule was a thin echoic line bounding the articular space and appeared as a triangular hypoechoic area (Figure 1). In each joint the line between the apex and the base of the triangle was measured in longitudinal lateral scan and the depth of articular space was evaluated (Figure 2). In normal joints values obtained by such measurements (Table I) were never greater than 3.2 mm (range 2.5–3.2 mm; average 2.89 mm; SD 0.22).

In 37 out of the 57 patient joints examined, the presence of effusion was demonstrated by the appearance of a sonolucent area within the articular space. The measurement of the distance between the apex and the base of the triangular articular space (Table I) showed significantly ( $p < 0.001$ ) increased values (average 3.55 mm; SD 0.58). Figure 3 shows the distribution of the values of the distance between apex and the base of the triangle in the 20 normal joints and in the 57 osteoarthritic articulations.

Arthrocentesis was carried out in 18 joints and sonographic examination was repeated, showing either the disappearance of the sonolucent area or



Fig. 2. The measurement of the distance between the apex and the base of the triangle shows the presence of joint effusion.

Table I. Results of sonographic examination in normal and osteoarthritic carpometacarpal joint of the thumb. The difference of the mean values of the distance between the apex and the base of the triangular space in normal subjects and OA patients is statistical significant ( $p < 0.001$ ).

	Mean value in mm	SD
Normal subjects	2.89	0.22
OA patients	3.55	0.58

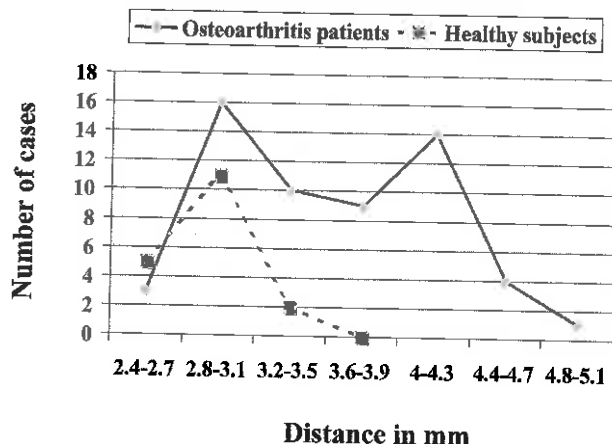


Fig. 3. Distribution of the values of the distance between the apex and the base of the triangle in the 20 normal first carpometacarpal joints and in the 57 joints with osteoarthritis. In osteoarthritis the graph is made by 2 gaussian curves: in the first curve the peak is constituted by values between 2.8 and 3.1 mm and it refers to cases without joint effusion; the second curve has a peak with values of measurements between 4.0 and 4.3 mm and it refers to joints with effusion.

the decrease of its extent within the articular space; moreover the measurements of the height of the triangle showed decreased values in all cases.

In 3 normal joints, after intra-articular infusion of 0.4 ml physiological saline solution within the first carpometacarpal joint, sonography showed the appearance of an anechogenic zone with contemporary increase of the distance between the apex and the base of the triangle (the mean distance changed from 2.8 to 4.1 mm).

### Discussion

The present sonographic study showed that the mean values of the distance between the apex and the base of the triangular articular space in normal carpometacarpal joints of the thumb was 2.89 mm (SD 0.22 mm). The presence of effusion (5) is very likely if that distance is greater than 3.33 mm (2.89 + 2 SD). The finding is confirmed by Figure 3, where the graphs show the distribution of the distances in normal joints and in osteoarthritis. In osteoarthritis 2 gaussian curves appear with presence of 2 peaks: the first peak refers to those cases with symptoms but without articular effusion; the second peak reports the symptomatic joints in which also effusion is present. The 2 gaussian curves cross at the value of 3.33 mm that represents the limit for the presence of joint effusion. The finding means that joint effusion is very likely if the measurement of the distance between the apex and the base of the triangular articular area is greater than 3.33 mm.

In osteoarthritis of the first carpometacarpal joint standard radiography shows changes of bony

structures. It is not able to demonstrate the presence of effusion and evaluate the conditions of articular and periarticular soft tissues. Other imaging techniques, such as computed tomography and particularly magnetic resonance imaging, are of value but their high costs and the low availability of the instruments limit their routine utilization. The present study shows that sonography is a useful diagnostic method for detection of joint effusion. The capability of measuring the extent of articular space makes it possible to exactly evaluate the amount of synovial fluid present within the joint and provides reproducible and quantitative information about the conditions of the joint. Moreover the easy repeatability of the technique is important for the assessment of therapeutic response.

Because osteoarthritis frequently involves the joint of the base of the thumb, the present study was carried out on osteoarthritic patients. However, the same method is easily applicable in other diseases, giving a good evaluation of soft tissue swelling. Therefore the clinical involvement of carpometacarpal joint of the thumb may be examined sonographically with high accuracy both in rheumatic pathologies and in post-traumatic disorders. A widespread application of this diagnostic technology is to be hoped for in all rheumatology units.

### References

1. Testut L. Anatomia Umana. Torino: UTET, 1923.
2. Netter FH. Atlante di anatomia, fisiopatologia e clinica. Varese: Ciba, 1994.
3. Dieppe PA, Lim KKT. Osteoarthritis. Clinical features and diagnostic problems. In: HJ Klippel, PA Dieppe, eds. Rheumatology. London: Mosby, 1998, 8.3.1-8.3.16.
4. Koski JM. Ultrasonographic evidence of hip synovitis in patients with rheumatoid arthritis. Scand J Rheumatol 1989;18:127-31.
5. Koski JM. Axillar ultrasound of the glenohumeral joint. J Rheumatol 1989;16:664-7.
6. Barr LL, Babcock DS. Sonography of the normal elbow. AJR 1991;157:793-8.
7. Koski JM. Ultrasonography of the elbow joint. Rheumatol Int 1990;10:91-4.
8. Iagnocco A, Coari G, Zoppini A. Sonographic evaluation of femoral condylar cartilage in osteoarthritis and rheumatoid arthritis. Scand J Rheumatol 1992;21:201-3.
9. Koski JM. Ultrasonographic evidence of synovitis in axial joints in patients with polymyalgia rheumatica. Br J Rheumatol 1992;31:201-3.
10. McDonald DG, Leopold GR. Ultrasound B-scanning in the differentiation of Baker's cyst and thrombophlebitis. Br J Radiol 1972;45:729-32.
11. Seltzer SE, Finberg HJ, Weissman BN. Arthrosonography—technique, sonographic anatomy and pathology. Invest Radiol 1980;126:19-28.
12. Benson CB. Sonography of the musculoskeletal system. Rheum Dis Clin North Am 1991;17:487-504.
13. Mack LA, Nyberg DA, Matsen FA. Sonographic evaluation of the rotator cuff. Radiol Clin North Am 1988;26:161-3.



14. van Holsbeeck MT, Kolowich PA, Eyler WR, Craig JG, Shirazi KK, Habra GK, et al. US depiction of partial-thickness tear of the rotator cuff. *Radiology* 1995;197:443-6.
15. Farin PU, Jaroma H. Acute traumatic tears of the rotator cuff : value of sonography. *Radiology* 1995;197:269-73.
16. van Moppes FI, Veldkamp O, Roorda J. Role of shoulder ultrasonography in the evaluation of the painful shoulder. *Eur J Radiol* 1995;19:142-6.
17. Farin PU, Jaroma H. Sonographic findings of rotator cuff calcifications. *J Ultrasound Med* 1995;14:7-14.
18. Alasaarela EM, Alasaarela ELI. Ultrasound evaluation of painful rheumatoid shoulders. *J Rheumatol* 1994;21:1642-8.
19. Coari G, Iagnocco A, Maggi S, Bracci M, De Cata A, Mastantuono M, et al. Sonographic findings in haemodialysis-related chronic arthropathy. *Eur Radiol* 1996;6:890-4.
20. O'Reilly MAR, Massouh H. Pictorial review: the sonographic diagnosis of pathology in the Achilles tendon. *Clin Radiol* 1993;48:202-6.
21. Rouaud JP, Dufour D, Caroit M. L'échographie dans les épaules douloureuses simples. *Rev Rhum* 1989;56:805-7.
22. Coari G, Iagnocco A. Shoulder Involvement in Rheumatic Diseases. Sonographic Findings. *J Rheumatol* 1999;26:668-73.
23. Alasaarela E, Tervonen O, Takalo R, Lahde S, Suramo I. Ultrasound evaluation of the acromioclavicular joint. *J Rheumatol* 1997;24:1959-63.
24. Grassi W, Tittarelli E, Blasetti P, Pirani O, Cervini C. Finger tendon involvement in rheumatoid arthritis. Evaluation with high-frequency sonography. *Arthritis Rheum* 1995;38:786-94.
25. Fornage BD. Soft-tissue changes in the hand in rheumatoid arthritis: evaluation with US. *Radiology* 1989;173:735-7.
26. Goldenstein C, McCauley R, Troy M, Schaller JG, Szer IS. Ultrasonography in the evaluation of wrist swelling in children. *J Rheumatol* 1989;16:1079-87.
27. Koski JM. Ultrasonography in detection of effusion in the radiocarpal and midcarpal joints. *Scand J Rheumatol* 1992;21:79-81.
28. Gooding GAW. Tenosynovitis of the wrist. A sonographic demonstration. *J Ultrasound* 1988;Med 7:225-6.
29. Fornage BD, Rifkin MD. Ultrasound examination of the hand and foot. *Radiol Clin North Am* 1988;26:109-29.
30. Koski JM. Ultrasonography of the metatarsophalangeal and talocrural joints. *Clin Exp Rheumatol* 1990;8:347-51.
31. Altman R, Alarcon G, Appelrouth D, Bloch D, Borenstein D, Brandt Ketal. The American College of Rheumatology criteria for the classification and reporting of osteoarthritis of the hand. *Arthritis Rheum* 1990;33:1601-10.