SONOGRAPHY : A VALUABLE MODALITY IN EVALUATION OF CHRONIC NON-TRAUMATIC DISORDERS OF THE SHOULDER JOINT

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ABSTRACT

Chronic non-traumatic shoulder pain may be due to arthralgia, shoulder myalgia, glenohumeral synovitis, adhesive capsulitis, or degenerative joint disease. Clinical skills and routine radiography may not be adequate to establish the diagnosis. This study was designed to assess the role of sonography in such a setting. Twenty-six consecutive patients attending the clinical immunology outpatient department for chronic shoulder pain were evaluated. Based on our findings, we have described 4 distinct sonographic patterns. Pattern 1 consisted of the normal sonographic appearance with semicircular smooth humeral head profile parallel to which was an echo-free synovial space measuring 1-2 mm. This pattern indicated shoulder arthralgia or myalgia without intrinsic shoulder joint disease. Pattern 2 consisted of reduction in the echo-free space indicative of adhesive capsulitis. Pattern 3 consisted of uniform increase in this space, thus indicating active synovial inflammation with effusion. Pattern 4 showed irregularity of the humeral head with reduction in the gleno-humeral joint space and loss of parallelism between the humeral head and the surrounding gleno-humeral synovial space. This last pattern indicated advanced deformed inflammatory or degenerative arthritis. It is concluded that these 4 sonographic patterns will be of considerable help in pinpointing the diagnosis in cases of chronic non-traumatic shoulder pain.

MJAFI 1998; 54: 27-31

KEYWORDS:

Introduction

Chronic shoulder pain may occur in isolation or as a part of systemic or polyarticular disease. Consequently, it may have varied underlying aetiological factors. Firstly, this pain may merely be arthralgia/shoulder girdle myalgia in the absence of any underlying structural damage in the joint. Secondly, it may be due to active glenohumeral synovitis with effusion. Thirdly, this pain may represent adhesive capsulitis. Lastly, it may be due to advanced erosive or degenerative joint disease causing joint space reduction and irregularity of the humeral head articular surface. The clinical picture may not provide adequate clues to the diagnosis. Degenerative joint disease, soft tissue calcification and peri-arthritis may be picked up by plain radiography but this modality is of little direct benefit in the diagnosis of lesions such as adhesive capsulitis, synovitis, or joint effusion [1]. Computerized tomography (CT) of the shoulder is only useful for assessing shoulder instability and rotator cuff integrity and is not routinely available [2].

Though magnetic resonance imaging (MRI) provides superb anatomic details of the shoulder and the rotator cuff [3], its high cost precludes its routine use. Arthrography is helpful in diagnosing adhesive capsulitis as also bicipital tenosynovitis and tendon rupture, but is an invasive procedure requiring expertise in intra-articular injection.

In contrast, sonography (USG) has several inherent advantages: it is relatively inexpensive, allows comparison with the normal opposite side, uses no radiation, is noninvasive, less time consuming and can be performed at bedside [4]. In spite of these potential advantages, literature on the role of USG in the diagnosis of non-traumatic shoulder disorders is scant. Reviews covering musculoskeletal imaging of the shoulder emphasize disorders such as rotator cuff tears but are conspicuously silent as regards other painful shoulder disorders such as synovial effusion, adhesive capsulitis and joint degeneration [4-6]. Hence, we decided to evaluate the role of USG in diagnosis of such nontraumatic shoulder disorders in this study.

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Material and Methods

Twenty-six consecutive patients attending the Clinical Immunology outpatient department of our hospital whose chief complaint was chronic nontraumatic shoulder pain were studied. In addition to detailed clinical and laboratory evaluation, they were also subjected to plain radiography of the affected shoulder joint. All these patients underwent USG examination of both shoulders using a 5 Mhz frequency sector transducer. The probe was moved along the glenohumeral joint-line from behind to front in a semi-circular sweep, always keeping the joint-space in view. Tendinitis, tenosynovitis and bursitis could not be detected due to nonavailability of higher frequency transducers (7.5/10 Mhz).

In cases where the knees were clinically involved, these were also evaluated using a 3.5 Mhz biconvex linear array transducer. The supra- and infra-patellar regions were sequentially evaluated using a medial approach and sweeping the sonography beam antero-posteriorly [8]. USG-guided arthrography [9] and CT evaluation of the affected shoulder was done in selected cases to look for correlation with USG findings.

Results

A total of 26 patients with diverse disorders were evaluated. The number of patients and shoulders with each disorder assessed and the sonographic patterns observed in these shoulder joints are shown in table. The normal sonographic appearance of the shoulder joint (pattern 1) consisted of a semicircular smooth humeral head profile parallel to which was seen an echo-free space representing synovial fluid and measuring 1-2 mm in width (Fig 1). The rotator cuff was seen as a zone of moderately increased echogenicity with fine parallel internal echos around this echo-free space. Diagnosis of shoulder arthralgia/shoulder girdle myalgia in the absence of any intrinsic shoulder joint disease or systemic disorder was confirmed in additional 14 cases (not shown in Table) by the presence of this pattern. Sonographic evaluation of diseased shoulders in this study showed 3 distinct patterns. The first pattern (pattern 2) was that of a smooth outline of the humeral head together with uniform reduction of the glenohumeral synovial space indicating adhesive capsulitis (Fig 2). The second pattern (pattern 3) consisted of a smooth humeral head contour together with uniform increase in the glenohumeral synovial space indicating joint effusion (Fig 3). The last pattern (pattern 4) comprised irregularity of the humeral head with reduction in the glenohumeral joint space and loss of parallelism between the humeral head and the surrounding glenohumeral synovial space indicating advanced arthritis (Fig 4). Synovial thickening was not observed in any shoulder but could clearly be seen as a bright hyperechoic mass in the suprapatellar fossa of 3 rheumatoid knees and in 1 patient with Reiter's disease. Suprapatellar effusions were also easily demonstrable (Fig 5). USG guidance was found to be particularly useful for giving intra-articular depot steroid injections in cases of adhesive capsulitis with joint space reduction to less than 1 mm.

Repeat USG was also found to be useful in evaluating response to therapy in cases of joint effusions.

Discussion

Reliable demonstration of pathologic macro-anatomy through various imaging modalities in cases of chronic non-traumatic painful disorders of the shoulder remains an area of importance to the physician. Clinical examination and routine radiography may not help in the separation of arthralgia from arthritis or of synovial effusion from capsulitis. This study shows

TABLE

Four sonographic patterns and radiologic findings in painful non-traumatic shoulder disorders

Diagnosis	Number of pts	Number of shoulder joints	Sonographic pattern			
			1	2	3	4
Idiopathic adhesive capsulitis	8	8	3	5	0	0
Rheumatoid arthritis	9	16	9	2	3	2
Degenerative joint disease	5	7	5	2	0	0
Gout	2	2	2	0	0	0
Reiter's disease	1	1	1	0	0	0
Ankylosing spondylitis with psoriasis	1	2	0	2	0	0
Total	26	36	20	11	3	2

Fig. 1a :

Fig. 1b :

Fig. 2a :

Fig. 2b :

Fig. 3a :

Fig. 3b :

Fig. 4a :

Fig. 4b :

Fig. 5a :

that certain USG patterns can come to the aid of the clinician. Pattern 1 (semicircular smooth humeral head with a surrounding parallel echo-free space measuring 1-2 mm) reliably indicates the absence of any gross structural disease in the glenohumeral joint. Pattern 2 (semicircular smooth humeral head with uniform reduction of adhesive capsulitis). Pattern 3 (semicircular smooth humeral head with uniform increase in the glenohumeral synovial space) establishes the diagnosis of active synovitis with joint effusion. Pattern 4 (irregular humeral head with reduced glenohumeral synovial space and loss of parallelism between the humeral head and the glenohumeral synovial space) indicates the presence of advanced destructive or degenerative shoulder arthritis.

Although MRI studies have established that the thickness of the articular cartilage of the humeral head varies between 1.2 mm and 1.4 mm [10], normal values for the width of the glenohumeral synovial space have not been established. Our study showed a normal value of 1 mm to 2 mm.

In so far as adhesive capsulitis is concerned, MRI studies have concluded that if the capsule and synovial thickness taken together measure more than 4 mm, irrespective of the fluid volume, the diagnosis is established [3], implying fibrotic thickening of the joint capsule. In contrast, our study has shown that reduction in the synovial space to less than 1 mm correlates very well with adhesive capsulitis.

Sonography has been taken as a reliable indicator for effusion [11], particularly in the setting of rotator cuff injuries where gross accumulation of fluid occurs [12]. However, no values have so far been established. Our study demonstrates that a synovial space width of

Fig. 5b :

more than 2 mm is indicative of effusion. It has also been observed that a difference of 1 mm more or 1 mm less as compared to the normal contralateral side is indicative of effusion and capsulitis respectively.

Though conventional plain radiography is a sensitive method for diagnosing advanced destructive or degenerative shoulder arthritis [13], USG also appears to be an effective and convenient method for this purpose, as observed by earlier workers also [1].

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