Sonography in soft-tissue trauma of the shoulder

Thomas Lind[1], Inge Reimann[1], Jan K. Larsen[2] and Steen Karstrup[2]

Seventy-five patients with soft-tissue trauma in the shoulder region were examined by ultrasonography. Normal conditions were found in 21 patients, distension of the acromioclavicular joint in 17, muscle hematoma or edema in 9, biceps tendinitis in 8, hematoma or partial rupture of the biceps tendon in 5, rupture of the biceps tendon in 1, and supraspinatus tendinitis or partial rupture in 14. A correlation was found between the sonography and clinical course; normal sonography was consistent with recovery in less than 1 week, whereas patients with pathologic changes in the supraspinatus or biceps tendon generally had symptoms for at least 1 month.

We concluded that sonography is a useful diagnostic tool for evaluation of soft-tissue trauma in the shoulder.

Clinical and radiographic examinations of injuries of the shoulder region are often inconclusive after fractures and dislocations are excluded. Recently, ultrasonography has been reported to be useful for evaluating the biceps tendon and rotator cuff (Ahovuo et al. 1986, Bretzke et al. 1985, Mack et al. 1985, Middleton et al. 1985, Rapf et al. 1986).

We have used sonography as a primary diagnostic tool for soft-tissue lesions of the shoulder region and have evaluated its capacity to predict the clinical course.

Patients and methods

From May to November 1986, 83 patients were admitted to our emergency department with acute shoulder pain following trauma without radiographic evidence of a fracture or a dislocation. Eight patients declined ultrasonography. The material thus comprised 75 patients. There were 27 females with a median age of 49 (9–91) years and 48 males with a median age of 32 (11–86) years. Sixty injuries occurred during spare time, nine of these being sports injuries. The trauma was direct in most cases. In 19 work-related injuries the predominant cause was strain. In the remainder the cause of trauma was not possible to classify.

In the majority of the patients the diagnosis made by the admitting physician was simply contusion or pain in the deltoid region (Table 1). In 56 patients the radiographic findings were normal. Calcifications were seen in 7 patients. Arthrotic changes in the acromioclavicular joint were present in 9 patients, and 3 of them also had humeroscapular arthrosis. Three patients had isolated humeroscapular arthrosis. Distension of the acromioclavicular joint was seen in 1 patient. No subluxation was found primarily. However after ultrasonography and supplementary loaded radiographs, subluxation was detected in 3 patients.

Ultrasonography was performed using a Brüel and Kjaer 1846 real-time scanner with a 7 MHz small-parts sector transducer.

Sonographic findings ware mainly changes in echogenicity and, to some extent, difference in size of various structures. It is well known that a lower echogenicity is ascribed to a higher fluid content, and can be interpreted as edema or inflammation (Figure 1). It is not possible to distinguish diffuse hemorrhage in the tissue from edema, whereas relatively well-delineated, circular, echo-poor areas can be interpreted as hematomas.

The sonography was performed with the patients sitting, their hands resting on the knees. The non-injured shoulder was examined first for reference. The biceps groove was identified in a transverse scan. The transducer was moved upwards noting the appearance of the biceps tendon, which is normally seen as a well-delineated echo-rich structure.

Where the biceps tendon was seen passing beneath

University of Copenhagen Departments of Orthopedics [1] and Ultrasonography [2], DK-2730 Herlev, Denmark

Correspondence: Dr. Thomas Lind, Hyldegaardsvej 56, 2. TV, DK-2920 Charlottenlund, Denmark

Table 1. Clinical diagnosis and findings related to sonographic diagnosis

	Sonography					
	Distension of AC joint[a] (n 17)	Muscle hematoma or edema (n 9)	Changes in the biceps tendon (n 14)	Changes in supraspinatus tendon (n 14)	Normal (n 21)	Total (N 75)
Clinical diagnosis						
Contusion or pain, deltoid region	12	8	8	9	18	55
Acromioclavicular contusion	5					5
Biceps tendinitis			2	2		4
Bursitis subacromialis				2	1	3
Lesion in supraspinatus		1		1	1	3
Periarthrosis			2		1	3
Rupture of the biceps tendon			2			2
Primary clinical findings						
Restricted, painful movement	11	6	9	8	5	39
Normal but painful movement	6	2	4	6	6	24
Localized pain only	0	1	1	0	10	12
Clinical findings at follow-up						
Restricted movement	4	4	9	10	2	29
Pain at the affected site	6	6	11	7	0	30
Pain elsewhere in the shoulder	0	0	2	4	3	9

[a] AC acromioclavicular joint.

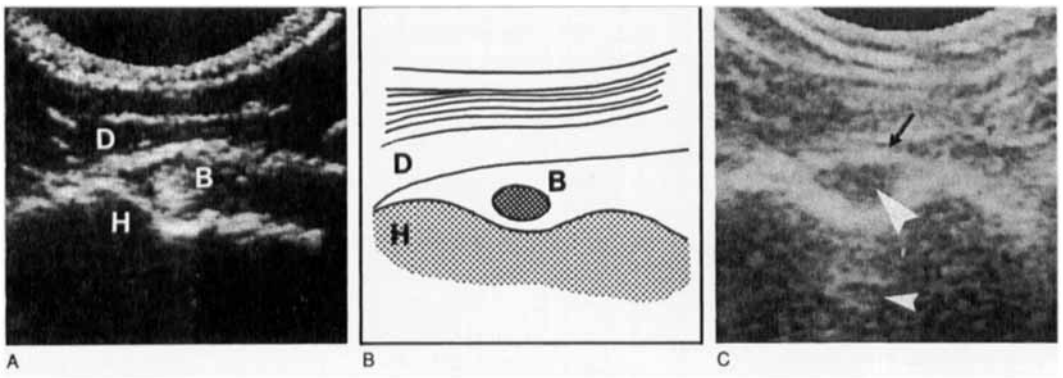

Figure 1. A and B. Normal transverse sonogram showing humerus (H) with bicipital groove, hyperechoic biceps tendon (B) and overlying deltoid muscle (D). C. Hyperechoic tendon sheath (black arrow) and slightly enlarged hypoechoic cross section of biceps tendon (large arrowhead). Small arrowhead shows reverberation artifact.

the supraspinatus, a relatively echo-poor beak-shaped structure pointing laterally, the transducer was turned approximately 90° and moved laterally to visualize the insertion of the supraspinatus tendon at the greater tuberosity. The delineation of the tendon was examined with respect to continuity and echogenicity. Then, a longitudinal scan of the biceps tendon groove from the tendon of the supraspinatus to the long head of the biceps was made. Finally, the acromioclavicular joint was examined.

Clinical follow-up was performed after 1 month with repeated sonography in 37 cases.

Results

Normal conditions were found in 21 of 75 patients. Of these, 2 had calcifications, depicted as small echo-rich areas. In 54 of the patients, pathologic findings were interpreted as follows: distension and hematoma in the acromioclavicular joint (Figure 2) 17; muscle edema or hematoma 9, biceps tendinitis 8, hematoma or partial rupture of the biceps tendon 5, rupture of the biceps tendon 1, tendinitis or hematoma in the supraspinatus tendon (Figure 3) 14; additional calcifications were found in 2 patients with biceps tendinitis and in 3 patients with supraspinatus tendon affections.

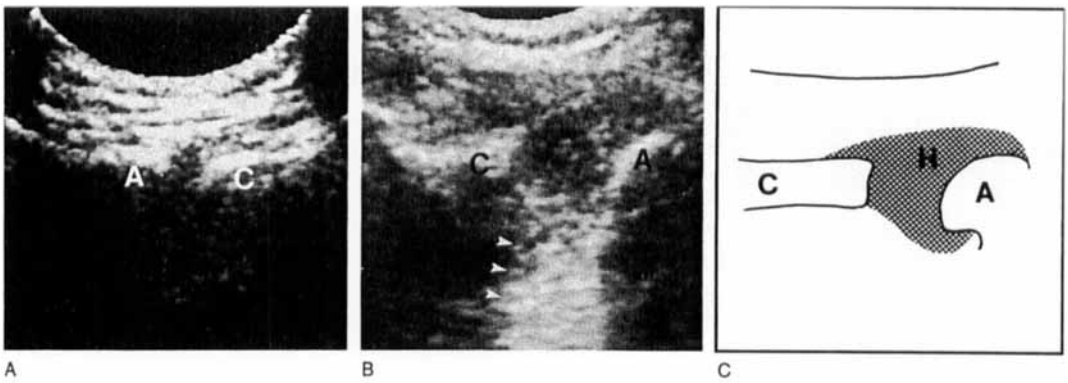

Figure 2. A. Normal acromioclavicular joint space. B and C. Acromioclavicular joint subject to trauma with effusion located in and above the joint (H). Radiographs did not show distension. A = acromion, C = clavicula, small arrows = enhancement.

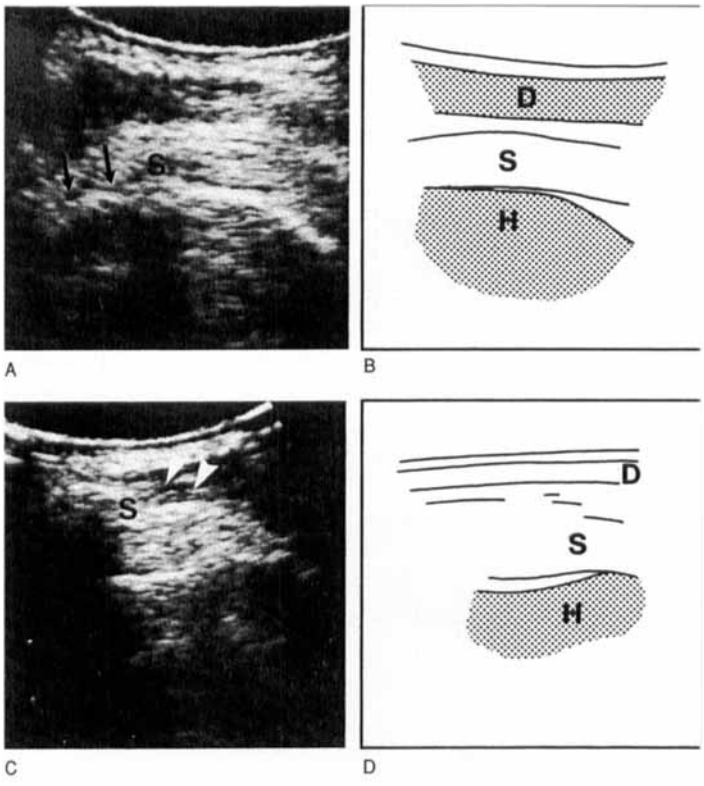

Figure 3. A. and B. Normal sonogram of a right shoulder. Longitudinal section of the supraspinatus tendon (S) and its attachment to the greater tuberosity (arrow).
C and D. Left shoulder. Longitudinal section of an enlarged supraspinatus tendon (S). Near the insertion a defect in the structure (arrow) representing a superficial tear. *H = humerus, D =* deltoid muscle.

Hematoma or edema was most often located in the deltoid muscle (Figure 4); only in 2 cases were such alterations seen in the triceps and infraspinatus muscles. In 4 cases a hematoma – approximately 1 cm in diameter – was seen in the biceps tendon along the bicipital groove (Figure 5), presumably a partial rupture. In one of the patients with clinical rupture of the biceps tendon, the presence of a hematoma made it impossible to verify the diagnosis.

Only 3 of the 21 patients with normal sonography had pain and/or restricted motion at follow-up while 18 were without complaints; the corresponding figures for the 54 patients with pathologic sonography were 36 and 18 ($P < 0.001$, chi-square test). Two of the 3 patients with normal primary sonography and complaints at follow-up had symptoms prior to injury. At follow-up, 6 patients had pathologic sonography in new locations (Table 3). Five had an additional biceps tendinitis. One patient with primary normal sonography had a distension of the subacromial bursa at follow-up.

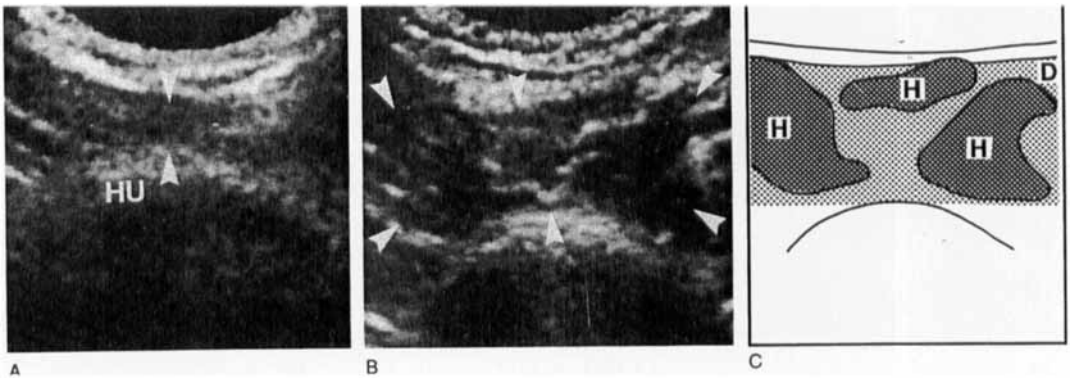

Figure 4. A. Normal sonogram showing deltoid muscle (arrowheads) and humerus (HU). B and C. The deltoid muscle (D) enlarged with relatively well-delineated echo-poor areas (arrowheads and H) representing hematoma (H).

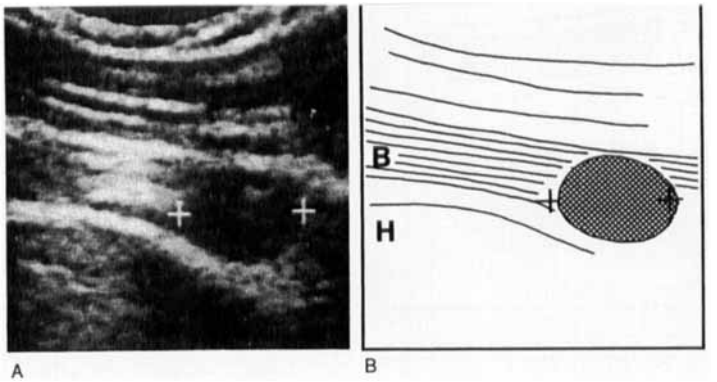

Figure 5. A and B. Longitudinal sonogram showing hyperechoic biceps tendon (B) containing a circular echo-poor area (hatched area between crosses) representing a hematoma. H = humerus.

Table 2. Duration of symptoms related to primary sonographic diagnosis

Sonography	Duration of symptoms (wk)			
	< 11	– 4	> 4	Total
Normal	18	0	3	21
Distension of acromioclavicular joint	3	8	6	17
Muscle hematoma or edema	3	0	6	9
Changes in the biceps tendon	0	1	13	14
Changes in the tendon of the supraspinatus	3	1	10	14
Total	27	10	38	75

Table 3. Sonography at follow-up compared with the primary findings (37 patients)

Primary sonography	Follow-up			
	Normal	Unchanged	New findings	Total
Normal	5	0	1	6
Distension of acromioclavicular joint	4	4	1	9
Muscle hematoma or edema	1	1	0	2
Changes in the biceps tendon	3	7	0	10
Changes in the tendon of the supraspinatus	6	2	4	12
Total	19	14	6	39[a]

[a] Two patients had changes in two structures.

Discussion

The clinical evaluation of soft-tissue lesions in the shoulder is difficult, and plain radiographs give little additional information. Following symptomatic treatment, the next diagnostic step has been either arthrography or arthroscopy.

The structures in the shoulder are relatively superficial, which allows the use of sonography with a high-resolution small parts transducer. Previous work (Ahovuo et al. 1986, Mack et al. 1985, Middleton et al. 1985, Rapf et al. 1986) have shown a high diagnostic accuracy (0.88–0.94) using sonography in rotator cuff and biceps tendon diseases. Bretzke et al. (1985) found no false negative and only one false-positive result comparing sonography with the operative findings in 19 patients with rotator cuff lesion. Our study of acute trauma shows good correlation between sonographic findings and the clinical course. However, occasionally edema and hematoma in the acute phase can blur the sonographic picture, as was the case with a proximal total biceps tendon rupture.

We could document that patients with a normal sonography usually have a good prognosis with a short duration of symptoms. Patients with changes affecting the rotator cuff or biceps tendon generally had symptoms at least 1 month. Overall, we find sonography useful as a primary diagnostic tool locating the lesion more exactly and giving the possibility to asses the need for further and more specific diagnostic and therapeutic procedures.

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