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## ULTRASONOGRAPHY OF THE HAND IN RHEUMATOID ARTHRITIS

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### Abstract

High resolution ultrasonography of the hand and wrist was performed on 20 patients with definite or probable rheumatoid arthritis (ARA standard criteria) in its early stage. In all the patients, swelling of the soft tissues of the fingers corresponded to an enlargement of the joint capsule containing a hypoechoic exudate. The rheumatoid nodules appeared as fluid-filled rounded cavities with sharp borders. Rheumatoid tenosynovitis was observed in 18/20 patients. This corresponded to oval or spindle-shaped cavities with a hypoechoic (10/18 cases) or anechoic content (8/18 cases) and with the tendon ribbon inside. Rupture of a tendon was diagnosed in 8/20 cases and it was always confirmed at surgery. Tenosynovitis of the flexor carpi ulnaris at the wrist level was observed in 10/20 patients. Ultrasonography is proposed as an effective first-line approach and as a periodical follow-up survey in early stage rheumatoid arthritis, in combination with standard radiography.

**Key words:** Arthritis, rheumatoid; finger; wrist, US studies.

Rheumatoid arthritis is a systemic disease of connective tissue involving the synovial lining of joints and tendon sheaths. As the disease progresses, granulation tissue or synovial pannus spreads across the articular cartilage and destroys it. Ultimately, infiltration into subchondral bone follows, with development of typical erosions and deformities.

The early radiologic diagnosis of rheumatoid arthritis is based mainly upon the soft tissue changes that occur in the tendons and joints (3, 4, 15). These changes, however, may be difficult to appreciate, even on non-screen radiographs or with xeroradiography (2, 8, 10, 14, 15). High resolution ultrasonography has proven to be very effective for the study of superficial soft tissues, muscles, tendons and joints in particular (5-7, 12). This technique is rather simple to perform, with no radiation, and is non-invasive; it thus appears very suitable for periodical follow-up controls.

The purpose of this investigation was to document the diagnostic value of ultrasonography of the hand and wrist in early rheumatoid arthritis and to present some typical ultrasound features of the disease.

### Material and Methods

The material was composed of 20 patients selected from a rheumatology clinic. The diagnosis of definite or probable rheumatoid arthritis according to the criteria of the American Rheumatism Association (11) had previously been established on clinical, radiographic and laboratory grounds. All the subjects examined had palpable swellings of the soft tissues of the hand and wrist, bilateral in 14/20 cases. There was a clear prevalence of females (14/20 patients) and of the more advanced age groups (mean age 57 years).

After a complete radiographic and xeroradiographic survey, the patients were submitted to high resolution ultrasonography. This investigation was undertaken both at rest and during flexion and extension of the wrist or of the fingers. Real-time equipment (ATL, Ausonics, Ansaldo) was used, with linear and sector small-part probes, at the frequency of 5 or 7.5 MHz. The transducers were employed in combination with a Kitecko path. In 10/20 patients, surgical confirmation of the echographic picture was obtained eventually.

### Results

In all cases with swelling of the small joints of the fingers echography disclosed the presence of an enlargement of the joint capsule, containing a hypoechoic exudate; small cortical erosions of the articular bone could

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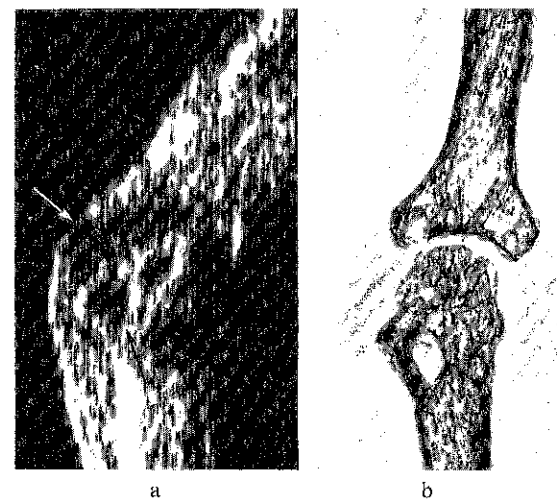


Fig. 1. Longitudinal scan of the second metacarpo-phalangeal joint (a). The soft tissue swelling corresponds to a hypoechoic widening of the articular space (→). A couple of osseous cavities (geodes) can be recognized within the metacarpal head (↔) corresponding to the findings at radiography (b).

also be distinguished (Fig. 1). They were confirmed by radiographs obtained as a first diagnostic step in all the patients (Table). The rheumatoid nodules within the para-articular soft tissues of the fingers corresponded to small rounded cavities with sharp borders and a hypoechoic content (Fig. 2).

Rheumatoid tenosynovitis of the flexor or extensor tendons was observed in 18/20 patients. In these cases, the enlarged tendon sheaths corresponded to oval or spindle-shaped cavities with a sharp outline. Their content appeared completely anechoic in 8/20 patients (Fig. 3). In the remaining 10 patients, the synovial fluid was moderately hypoechoic (Fig. 4), suggesting the presence of a corpuscular exudate, which was confirmed by puncture in 4/10 cases. The tendon sheaths always contained a central hyperechoic structure corresponding to the tendon itself (Fig. 5). The latter could be better observed during flexion and extension of the fingers in real-time scans, where it appeared as a moving ribbon embedded in an echopoor cavity. In these conditions, particularly with longitudinal scans, a detailed evaluation of the tendon's structure was possible; the most common abnormal findings observed were localized swelling of the tendon's profile (Fig. 6) or microcystic vacuolisation of its echogenic pattern (Fig. 7). Rupture of a tendon was observed in 8/20 cases, particularly well during real-time scans (Fig. 8). In all these cases, the ultrasonographic diagnosis of a ruptured tendon was confirmed at surgery.

At the wrist level, synovial swelling around the ulnar styloid process ('caput ulnae syndrome') is a hallmark of early rheumatic disease (3, 15). This condition was present in 10/20 patients, and corresponded to a hypoechoic cavity surrounding the styloid (Fig. 9).

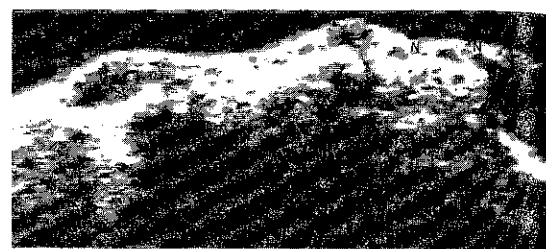


Fig. 2. Longitudinal scan of the interphalangeal joints of the third finger. There are two hypoechoic cavities within the superficial soft tissues, with clear-cut borders. They correspond to rheumatoid nodules clinically evident in the soft tissues of the finger. N = nail.

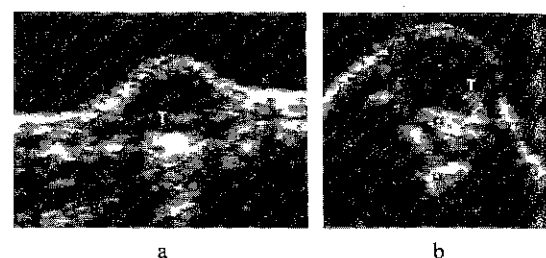


Fig. 3. Longitudinal (a) and transverse (b) scans of the dorsal aspect of the wrist. The soft tissue swelling due to anechoic cystic tenosynovitis corresponds to a cavity completely echo-poor, where the tendon (T) appears as a hyperechoic ribbon.

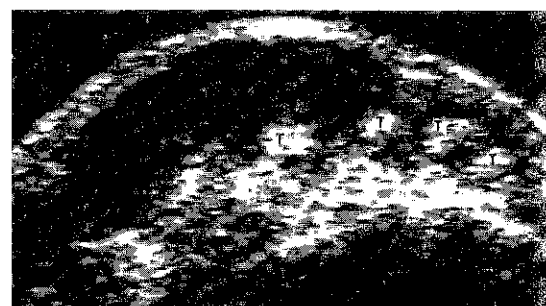


Fig. 4. Transverse scan of the dorsum of the wrist. The extensor tendons (T) are embedded in a cavity containing a large amount of hypoechoic, corpuscular exudate due to rheumatoid tenosynovitis.

Table

Correlation between ultrasound findings and radiography

Lesion*	Total No. of cases	Radiography positive	Ultrasound positive
Capsular swellings	15	9	15
Rheumatoid nodules	16	8	15
Tenosynovitis	18	11	18
Bone erosions	11	11	6
'Caput ulnae syndrome'	10	8	10

\* The value of the radiograph regarding soft tissue swellings was always restricted to a study of the external profile of the lesions.

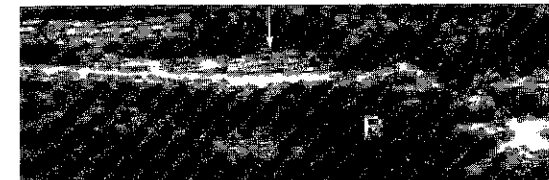


Fig. 5. Extensor tenosynovitis. Longitudinal scan of the dorsum of the wrist. The sheath of the tendon is markedly enlarged by the presence of hypoechoic fluid. The tendon can be appreciated as a hyperechoic ribbon (→). R = head of the radius.

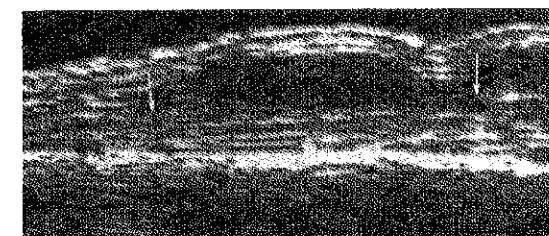


Fig. 6. Longitudinal scan of the dorsum of the third metacarpal. In this case of rheumatoid tenosynovitis the extensor tendon possesses an inhomogeneous hyperechoic structure and contains multiple vacuoles. The profile of the tendon (→) is irregular within the enlarged synovial cavity.

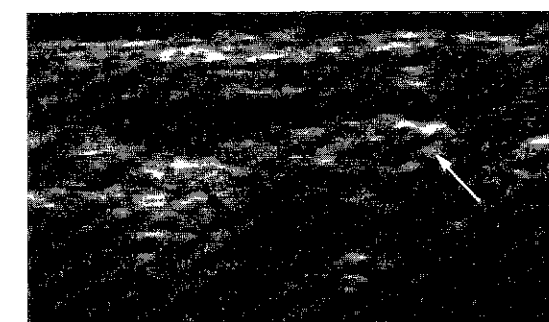


Fig. 7. Longitudinal scan of the dorsum of the wrist. Within an enlarged synovial sheath, the tendon appears swollen and irregular. A cystic degenerative cavity (→) appears to be located within the tendon itself.



Fig. 8. Extensor tenosynovitis. Longitudinal scan of the wrist. The sheath of the tendon is enlarged and the tendon contains a hypoechoic cleft (→). In this case of early rupture, persistence of an incomplete extensor movement could be observed in real-time scans.



Fig. 9. Longitudinal scan of the medial aspect of the wrist. The ulnar head is surrounded by a hypoechoic cavity corresponding to exudative tenosynovitis of the flexor carpi ulnaris ('caput ulnae syndrome').

## Discussion

While the radiographic changes of established rheumatoid arthritis are very typical and sometimes dramatic, the radiographic findings of early stages of the disease are based upon subtle changes, mainly at the soft tissue level. Our preliminary experience shows that high resolution ultrasonography may be useful for the diagnosis of initial rheumatoid arthritis, in particular for the evaluation of soft tissue swellings due to capsular enlargement or to fluid collection within the tendon sheath (Table). In addition, since most of the rheumatic swellings of the hand and wrist are caused by oedema and synovial fluid collection, ultrasonography is effective in differentiating them from other solid masses. One of the most important features of early rheumatic disease is tendon involvement, with formation of a congested synovial membrane and of synovial effusions around the tendons of the fingers. This condition may lead to rupture of the tendon, a cause of severe deformity of the hand (9, 13). Moreover, in rheumatoid tenosynovitis the structural alterations of the tendon can be recognized with ultrasound, which may be of assistance in achieving a correct treatment before frank rupture can occur. The ruptured tendon itself can be revealed by ultrasonography and thus differentiated from finger paralysis of neurologic origin. After surgical reconstruction, the clinical evaluation of the function of the tendon remains the method of choice for control of healing, but ultrasound may be of value in complicated cases. Also capsular swelling of small joints and rheumatoid nodules can be well differentiated from other soft tissue masses, ganglia in particular. Synovial enlargement due to exudative tenosynovitis of the flexor carpi ulnaris and of the flexor digiti minimi can be distinguished from other causes of wrist swelling, ganglia in particular. The latter, in fact, appear as rounded, thin-walled anechoic cavities communicating with the articular space of the wrist joint (1). Tendon sheath effusions, on the contrary, appear as longitudinal, spindle-shaped cavities containing the tendon ribbon.

Ultrasonographic examination of the hand is a simple and harmless procedure that can be performed and repeated freely, also in combination with radiography. For these reasons, it appears suitable for the first diagnostic work-up of early rheumatic disease and for periodical monitor-

ing of treated patients. After surgical reconstruction of ruptured tendons, ultrasonography is useful for control of the suture and for dynamic real-time assessment of the function of the tendon.

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