

## Ultrasonographic Findings of the Shoulder in Patients with Rheumatoid Arthritis and Comparison with Physical Examination

The objectives of this study were: 1) to identify the ultrasonographic (US) abnormalities and 2) to compare the findings of physical examination with US findings in rheumatoid arthritis (RA) patients with shoulder pain. We studied 30 RA patients. Physical examination was performed systemically as follows: 1) area of tenderness; 2) range of passive and active shoulder motion; 3) impingement tests; 4) maneuvers for determining the location of the tendon lesions. US investigations included the biceps, the supraspinatus, infraspinatus, and subscapularis tendons; the subacromial-subdeltoid bursa; and the glenohumeral and acromioclavicular joints. Thirty RA patients with 35 painful and 25 non-painful shoulders were examined. The range of motion affected the most by shoulder pain was abduction. The most frequent US finding of shoulder joint was effusion in the long head of the biceps tendon. Among the rotator cuff tendons, subscapularis was the most frequently involved. Tendon tear was also common among non-painful shoulders. Physical examination used for the diagnosis of shoulder pain had low sensitivity and specificity for detecting abnormalities in the rheumatoid shoulder joint. In conclusion, US abnormalities showed frequent tendon tears in our RA patients. Physical examination had low sensitivity and specificity for detecting rotator cuff tear in the rheumatoid shoulder joint.

**Key Words :** Rheumatoid Arthritis; Shoulder; Pain; Ultrasonography; Rotator Cuff; Osteoarthritis; Physical Examination

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## INTRODUCTION

Shoulder pain is one of the most common complaints encountered in patients with rheumatoid arthritis (RA). During the first 2 yr of RA, nearly 50% of patients have shoulder symptoms, and 90% complain of shoulder pain at some time during the course of the disease (1). In addition to the synovitis of the glenohumeral (GH) joint, shoulder pain in RA arises from pathologies involving diverse periarticular soft tissues, and the involvement of more than one anatomical structure is common. Because it is difficult to detect and identify the site of anatomical alterations with clinical examinations even in non-RA shoulders (2), correct diagnosis and management of painful RA shoulder by clinical examination alone is often problematic.

Radiographic assessment of peripheral joints has served as an objective standard for the evaluation of RA progression. However, it is difficult to evaluate complex anatomical structures such as the shoulder joint by conventional radiography alone. Ultrasonographic (US) evaluation is useful for diagnosing a variety of regional pain syndrome and soft tissue

rheumatism and has been increasingly employed in the rheumatologic practice (3). Given the great improvement in resolution achieved by high frequency ultrasound, it is expected to serve as an important tool for accurate evaluation of RA shoulders. In a study performed in 43 RA patients, US examination detected more erosions in the humeroscapular joint compared to conventional radiography (4). In addition, US examination detected synovitis, tenosynovitis, and bursitis in a significant number of patients, implicating its value for the diagnosis of shoulder pain in RA patients (4).

The objectives of this study were: 1) to identify the US abnormalities and 2) to compare the physical examination with US findings, especially of the rotator cuff abnormalities in RA patients with shoulder pain.

## MATERIALS AND METHODS

We studied 30 consecutive RA patients visiting a university affiliated rheumatology clinic. Sex, age, height, weight, body mass index (BMI), duration of RA, involved joint groups,

current RA medications, erythrocyte sedimentation rate (ESR), and C-reactive protein (CRP) were recorded. Detailed history of shoulder pain including duration, involved site, previous diagnosis, and the category of previous treatment was obtained. Patients who developed shoulder pain after trauma in the shoulder area were excluded.

**Physical examination**

Physical examination of the shoulder was performed systematically by one blinded rheumatologist as follows: 1) area of tenderness in the GH joint, acromioclavicular (AC) joint, bicipital groove, and subacromial space; 2) range of passive and active motion for abduction, forward flexion, external rotation, and internal rotation measured with a goniometer; 3) Neer and Hawkins tests for shoulder impingement; 4) maneuvers for determining the location of the tendon lesions (Jobe’s test for supraspinatus, Patte’s test for infraspinatus, Gerber’s lift off test for subscapularis, and Yergason’s test for the long head of the biceps brachii). For the impingement maneuver of Neer (5, 6), the examiner stands behind the seated patient and uses one hand to prevent rotation of the scapula while passively raising the patient’s arm with the other hand to produce both forward elevation and abduction. In Hawkins’s test (7), the examiner stands facing the patient and after raising the patient’s arm to 90° of strict forward elevation with the elbow in 90° flexion, rotates the arm medially by lowering the forearm. These tests are positive when patients experience pain during the maneuvers. In Jobe’s maneuver (8), the patient places both arms in 90° abduction and 30° horizontal adduction, in the plane of the scapula; the examiner then pushes the patient’s arms downward while asking the patient to resist the pressure. For Patte’s maneuver (9), the examiner supports the patient’s elbow in 90° flexion while the patient is asked to rotate the arm laterally. Jobe’s and Patte’s maneuvers can produce three types of response: 1) absence of pain, indicating that the tested tendon is normal; 2) the ability to resist despite pain, denoting tendinitis; 3) the inability to resist with gradual lowering of the arm or forearm, indicating tendon rupture. In Gerber’s lift off test (10), the patient is asked to place the hand against the back at the level of the waist with the elbow in 90° flexion. The examiner pulls the hand to about 5-10 cm from the back while maintaining the 90° bend in the elbow. In Yergason’s test (11), pain along the course of the biceps tendon produced by resisted supination of the forearm denotes bicipital tendinitis.

**Ultrasonographic (US) examination**

US examination was performed by a rheumatologist who was blinded to the clinical test. A linear array 7 MHz transducer (HDI 5000, ATL ultrasound, Bothell, U.S.A.) was used. Investigations included transverse and longitudinal

planes from the long head of the biceps, the supraspinatus, the infraspinatus, and the subscapularis tendons; the subacromial-subdeltoid bursa; and the GH and AC joints. Tendon thickness, homogeneity of the fibrillar pattern, and the presence of calcification were noted. In all patients, images of the bilateral shoulder were obtained in order to compare US findings between 2 shoulders in case of unilateral involvement. The US examination technique for the shoulder is widely described (5, 12). The biceps tendon was examined with the patient seated with the elbow flexed to 90° and the forearm half pronated on the lap. On the anterior aspect of the shoulder, the long head of biceps tendon is imaged as an oval-shaped echogenic structure. Anteromedial to the biceps tendon, the hyperechoic subscapularis tendon was identified with slight external rotation of the GH joint. The supraspinatus tendon was examined with the patient’s shoulder in hyperextension and full internal rotation with the dorsum of the hand placed in the small of the back. These tendons appear as a hyperechoic fibrillar layer, convex, tapered and inserting at the greater tuberosity on longitudinal view. The subacromial-subdeltoid bursa was imaged as a hypoechoic line, between the deltoid muscle and the supraspinatus and infraspinatus tendons. The infraspinatus tendon and GH joint were examined with the patient’s hand placed on the contralateral shoulder. The transducer was oriented in the axial plane until the head of the humerus was seen adjacent to the posterior glenoid labrum. The presence of GH joint effusion, pannus and humeral head irregularity was observed. The infraspinatus tendon and its insertion were observed by moving the transducer laterally from the GH joint. The AC joint was examined with the transducer oriented along the coronal plane, and the presence of intra-articular fluid was noted. US diagnostic criteria of shoulder abnormalities are presented in Table 1.

**Statistical analysis**

Data are presented as mean ± standard deviation for continuous variables and as frequency (%) for categorical variables. A *p* value was calculated by Student’s *t*-test for continuous variables or by chi-squared test for categorical variables. A *p* value less than 0.05 was considered statistically

**Table 1.** Ultrasonographic diagnostic criteria of shoulder abnormalities

| Shoulder abnormality   | Diagnostic criteria  |
|------------------------|--|
| Biceps sheath effusion | Thickness of the hypoechoic halo of fluid surrounding the biceps tendon >2 mm  |
| Glenohumeral effusion  | Distance from the posterior labrum to the posterior infraspinatus tendon >2 mm |
| Full thickness tear    | Non-visualization of tendon or complete fiber discontinuity                    |
| Partial thickness tear | Partial fiber discontinuity  |
| Subdeltoid effusion    | Hypoechoic fluid filled bursa >2 mm  |

significant. All the statistical analyses were performed using SPSS for Windows (Version 10.0, Chicago, IL, U.S.A.).

**RESULTS**

Table 2 shows the baseline demographic characteristics of the subjects. The majority of patients had active RA with a

**Table 2.** Baseline characteristics of the 30 RA patients examined

|  |                           |
|--|---------------------------|
| Age                                    | 52.9 ± 14.8 (range 16-75) |
| Sex (male/female)                      | 6/24                      |
| Duration of RA (yr)                    | 6.4 ± 7.6 (range 0.5-30)  |
| Involved site (%)                      |                           |
| Right                                  | 9 (30)                    |
| Left                                   | 8 (26.7)                  |
| Both                                   | 9 (30)                    |
| Non-painful                            | 4 (13.3)                  |
| Duration of shoulder pain (months)     | 10.6 ± 16.0 (range 1-60)  |
| Number of involved joint groups (%)    |                           |
| 1                                      | 2 (6.7)                   |
| 2                                      | 7 (23.3)                  |
| 3                                      | 3 (10)                    |
| 4                                      | 7 (23.3)                  |
| >5                                     | 11 (36.7)                 |
| Presence of hand/foot erosion (%)      |                           |
| Yes                                    | 18 (60)                   |
| No                                     | 12 (40)                   |
| Erythrocyte sedimentation rate (mm/hr) | 42.8 ± 37.3               |
| C-reactive protein (mg/dL)             | 28.0 ± 34                 |
| RF positivity (%)                      | 15 (50)                   |

RA, rheumatoid arthritis.

**Table 3.** Positive physical examination findings of RA shoulders

|   | non-painful<br>(n=25) | Painful<br>(n=35) |
|---|-----------------------|-------------------|
| <b>Tenderness</b>                           |                       |                   |
| Glenohumeral                                | 3 (12)*               | 22 (62.9)         |
| Subacromial                                 | 4 (16)                | 15 (42.9)         |
| Bicipital                                   | 5 (20)                | 17 (48.6)         |
| Acromioclavicular                           | 4 (16)                | 8 (22.9)          |
| <b>Limitation of motion</b>                 |                       |                   |
| Forward flexion                             | 3 (12)                | 18 (51.4)         |
| Abduction                                   | 4 (16)                | 19 (54.3)         |
| External rotation                           | 3 (12)                | 12 (34.3)         |
| Internal rotation                           | 4 (16)                | 16 (45.7)         |
| Range of passive motion greater than active | 4 (16)                | 14 (40)           |
| <b>Impingement test</b>                     |                       |                   |
| Neer  | 1 (4)                 | 13 (37.1)         |
| Hawkins                                     | 2 (8)                 | 15 (42.9)         |
| <b>Individual tendon test</b>               |                       |                   |
| Jobe's test (supraspinatus)                 | 5 (20)                | 21 (60)           |
| Patte's test (infraspinatus)                | 1 (4)                 | 11 (31.4)         |
| Gerber's lift off test (subscapularis)      | 2 (8)                 | 14 (40)           |
| Yegarson's test (Biceps)                    | 3 (12)                | 6 (17.2)          |

\* , % in parenthesis. RA, rheumatoid arthritis.

mean ESR of 42.8 mm/hr. Sixteen (53.3%) patients were treated with oral corticosteroid. Twenty-seven (90%) patients were treated with disease-modifying anti-rheumatic drug (DMARD), and the median number of DMARDs used was 2. Simple radiography findings of the shoulder included 18 (60%) patients with normal findings, 6 (20%) with erosion, 5 (16.7%) with a degenerative change showing osteophytes and joint space narrowing, 2 (6.7%) with total destruction of shoulder bony architecture, and 1 (3.3%) with calcification.

Table 3 shows physical examination findings for the shoulder joints of the study patients. Overall, painful shoulders showed more positive findings on physical examination compared to non-painful shoulders. The range of motion affected the most by shoulder pain in our patients was abduction, followed by forward flexion and internal rotation. For physical examination of individual tendons, we first tried to differentiate positive response as either pain or weakness. However, during the physical examination, we found that it was very difficult to differentiate the failure to resist due to pain or weakness in many of our patients; patients often refused to continue the test due to elicitation of severe pain by the maneuver. Therefore, this examination was recorded as either positive or negative, with positive result including inability to resist the examiner's force, be it due to pain or weakness. The majority of the shoulder joints exhibited abnormalities in Jobe's test, indicating supraspinatus lesion, followed by

**Table 4.** Ultrasonographic examination findings of RA shoulders

|                                       | non-painful<br>(n=25) | Painful<br>(n=35) |
|---------------------------------------|-----------------------|-------------------|
| <b>Long head of the biceps tendon</b> |                       |                   |
| Effusion                              | 9 (36)*               | 13 (37.1)         |
| Rupture                               | 2 (8)                 | 5 (14.3)          |
| Subdeltoid effusion                   | 1 (4)                 | 5 (14.3)          |
| <b>Supraspinatus tendon</b>           |                       |                   |
| Thickening                            | 2 (8)                 | 6 (17.1)          |
| Thinning                              | 5 (20)                | 7 (20)            |
| <b>Tears</b>                          |                       |                   |
| Partial thickness                     | 4 (16)                | 6 (17.1)          |
| Full thickness                        | 3 (12)                | 6 (17.1)          |
| Calcification                         | 1 (4)                 | 2 (5.7)           |
| <b>Infraspinatus</b>                  |                       |                   |
| Thickening                            | 0 (0)                 | 3 (8.6)           |
| Thinning                              | 6 (24)                | 6 (17.1)          |
| <b>Tears</b>                          |                       |                   |
| Partial thickness                     | 2 (8)                 | 4 (11.4)          |
| Full thickness                        | 1 (4)                 | 0 (0)             |
| <b>Subscapularis</b>                  |                       |                   |
| Thickening                            | 0 (0)                 | 2 (5.7)           |
| Thinning                              | 6 (24)                | 13 (37.1)         |
| <b>Tears</b>                          |                       |                   |
| Partial thickness                     | 5 (20)                | 8 (22.9)          |
| Full thickness                        | 3 (12)                | 5 (14.3)          |
| GH effusion                           | 5 (20)                | 12 (34.3)         |
| Humeral bony irregularity             | 2 (8)                 | 10 (28.6)         |

\* , % in parenthesis. GH, glenohumeral; RA, rheumatoid arthritis.

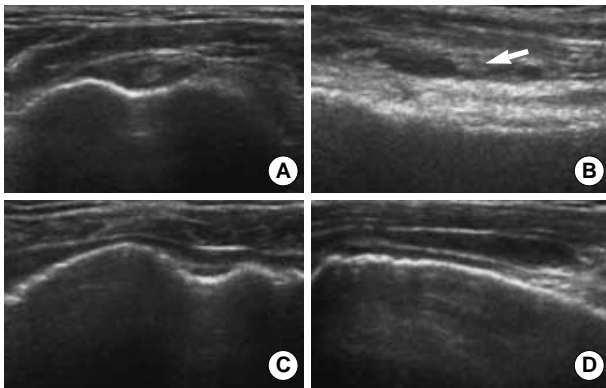


Fig. 1. Ultrasonographic findings of biceps abnormalities. (A, B) Biceps effusion with pannus (arrow) in biceps tendon sheath. (C, D) Biceps tendon rupture with empty sheath. (A, C) Transverse view. (B, D) Longitudinal view.

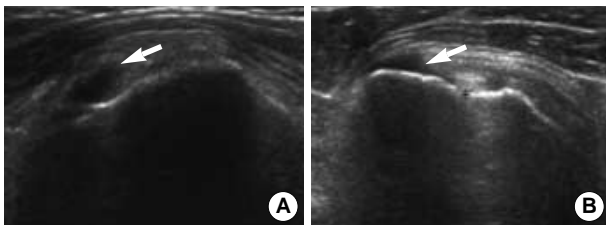


Fig. 2. Partial thickness tear in subscapularis tendon (arrow) in a non-painful shoulder. (A) Transverse view. (B) Longitudinal view.

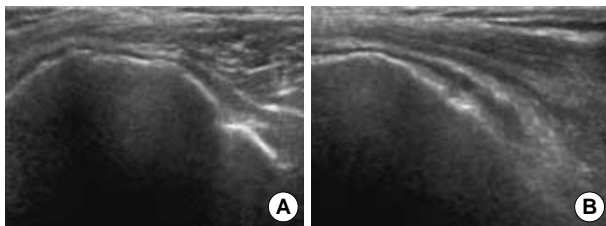


Fig. 3. Complete massive tear in supraspinatus in a non-painful shoulder. (A) Transverse view. (B) Longitudinal view.

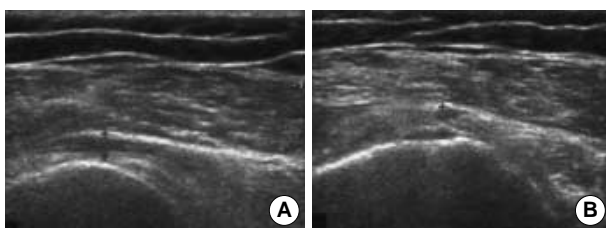


Fig. 4. Bilateral partial thickness tear in infraspinatus in one patient. Transverse view. (A) Painful shoulder. (B) Non-painful shoulder.

Gerber's lift off (subscapularis) and Pattes' (infraspinatus) test.

Table 4 lists US findings for the study patients. The most frequent finding was effusion in the long head of the biceps tendon, which was observed in 37.1% of painful shoulders. It was also observed in 36% of non-painful shoulders. The

Table 5. Clinical parameters associated with tendon tear in RA patients

|                                     | Tear (n=20) | No tear (n=10) |
|-------------------------------------|-------------|----------------|
| Age                                 | 53.15       | 52.4           |
| Sex (M:F)                           | 4:16        | 2:8            |
| Duration of RA (yr)                 | 8.0         | 3.15           |
| Number of involved joint groups     |             |                |
| 1                                   | 5           | 10             |
| 2-4                                 | 55          | 60             |
| >5                                  | 40          | 30             |
| Duration of shoulder pain (months)  | 9.75        | 8.2            |
| Number of DMARDs used (%)*          |             |                |
| 1                                   | 30          | 80             |
| >2                                  | 70          | 20             |
| ESR (mm/hr)                         | 40.7        | 47.1           |
| CRP (mg/dL)                         | 24.7        | 32.0           |
| Rheumatoid factor positive (%)      | 55          | 40             |
| Presence of small joint erosion (%) | 75          | 50             |
| Presence of GH joint erosion (%)*   | 20.7        | 0              |

\*, denotes a difference statistically significant between tear and non-tear groups ( $p < 0.05$ ).

RA, rheumatoid arthritis; ESR, erythrocyte sedimentation rate; CRP, C-reactive protein; GH, glenohumeral; DMARD, disease-modifying anti-rheumatic drug.

Table 6. Sensitivity and specificity of physical examination for detection of US tendon tears in RA patients (%)

|  | Any tear    |             | Specific tendon tear |             |
|--|-------------|-------------|----------------------|-------------|
|  | Sensitivity | Specificity | Sensitivity          | Specificity |
| GH tenderness                          | 52          | 54          |                      |             |
| SA tenderness                          | 78.9        | 65.9        |                      |             |
| LOM                                    |             |             |                      |             |
| Forward flexion                        | 52.4        | 53.8        |                      |             |
| Abduction                              | 56.5        | 56.8        |                      |             |
| External rotation                      | 53.3        | 53.3        |                      |             |
| Internal rotation                      | 45          | 52.6        |                      |             |
| Jobe's test (supraspinatus)            |             |             | 72.4                 | 45.2        |
| Gerber's lift off test (subscapularis) |             |             | 68.8                 | 47.7        |
| Patte's test (infraspinatus)           |             |             | 62.5                 | 72.7        |
| Yegarson's test (biceps)               |             |             | 14.3                 | 89.1        |

US, ultrasonography; RA, rheumatoid arthritis; GH, glenohumeral; SA, subacromial; LOM, limitation of motion.

mean thickness of the biceps effusion was 3.30 and 3.41 mm in painful and non-painful shoulders, respectively. Biceps tendon rupture and subdeltoid effusion were detected in 14.3% of painful shoulders, respectively. Among the rotator cuff tendon, except for the teres minor which was not included in our US examination, subscapularis was the most frequently involved, with tendon tear observed in 37% of shoulders. For supraspinatus and infraspinatus tendon, tendon tear was observed in 34 and 11% of the shoulders. It is of note that tendon tear was also common among non-painful shoulders, with 32, 28, and 12% of shoulders showing tear in the sub-

scapularis, supraspinatus and infraspinatus tendons, respectively. Multiple tendon tear was also common with rupture of 2 tendons in 12 and 22.9%, and rupture of 3 tendons in 8 and 11% of non-painful and painful shoulders, respectively. Calcification in the supraspinatus tendon was observed in 3 (5%) shoulders, among which only 1 showed calcification on simple radiography. GH joint effusion was noted in 20 and 34.3% of non-painful and painful shoulders, respectively, and the mean thickness of the effusion was 5.06 and 3.64 mm, respectively. Humeral cortical irregularity was detected in 12 shoulders (20%), among which 6 showed erosion on simple radiography. Representative US findings are presented in Fig. 1–4.

Next, clinical parameters associated with tendon tear were analyzed (Table 5). Age of the patient, sex, the duration of RA, ESR, CRP, the presence of rheumatoid factor, the presence of erosion in small joints, and the number of involved joint group were not significantly associated with the presence of tendon tear. The number of DMARDs used, and the presence of GH joint erosion was significantly associated with the presence of tendon tear. Table 6 shows the sensitivity and specificity of physical examination for the detection of US tendon tear. As shown, most of the tests for examination of shoulder joint and rotator cuff yielded low sensitivity and specificity.

## DISCUSSION

In this study of RA patients with a relatively short disease duration, US abnormalities in the shoulder were common, with many shoulders showing rotator cuff tendon tears. Many non-painful shoulders also showed US abnormalities. The most frequent US finding of shoulder joints in our patients was effusion in the long head of the biceps tendon. Among the rotator cuff tendons, subscapularis was the most frequently involved, followed by supraspinatus and infraspinatus tendon. Physical examination traditionally used for the diagnosis of shoulder pain had low sensitivity and specificity for detecting tendon tear in the rheumatoid shoulder joint.

The frequency of abnormal US findings of rheumatoid shoulder joints differs depending on the patient population studied. In a study evaluating 44 hospitalized RA patients with mean disease duration of 12 yr, subacromial bursitis was the most frequent finding, followed by GH joint synovitis, bicipital tendinitis and abnormalities in the supraspinatus tendon (13). In accordance with our result, abduction and forward flexion were often restricted, but clinical findings were non-specific (13). In another US study evaluating 90 RA shoulders with a mean disease duration of 5.5 yr (2), effusion in the long head of the biceps tendon was noted in 32.2%, and subacromial bursitis in 17.7%, while rotator cuff tear was detected infrequently (1.1 for infraspinatus and 4.4% for supraspinatus). Compared to polymyalgia rheumat-

ica or periarticular disorders of the shoulders not related to RA, rheumatoid shoulders tended to show involvement of all periarticular structures (2). This discrepancy from our data may stem from the difference in patient profile as well as the quality of the US equipment or the protocol for the evaluation of the shoulder. In a more recent study (14), 57 consecutive RA patients were evaluated using a 7.5 MHz linear probe and a standardized study protocol. Rotator cuff tear was noted in 10% of the painful shoulders. In line with our data, painless RA shoulders also revealed frequent US abnormalities (14). Tendon tear was most frequently observed in subscapularis tendon in our patients, and this is in contrast with rotator cuff tear in non-RA shoulder pain, which shows tear in supraspinatus most often (15, our unpublished observation). Whether this is a specific finding in RA shoulder should be explored in more patients.

There have been no reports assessing the risk factors for rotator cuff tendon tear in RA patients. In our study, usual indicators of disease activity, such as ESR, CRP or the presence of hand/foot joint erosion were not significantly correlated with the presence of tendon tear. Duration of RA or shoulder pain and RF positivity were not correlated, either, but the presence of GH joint erosion or number of DMARDs used were. Because data were collected cross-sectionally at the time of US evaluation, number of DMARDs used may be a better indicator of overall disease activity compared to ESR or CRP. In addition, duration of RA tended to be longer in RA patients with tendon tear compared to those without, and the statistical non-significance might have been due to the small sample size.

In line with previous reports (5, 16), our results show that the clinical examination of periarticular conditions in the painful RA shoulder is not accurate. The low sensitivity and specificity of physical examination for RA shoulders may be due to the fact that most RA patients with shoulder pain have multiple periarticular lesions, involving tendons, the subacromial-subdeltoid bursa, and GH joint simultaneously. The failure to distinguish between positive findings due to weakness or pain might also have resulted in the low specificity of physical examination in our patients. In addition, involvement of elbow or wrist joint often hinders from proper examination of the shoulder, decreasing diagnostic accuracy.

Currently, magnetic resonance imaging (MRI) has been widely used to evaluate painful shoulders. A recent study compared US examination with dynamic contrast-enhanced MRI in shoulders of patients with RA (17). Although US examination detected significantly more bony erosion compared to conventional radiography, MRI was significantly more sensitive for detecting synovitis, tenosynovitis, and bursitis as well as bony erosion than US examination. However, while MRI is expensive, time-consuming, and not widely available, US examination is quick, inexpensive, and easy to perform. US examination can also routinely be used for dynamic examination of the musculoskeletal system. More

recently, US supplemented by power Doppler was found to have value in differentiating rheumatoid inflammation from the degenerative shoulder disease by detection of the changes in vascularities, extending the applicability of US examination to the evaluation of the process of inflammation in relation to neoangiogenesis (18).

Although US examination offers considerable benefit for proper evaluation of shoulder joint problems, limitations exist such as lack of visualisation of the posterior aspect of the rotator cuff tendons, limited view of the GH joint, and considerable dependence on the operator. Therefore, despite the fact that most rotator cuff lesions involve the "critical zone" in the anterior aspect of the tendons (19), US examination may underestimate the prevalence of rotator cuff abnormalities.

Our study has a few limitations. First, gold standard for assessing the shoulder lesion, such as arthroscopy or MRI was not done. Although the agreement between US examination and MRI in the detection of tendon tear was good in 4 of our patients who underwent MRI after US examination (data not shown), the incidence of rotator cuff tear detected by US examination alone might have been incorrect. Second, normal controls without shoulder pain were not examined. Non-painful shoulders in RA patients showed more US abnormalities compared to asymptomatic shoulders in non-RA patients examined in a separate study (unpublished observation). Therefore, our main finding is that RA shoulders exhibit multiple lesions regardless of the presence of pain.

Conservative treatments of shoulder problems in RA include medical treatment, physiotherapy, and local injections of corticosteroids. The high prevalence of rotator cuff tear in RA shoulders shown in our series warrants precaution against these empirical treatments; it would be more desirable to obtain an exact anatomical diagnosis in order to optimize treatment. Few studies have compared the outcome of treatment for periarticular shoulder lesions with or without an accurate imaging technique (20). A recent surgical series revealed that RA patients with both partial and full-thickness rotator cuff tears had significant improvements in overall pain and satisfaction after the repair (21). However, only patients with a partial-thickness tear had improvement of active elevation. This result suggests that rotator cuff tendon repair performed early in its course may be more beneficial to obtain satisfactory result. There is a need for further trials investigating whether the US examination of the shoulder in RA patients offers a possibility of improving its treatment.

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