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# Would Static and Dynamic Shoulder Ultrasound Add a Diagnostic Value in Rheumatoid Arthritis Patients?

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## Abstract

*Background:* Musculoskeletal (MS) ultrasonography (US) plays an important role in detection of subclinical abnormalities in rheumatoid shoulder, which allows early treatment. MS US is a useful tool in the evaluation of inflammatory RA arthritis being more sensitive than clinical examination. It is a useful tool in detection of disease progression and follow up post treatment. Dynamic sonography allows accurate evaluation of multiple musculoskeletal disorders that are best or only shown during movements.

*Aim of Study:* To assess the diagnostic value of shoulder US in the evaluation of rheumatoid arthritis with shoulder pain as a disease activity parameter providing a semi-quantitative scoring system for synovitis and sub acromial impingement being frequently involved to monitor treatment response in correlation with other clinical and laboratory parameters.

*Patients and Methods:* This study included 51 unilateral shoulder joints in 51 patients (34 females and 17 males) with mean age of 39.8 years. All patients were RA diagnosed. Musculoskeletal ultrasound were performed for all patients with static (including gray scale and power Doppler modes) and dynamic manners for semi-quantitative scoring system of synovitis, erosions and sub acromial impingement. Follow-up US were repeated after 3 to 6 months of treatment.

*Results:* 47(92.2%) RA patients studied had synovial thickening and synovitis on B-mode and PD with variable semi-quantitative scoring grades of severity. 26 patients showed improvement on PD after treatment by recording better scoring compared to their baseline before treatment. Pre-treatment dynamic ultrasonography found that most impingement cases (45.1%) were classified as grade 2and 13 patients of them improved after physiotherapy treatment. In our study 41 (80.4%) of the patients received corticosteroids; 12 patients had progressive disease status with subsequent treatment complications.

*Conclusion:* US is an informative tool in assessment of shoulder pain in RA patients whether static or dynamic US that provides a semi-quantitative scoring system for synovitis and erosions as well as dynamic US scoring system in sub-acromial impingement cases. This scoring system is effective in the evaluation ofdisease progression and treatment response parallel to other clinical and laboratory parameters. US is a specific imaging tool, but with poor sensitivity in supraspinatus pathologies compared to MRI.

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***Key Words:*** *Ultrasound – Static – Dynamic – Rheumatoid arthritis – Shoulder.*

## Introduction

**RHEUMATOID** arthritis (RA) is an autoimmune inflammatory systemic disease. RA attacks multiple tissues and organs with preferred affection of the synovial joints. The pathology of the disease often leads to the destruction of articular cartilage, bone erosions, and ankylosis of the joint **[1]**.

The shoulder joint is frequently affected in patients with RA. RA affects multiple structures including the glenohumeral joint and peri-articular soft tissues. Clinical examination detects shoulder tenderness and swelling in few patients, whereas up to 5% of patients after 2 years and 96% after

***List of Abbreviations:***

| | |
|---|---|
| ACR | : American College of Rheumatology. |
| AVN | : A Vascular Necrosis. |
| CRP | : C reactive protein. |
| EULAR | : European League Against Rheumatism. |
| ESR | : Erythrocyte Sedimentation Rate. |
| FOV | : Field of View. |
| FSE | : Fast Spin Echo. |
| IA | : Inflammatory arthritis. |
| MHZ | : Megahertz. |
| MR | : Magnetic Resonance Imaging. |
| MS | : Musculoskeletal. |
| OMERACT | : Outcome Measures in Rheumatology Clinical Trials. |
| PD | : Power Doppler. |
| PD-FSE | : Proton Density Fast Spin Echo. |
| PPV | : Positive Predictive Value. |
| RA | : Rheumatoid Arthritis. |
| RF | : Rheumatoid Factor. |
| SPSS | : Social Sciences. |
| TE | : Time of Echo. |
| TR | : Time of Repetition. |
| US | : Ultrasonography. |
| UTI | : Urinary tract infection. |

12 years show erosive damage at the shoulder. Because of this, clinical examination of the shoulder joint does not allow accurate evaluation of this joint [2]. Moreover, conventional radiography ascertains tardily the diagnosis. Musculoskeletal (MS) ultrasonography (US) plays an important role in detection of subclinical abnormalities in rheumatoid shoulder, which allows early treatment before the damage occurrence [3].

US is considered as a useful tool in the evaluation of inflammatory arthritis, including RA, and proved to be more sensitive than clinical examination in detection of shoulder joint affections in rheumatoid patients. Moreover, it correlates well with clinical and biologic parameters [4].

MSUS allows assessment of multiple structures including synovium, tendon sheaths, tendons, and ligaments as well as fluid collection, bone erosions and joint space/cartilage. It was proved to be a useful tool in detection of disease progression and follow up post treatment [5].

MSUS permits dynamic evaluation of shoulder joint because of its real-time imaging capability. Dynamic sonography allows accurate evaluation of multiple musculoskeletal disorders that are best or only shown during movements [6].

The advantages of US driving its recent increased use include low cost, accessibility, and capability for real time high-resolution imaging that enables a dynamic as assessment and needle guidance [7].

(MRI)is the imaging modality of choice for evaluation of the soft tissues, especially the rotator cuff muscles. However, MRI is expensive, time-consuming. Moreover, it is unsuitable for claustrophobic patients and with MRI contraindications, such as pace-makers or cochlear implants [8].

*Aim of work:*

This study was designed to assess diagnostic value of shoulder US as a non-invasive imaging modality in evaluation of patients with RA presenting with shoulder pain as a disease activity parameter with semi-quantitative scoring for synovitis, erosions and impingement to detect progression and therapeutic response in correlation with other clinical and laboratory parameters.

## Patients and Methods

This study done in Kasr Al-Ainy, Department of Radiology during From January 2023 to May 2023 Ethical Committee (N-200-2023).

This observational cross sectional study included 51 unilateral shoulder joints in 51 patients (34 females and 17 males) with mean age of 39.8 years. All patients referred from rheumatology clinic where RA was diagnosed according to 2010 American College of Rheumatology/European League Against Rheumatism(ACR/EULAR) classification criteria for RA [9].

Clinical data were provided by the rheumatology clinician including the duration of RA diagnosis, duration of shoulder pain or limitation of movement, full shoulder joint examination with special tests (impingement tests) and laboratory investigations including erythrocyte sedimentation rate (ESR), C reactive protein (CRP), rheumatoid factor (RF).

All patients underwent ultrasound examination in static and dynamic manners using Grey scale and Doppler modes before treatment and 3 to 6 months post treatment. Interpretation of US was done by 2 expert radiologist with more than 12 years' experience, who were blinded with clinical or laboratory findings after treatment.

41 of our patients received corticosteroids (systemic/intra articular) as a treatment, while 22 patients received 12 sessions of physiotherapy. Few patients received both of them.

MRI shoulder was done for selected patients with supraspinatus pathologies by US. Interpretations were done by 2 expert radiologists with more than 12 years' experience, who were blinded with US findings.

Written informed consent was obtained from all patients for their study participation.

*Exclusion criteria:* Patients with history of shoulder surgery, trauma, fracture, or malignancy were excluded from the study.

*Imaging techniques:*

1- *Ultrasonography:*

Ultrasound was done for all patients using ultrasound probe of 7-14 MHz frequency. Gray scale and power Doppler modes were applied.

We followed the European League Against Rheumatism (EULAR) guidelines for MSUS examination [10] for proper patient position and standard scans.

1A-*Static ultrasonography:*

It was done in both transverse and longitudinal planes with the patient seated on a stool chair.

1B- *Dynamic ultrasonography:*

We asked the patient to raise his arm midway between flexion and abduction and his hands in pronation and the elbow extended during the dynamic ultrasonography evaluation, the ideal site of ultrasound probe during examination is in the coronal plane along the long axis of the supraspinatus tendon, between the acromion and the greater tuberosity of the humerus. During examination the patient has to repeat the active movement as we can assess the relationship between the acromion, the humeral head, the subacromial bursa and supraspinatus tendon- can be assessed during activity

*Image interpretations:*

We used the outcome measures in rheumatology clinical trials (OMERACT) definitions of pathology in MSUS **[11]**, for definition of structural pathology in which:

Sub-acromial impingement, diagnosed when the vertical dimension of the sub-acromial tunnel is less than 6mm in resting position and shows more reduction (about 25%) in stress position. Synovial hypertrophy (synovitis): Abnormal hypoechoic (may be isoechoic or hyperechoic) intra-articular tissue that is non-displaceable and poorly compressible and may show Doppler signal. Joint effusion: hypoechoic or anechoic intra-articular material that is displaceable and compressible, but with no Doppler signal. Tenosynovitis: Hypoechoic or anechoic tissue with or without fluid within the tendon sheath, which is seen in 2 perpendicular planes and which may elicit Doppler signal. Subacromial bursitis: Increase in amount of hypoechoic fluid within the bursa and may show Doppler signals.Tendinosis: Thickened and heterogeneous tendon. Tendon tear: Hypoechoic area in the tendon at both planes either partial at the articular/bursal surface or intra-substance. A full-thickness tear: Continuous hypoechoic area from the bursal aspect to the articular surface, denoting a complete absence of the tendon **[16]**.

Scoring by B mode of the synovial thickening and effusion: Grade 0: No thickening or effusion; Grade 1: Mild synovial hypertrophy without bulging over the bones / Minimal effusion; Grade 2: moderate hypertrophy over the bones but not reaching to the diaphysis / Minimal effusion; Grade 3: severe bulging hypertrophy with extension to at least one diaphysis / significant effusion. Scoring by power Doppler (PD) of the synovitis: Grade 0: No PD signal; Grade 1: 3 separate spots or 2 confluents spots or 1 confluent spot with 2 separate spots of signal; Grade 2: Increased vascularity in less than 50% of the areas of the synovium; Grade 3: Increased vascularity in more than 50% of the areas of the synovium **[13]**.

*Erosions:* Assessed semi-quantitatively from 0 to 3. Grade 0: Intact cortical surface; Grade 1: Irregular cortical surface without visible defect in 2 shots; Grade 2: Defect in bone surface seen in two perpendicular planes; Grade 3: Associated bone destruction with bone defect **[13]**.

*Grading of sub-acromial impingement by dynamic US was as follows:*

Grade 0: no pain elicited during movement of the shoulder; No evidence of anatomic impingement. Grade 1: Pain during movement of the shoulder; No evidence of anatomic impingement. Grade 2: Pain during movement of shoulder; Evidence of soft-tissue/fluid impingement. Grade 3: Pain during shoulder motion with evidence of upward displacement of the humeral head **[14]**.

*MRI Technique:*

MRI examinations will be performed on a 1.5 Tesla (PHILIPS) using shoulder coils.

*- The following sequences will be used:*

Axial: Fat-suppressed proton density T2WI

Coronal: T1WI, T2WI, STIR.

Sagittal: Fat-suppressed proton density T2WI.

A full thickness tear is seen as continuous tendon gap that communicates between the bursal-spaces with the articular surface. A partial thickness tear diagnosed when there is area of increased signal intensity in T2-weighting and fat suppressed PD-weighted images within the tendon substance without retraction of the tendon **[15]**.

*Statistics:*

Data were coded and entered using the statistical package for the Social Sciences (SPSS) version 28 (IBM Corp., Armonk, NY, USA). Data was summarized using mean, standard deviation, median, minimum and maximum in quantitative data and using frequency (count) and relative frequency (percentage) for categorical data. Standard diagnostic indices including sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and diagnostic efficacy were calculated as described by Galen RS **[16]**.

## Results

51 patients were included in this study with mean age of 39.8 years with female predominance (66.7%). RA disease duration in patients was a range from 1 year to 12 years (mean 5.14). Shoulder

pain duration in patients was a range from 1 month to 8 months (mean 4.31).

Descriptive clinical data are shown in (Table 1) where all patients (100%) had positive impingement tests, 47 (92.2%) of them were still positive and only 4 (7.8%) became negative after treatment. Morning stiffness was encountered in all patients (100%), 46 (90.2%) of them still had stiffness, 3 (5.9%) improved and 2 (3.9%) had no more stiffness after treatment. Joint swelling was present in 35 (68.6%) of patients, while after treatment 20 (39.3%) still suffered swelling, 16 (31.4%) had no more swelling and 15 (29.4%) showed improvement. Tenderness was seen in 41 (80.4%) of patients, while after treatment 9 (17.7%) still had tenderness, 4 (7.8%) showed partial tenderness and 21 (41.2%) showed improvement. Limitation of movement was positive in 48 (94.1 %) of patients; while 17 (33.3%) still showed limitation after treatment, 3 (5.9%) had no limitation and 31 (60.8%) showed improvement. Laboratory data are also shown in (Table 1). All patients (100%) tested positive for RF both before and after treatment. Forty-seven (92.2%) of patients showed high CRP levels before treatment, following treatment it dropped in 16 (32.4%) patients of them, who showed improvement of their clinical presentations. ESR was elevated beyond reference range in all Patients with progressive elevation detected in 9 Patients after treatment.

Static US of the shoulder detected that 47 (92.2%) RA patients studied had synovial thickening and synovitison B-mode and PD with variable semi-quantitative scoring grades of severity. In our study; B mode scoring of synovial thickening showed 21 patients with grade 3 (41.2%) that decreased to be 14 patients (27.5%) after treatment denoting improvement of 7 patients of this group. 26 patients showed improvement on PD after treatment with intra articular corticosteroids injection by recording better scoring compared to their baseline before treatment. Associated clinical and laboratory improvement demonstrated in these patients (Tables 2,3) (Figs. 4,5).

32 (62.7%) of patients had variable grades of erosions with 14 patients with grade 2 scoring (27.5%). 31 (60.8 %) of patients with erosions had history of RA disease duration more than 5 years associated with significant relation of erosions development to disease duration ($p$0.05)

While dynamic US on shoulders detected that 47 (92.2%) of patients showed supraspinatus tendon impingement with variable grades of impingement severity scores and 13 patients of them improved after physiotherapy treatment (Tables 2,3) (Figs. 1,3).

Associated long head of biceps tenosynovitis was present in 36 (70.6%) of patients, while after treatment 5 patients still suffered from tenosynovitis, and 24 patients showed regressive course. (Table 5) (Fig. 2).

Other associated US findings, such as sub acromial bursitis was present in 33 (64.7%) of patients, while following treatment improvement was detected in 21 (41.2%) of patients (Table 5).

Supraspinatus tendinopathy; Before receiving physiotherapy treatment: tendinosis was seen in 8 (15.7%), partial thickness tear in 16 (31.4%) and full thickness tear in 3 (5.9%) of the patients (Tables 4,5).

In our study 41 (80.4%) of the patients received corticosteroids,12 patients reported non improvement status with subsequent treatment complications as follow: 5 chest infection, 4 urinary tract infection UTI, 2 interstitial lung disease ILD and 1 avascular necrosis AVN (Table 6).

22 of our patients (43.1 %) had physiotherapy. After treatment with physiotherapy one of the patients with partial thickness tear developed full thickness tear. 4 (7.9%) of all patients with full thickness tear underwent tendon repair. MRI confirms the same US findings in 20 patients. US sensitivity was 100% with 74.51% accuracy (Tables 6,7) (Fig. 6).

Table (1): Clinical and laboratory parametersof patients before and after treatment.

| Pre-treatment | | | Post-treatment | | |
|---|---|---|---|---|---|
| | Count | | | Count | % |
| *Impingement tests:* | | | Yes | 47 | 92.2 |
| Positive | 51 | 100.0 | No | 4 | 7.8 |
| *Morning stiffness:* | | | Stationary | 46 | 90.2 |
| Yes | 51 | 100.0 | No | 2 | 3.9 |
| *Swelling :* | | | Regressive | 3 | 5.9 |
| Yes | 35 | 68.6 | Stationary | 20 | 39.3 |
| No | 16 | 31.4 | No | 16 | 31.4 |
| *Tenderness:* | | | Regressive | 15 | 29.4 |
| Yes | 41 | 80.4 | No | 17 | 33.3 |
| No | 10 | 19.6 | Regressive | 25 | 49 |
| *Limitation:* | | | Stationary | 9 | 17.7 |
| Positive | 48 | 94.1 | Stationary | 17 | 33.3 |
| No | 3 | 5.9 | No | 3 | 5.9 |
| *RF:* | | | Regressive | 31 | 60.8 |
| Positive | 51 | 100.0 | Positive | 51 | 100.0 |
| *CRP:* | | | Low | 35 | 68.6 |
| Low | 4 | 7.8 | High | 16 | 31.4 |
| High | 47 | 92.2 | | | |

Table (2): Semi-quantitative US findings detected in patients before treatment.

| | Count | % |
|---|---|---|
| *Erosions pre:* | | |
| 0 | 19 | 37.3 |
| 1 | 8 | 15.7 |
| 2 | 14 | 27.5 |
| 3 | 10 | 19.6 |
| *B mode synovial thickening:* | | |
| 0 | 4 | 7.9 |
| 1 | 13 | 25.5 |
| 2 | 13 | 25.5 |
| 3 | 21 | 41.2 |
| *Power Doppler synovitis pre:* | | |
| 0 | 4 | 7.9 |
| 1 | 14 | 27.5 |
| 2 | 22 | 43.1 |
| 3 | 11 | 21.6 |
| *Impingement pre:* | | |
| 0 | 4 | 7.8 |
| 1 | 13 | 25.5 |
| 2 | 23 | 45.1 |
| 3 | 11 | 21.6 |

Table (3): Semi-quantitative US findings detected in patients after treatment.

| | Count | % |
|---|---|---|
| *Erosions post:* | | |
| 0 | 23 | 45.1 |
| 1 | 11 | 21.6 |
| 2 | 7 | 13.7 |
| 3 | 10 | 19.6 |
| *B mode synovial thickening post:* | | |
| 0 | 9 | 17.6 |
| 1 | 16 | 31.4 |
| 2 | 12 | 23.5 |
| 3 | 14 | 27.5 |
| *PD synovitis post:* | | |
| 0 | 16 | 31.4 |
| 1 | 16 | 31.4 |
| 2 | 9 | 17.6 |
| 3 | 10 | 19.6 |
| *Impingement post:* | | |
| 0 | 5 | 9.8 |
| 1 | 22 | 43.1 |
| 2 | 20 | 39.2 |
| 3 | 4 | 7.8 |

Table (4): US non quantitative findings detected in patients at time of presentation.

| | Count | % |
|---|---|---|
| *Supraspinatus tendon Pathology pre:* | | |
| Thickened | 8 | 15.70 |
| Partial thickness tear | 16 | 31.40 |
| Full tear | 3 | 5.90 |
| No | 24 | 47.10 |
| *Bursitis pre:* | | |
| Yes | 33 | 64.70 |
| No | 18 | 35.30 |
| *Biceps tenosynovitis pre:* | | |
| Yes | 36 | 70.60 |
| No | 15 | 29.40 |

Table (5): US non quantitative findings detected in patients after treatment.

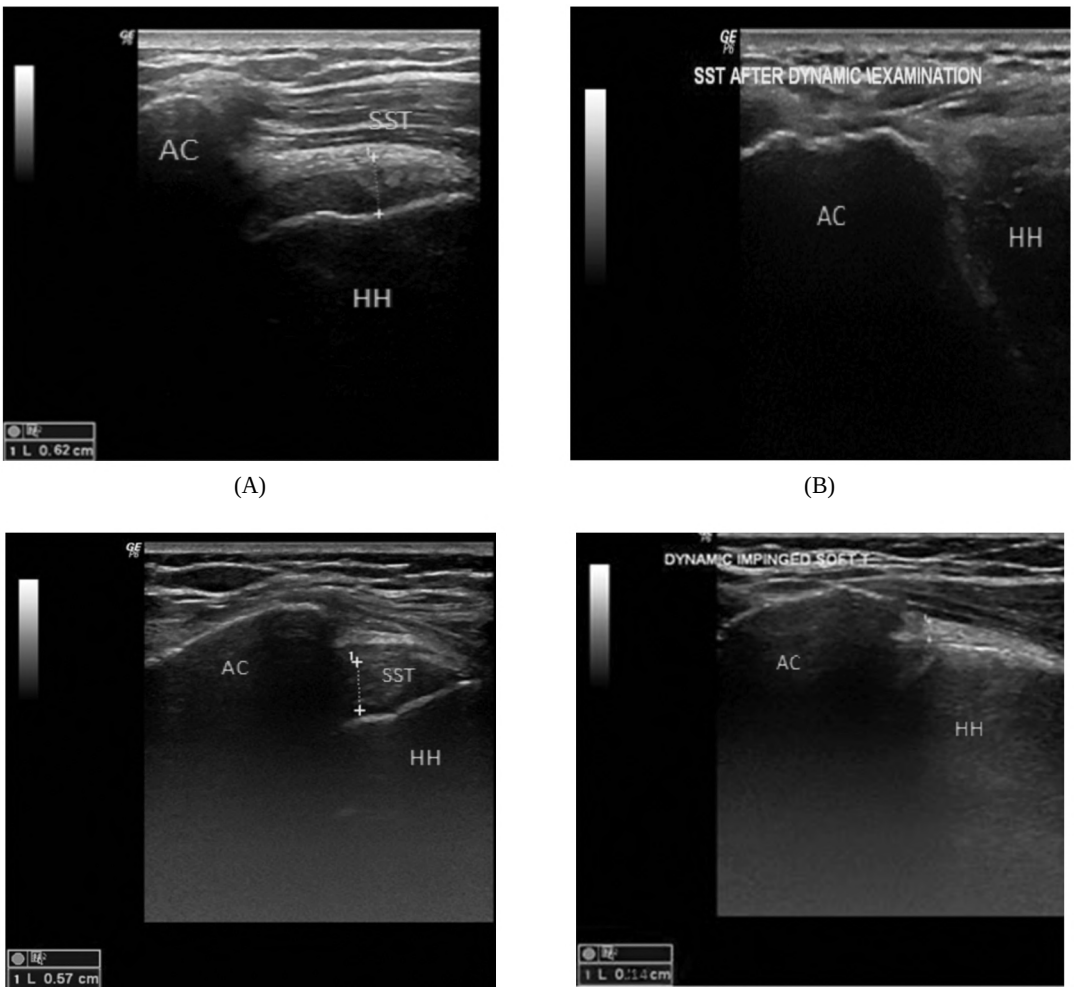
| | Count | % |
|---|---|---|
| *Supraspinatus pathology post:* | | |
| Thickened | 3 | |
| Partial thickness tear | 18 | |
| Full thickness tear | 4 | |
| Normal | 26 | |
| *Bursitis post:* | | |
| Stationary | 5 | 9.8 |
| Progressive | 1 | 2.0 |
| Not present | 24 | 47.1 |
| Regressive | 21 | 41.2 |
| *Biceps tenosynovitis post:* | | |
| Stationary | 5 | 9.8 |
| Not present | 22 | 43.1 |
| Regressive | 24 | 47.1 |

Table (6): Complications following corticosteroids and physiotherapy therapy.

| | Count | % |
|---|---|---|
| *Corticosteroids:* | | |
| Yes | 41 | 80.4 |
| No | 10 | 19.6 |
| *Physiotherapy:* | | |
| Yes | 22 | 43.1 |
| No | 29 | 56.9 |
| *Complications:* | | |
| UTI | 4 | 7.8 |
| ILD | 2 | 3.9 |
| Full | 2 | 3.9 |
| Chest infect | 5 | 9.8 |
| AVN | 1 | 2.0 |
| No | 37 | 72.5 |

Table (7): Sensitivity and specificity of US versus MRI in supraspinatus tendon pathologies.

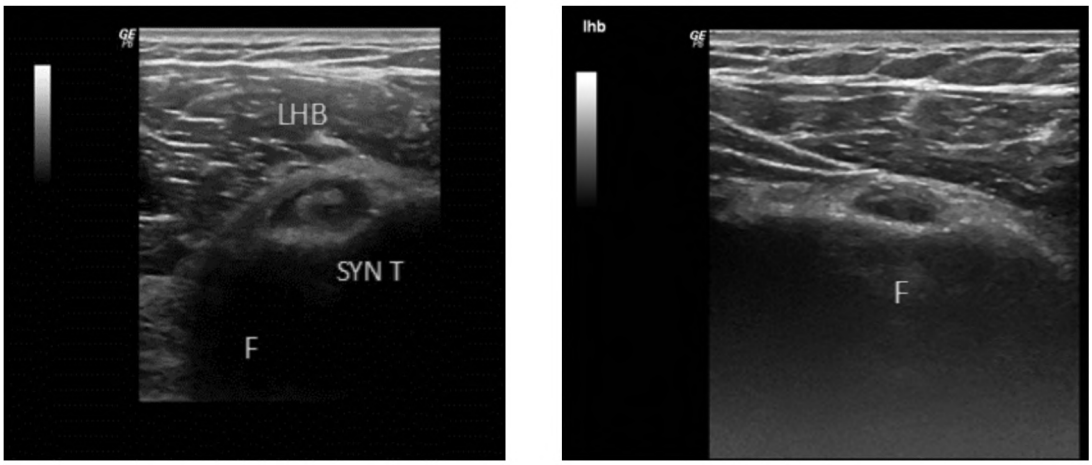
| Statistic | Value | 95% CI |
|---|---|---|
| Sensitivity | 100.00% | 90.75% to 100.00% |
| Specificity | 0.00% | 0.00% to 24.71% |
| Positive Predictive Value | 74.51% | 74.51% to 74.51% |
| Accuracy | 74.51% | 60.37% to 85.67% |




(A) (B)

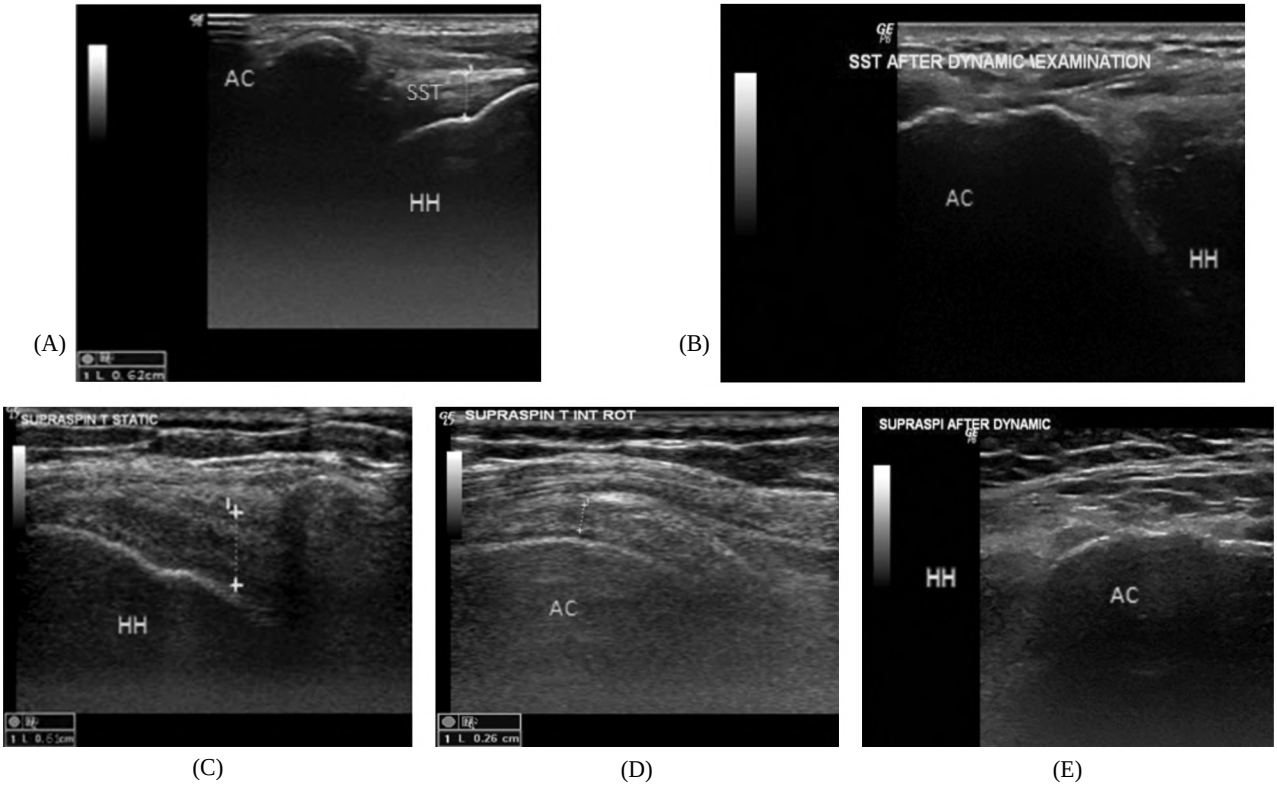
(C) (D)

Fig. (1): Static (A) Ultrasonography coronal view showed: No evidence of anatomic impingement as the humeral head (HH) passed easily and freely underneath the acromion (AC) & dynamic (B) with pain during shoulder motion (grade 1 impingement) (SST: Supraspinatus tendon). Follow-up by static (C) and dynamic (D) Ultrasonography coronal view showed: Relative narrowing (0.57cm) of the subacromial tunnel that became accentuated in stress positionwith soft tissue impingement (grade 2) (HH: Humeral head, SST: Supraspinatus, AC: Acromion).




(A) (B)

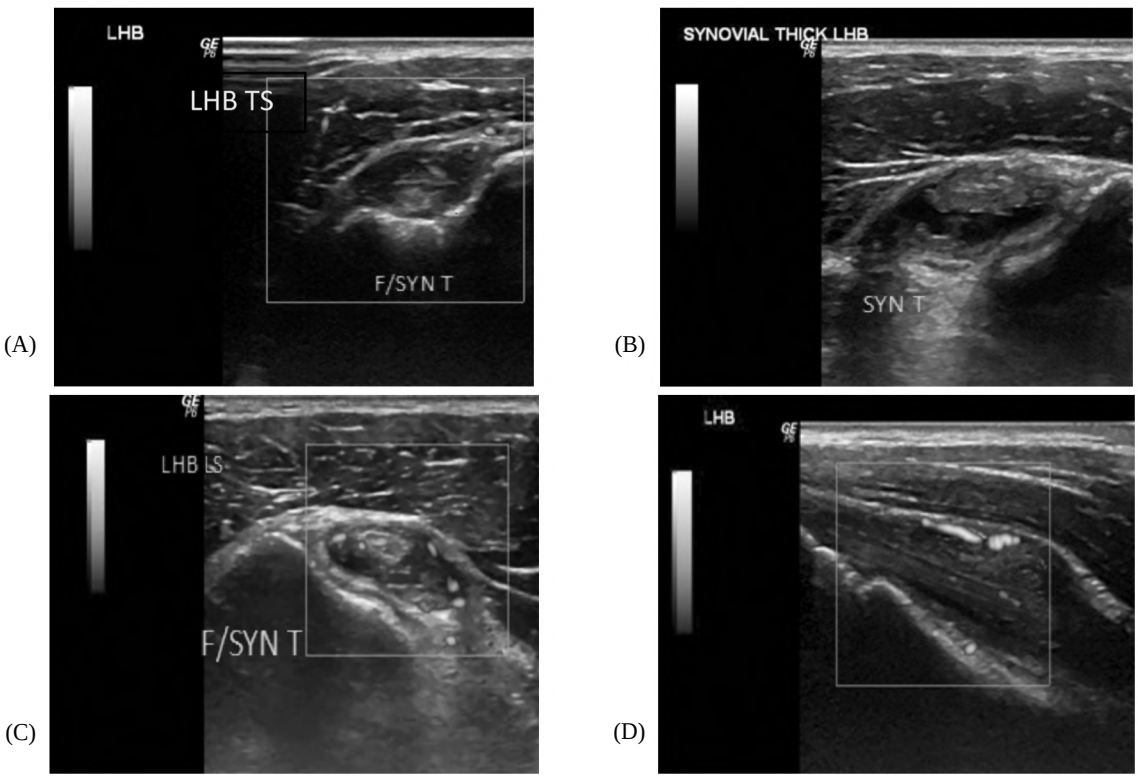
Fig. (2): Static B mode ultrasonography TS view (A) Long head of biceps (LHB) tenosynovitis with relative synovial thickening (SYN T) (4mm) (grade 2) and synovial effusion (F). Follow-up static ultrasonography TS view B mode (B) Decreased amount of biceps synovial fluid (F) denoting improvement (grade 1). (N.B: LHB = Long head of biceps).




(A) (B)

(C) (D) (E)

Fig. (3): Static (A) ultrasonography coronal view showed: No evidence of anatomic impingement as the humeral head (HH) passed easily and freely underneath the acromion (AC) & dynamic (B) during shoulder motion with pain during active shoulder motion (grade 1 impingement).(NB: SST = Supraspinatus tendon). Follow-up static (c) ultrasonography coronal view showed: no evidence of anatomic impingement as the humeral head (HH) passed easily and freely underneath the acromion (AC) during shoulder motion active shoulder motion & dynamic (d) no pain during on (grade 0) (e).




(A) (B)

(C) (D)

Fig. (4): Power Doppler ultrasonography TS (A) and B mode (B) showed synovial thickening (SYN T) grade 3 (3 mm), synovial effusion (F) and increased vascularity. Follow-up by Power Doppler ultrasonography TS, LS (d) showed evidence of stationary synovial thickening (SYN T) grade (3 mm), synovial fluid (F) and vascularity with long head of biceps (LHB) tenosynovitis (d) without improvement.

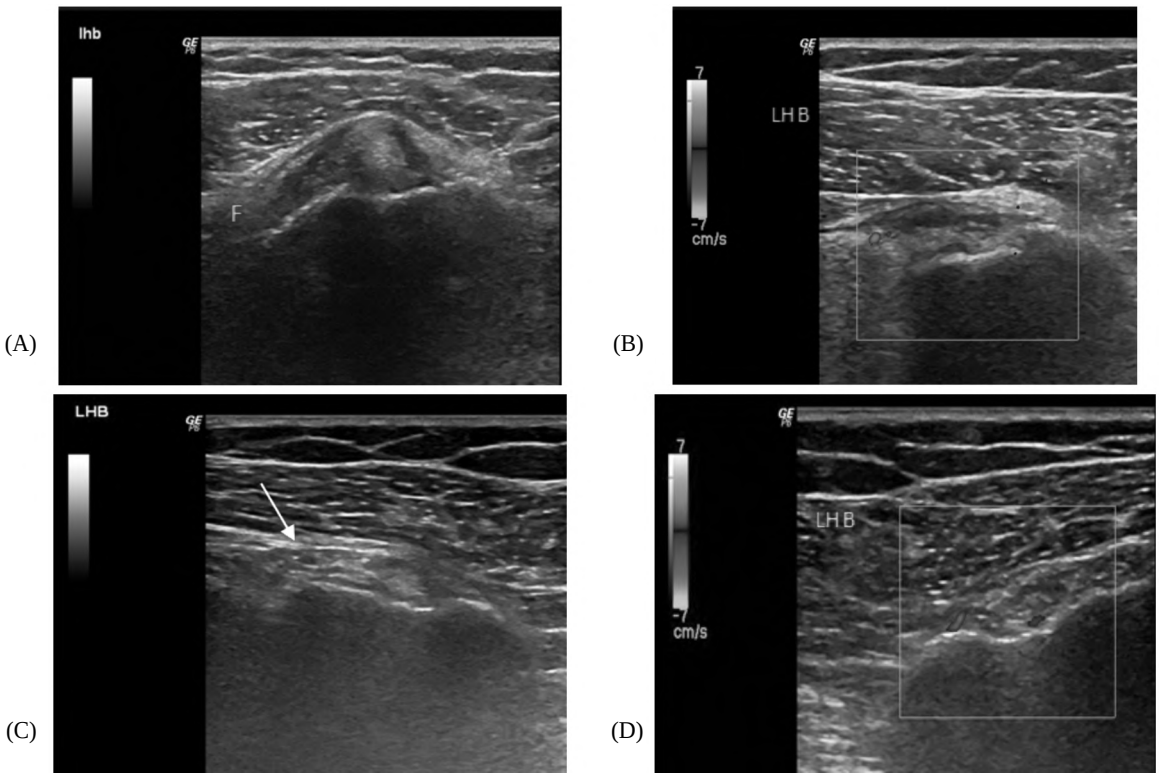



Fig. (5): Static (A) and Colour Doppler ultrasonography TS view (B) showed: Evidence of long head of biceps (LHB) tenosynovitis with relative synovial fluid (F) and increased vascularity. Follow-up static (C) and Colour Doppler ultrasonography TS view (D) showed: Decreased amount of long head of biceps (LHB) synovial fluid denoting improvement.

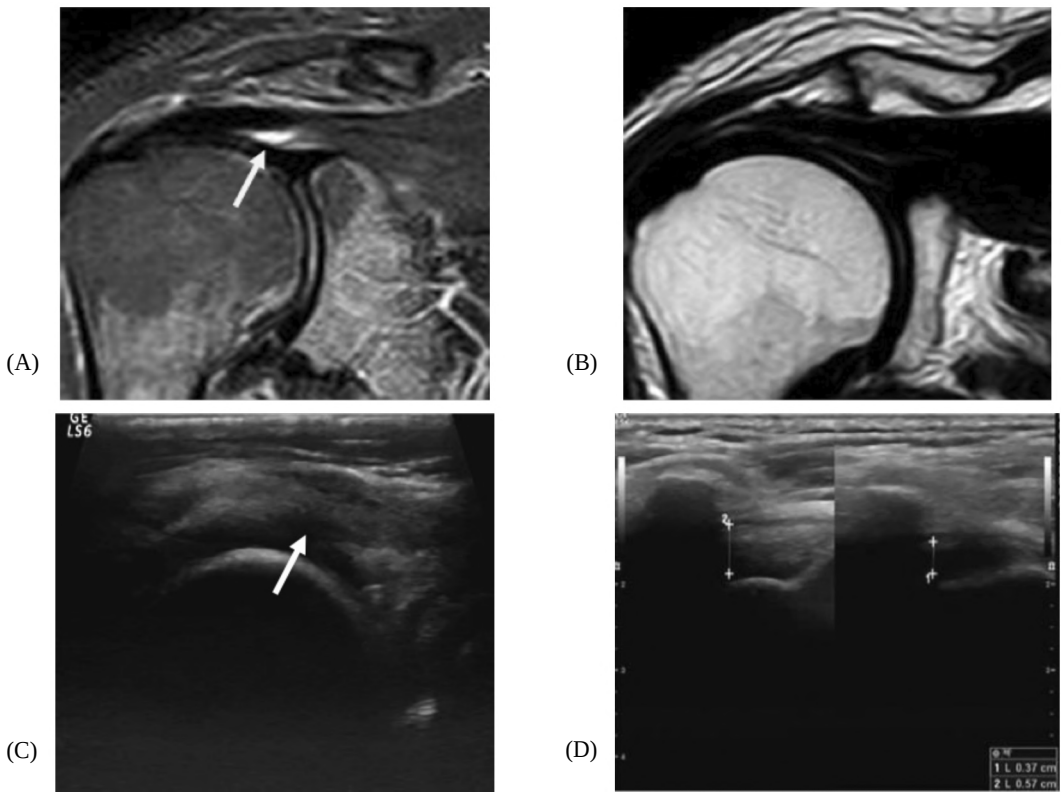



Fig. (6): (A): MRI, sagittal STIR WIs: fluid signal seen at the articular surface of the musculo-tendinous junction of supraspinatus tendon "arrow". No evidence complete fiber interruption detected. (B) MRI, Coronal T2WIs of the shoulder showing acromio-clavicular osteoarthritis. (C) Static US images shows partial thickness tear of the humeral surface of the supraspinatus tendon, seen as a hypoechoic linear defect interrupting the tendon fibers "arrow". (D) Dynamic ultrasonography showed narrowing of the sub acromial tunnel that became accentuated in stress position.

## Discussion

The use of musculoskeletal US in the management of RA has been markedly increased, especially in the past three decades. It has been considered as a useful aid to clinical examination. During disease activity US-detected abnormalities, especially synovial power Doppler findings which were strongly correlated with active synovitis **[17]**.

Visualization of the joint structures by grey scale US,allows distinction between synovial hypertrophy and other causes of joint swelling, such as subcutaneous edema or tenosynovitis. Power Doppler (PD) enables the assessment of synovial vascularity and this could be used for differentiation between inflamed and nonvascular synovial swelling **[18]**.

In our study, the static ultrasound examination has a role in detecting common associated findings in cases of shoulder impingement in rheumatoid arthritis patients; the findings with frequency included are as follows: Sub-acromial bursitis (64.7%), Biceps tenosynovitis (70.6%) and Doppler vascularity added to the value of the examination showing active synovitis 92.2% of cases.

This is in agreement with multiple studies **[19]**; which reported ultrasound sensitivity varying between 70% and 100% for detecting similar associated findings in rheumatoid arthritis patients with shoulder impingement.

In this study, it was shown that by dynamic ultrasonography we can characterize the sub-acromial impingement in RA patients into 3 grades where we have found that most cases (45.1 %) were classified as grade 2. The study has detected that dynamic US examination of the shoulder is very useful in the management of RA by grading the sub-acromial impingement, so the rheumatologist can decide the treatment plan.

This agrees with the study Nathalie J et al., **[20]** which had detected that the majority of the cases (66.7%) were classified as grade 2, (23.8%) as grade 1 and (9.5%) as grade 0.

In this study, at the time of presentation B-mode US detected synovial hypertrophy in 49 (98%) of the cases & divided them into 4 grades (0-3) with the majority (41.2%) being grade 3. Following the course of the treatment, the most prevalent grade became grade 1 (31.4%). Also, PD US was used in conjunction with B-mode for detection of active synovitis which was seen in 49 (98%) of the cases & divided them into 4 grades (0-3) with the majority (43.1%) being grade 1 & following the course of the treatment, the most prevalent grade became grade 2 (31.4%).

This agrees with the study done, in the Amsterdam seropositive arthralgia cohort, whilst grey-scale synovitis was associated with progression to inflammatory arthritis, intra-articular PD signal was infrequently identified and was not predictive of progression to inflammatory arthritis IA **[21]**. This contrasts with the data from study done by Nam JL et al., where PD signal was identified in 30% of patients and was strongly associated with development of inflammatory arthritis and its timing, both at patient and joint levels **[22]**.

These results also match with those of Szkudlarek et al., who studied the effectiveness of the power Doppler for assessing inflammatory activity in the metacarpo-phalangeal joints of patients with RA compared with MRI as reference imaging method **[23]**.

In our study 32 (62.7%) of patients had variable grades of erosions. 31 patients had history of RA disease more than 5 years with significant relation to disease duration. This is also matched to a study done by Mariana O et al., were bone erosions were noticed within 6 years of disease duration in >50% of RA patients **[24]**.

In our study among cases of supraspinatus tendinopathy; 4 (7.9%) of the patients underwent tendon repair. MRI confirms the same US findings in 20 patients.US sensitivity was 100% with 74.51% accuracy. This is agreeing with studies of Melanie et al., **[25]** and Nathalie et al., **[20]** that reported the very high sensitivity (about 100%) of dynamic ultrasonography in detection of different types of partial-thickness rotator cuff tears.

In our study 41 (80.4%) of the patients received corticosteroids, 12 patients reordering non improvement status with subsequent treatment complications.

This is in agreement with the study **[26]** that stated that persistent pain unresponsive to therapy - including injection therapy - should prompt the physician to consider other causes.

22 of our patients (43.1 %) had physiotherapy with 2 patients of them developed complication in the form of full thickness tear of supraspinatus and surgical repairs were done to them.

This is in agreement with the study **[27]** which stated that patients with a rotator cuff tear and are refractory to physical therapy, should do rotator cuff repair or debridement.

Static US on shoulders detected that 47 (92.1 %) RA patients studied had synovitis on B-mode and PD before treatment, becoming 42 (82.4%) on B-mode and 35 (68.6%) on PD after corticosteroids treatment. Sub acromial bursitis was present in 33 (64.7%) of patients, while 21 (41.2%) of patients improved after treatment with cortico steroids. Associated clinical and laboratory improvement are also demonstrated in these patients.

This agrees with the study done by Fiocco U et al., where the changes in clinical and ultrasonography findings in patients with rheumatoid knee synovitis, were concordant in showing a sustained reduction in disease activity indices, particularly at 12 months, at which time the reduction in ultrasonography synovial thickening appeared highly significant **[28]**.

*Conclusion:*

US is useful and informative imaging tool in assessment of shoulder pain in RA patients whether static or dynamic US; (B mode and PD mode) that provides semi-quantitative scoring system for synovitis and erosions as well as dynamic US scoring system in shoulder impingement cases.US is an effective tool as a disease activity parameter in follow-ups to evaluate treatment response in addition to other clinical and laboratory parameters. Us is a specific imaging tool, but with poor sensitivity in supraspinatus pathology compared to MRI as a gold standard imaging tool.

*Limitations:*

The lack of standardization of US examination method previously can limit the use of this technique in clinical practice. Although it is generally accepted to use a semi-quantitative scoring system, it is not the gold standard.The operator dependent nature of US, inability of bone assessment and detection of bone marrow edema (which is an indicator of early joint destruction).

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# هل ستضيف الموجات فوق الصوتية الثابتة والديناميكية للكتف قيمة تشخيصية لمرضى التهاب المفاصل الروماتويدى ؟

يلعب التصوير بالموجات فوق الصوتية للجهاز العضلى الهيكلى دوراً مهماً فى إكتشاف التشوهات تحت الإكلينيكية فى الكتف الروماتويدى، مما يسمح بالعلاج المبكر. تعد الموجات الصوتية للجهاز الحركى أداة مفيدة فى تقييم التهاب المفاصل الروماتيزمية كونه أكثر حساسية من الفحص السريرى. إنها أداة مفيدة فى الكشف عن تطور المرض ومتابعة ما بعد العلاج. يسمح التصوير بالموجات فوق الصوتية الديناميكى بإجراء تقييم دقيق لاضطرابات العضلات والعظام المتعددة التى تظهر بشكل أفضل أو تظهر فقط أثناء الحركات.

تهدف هذه الدراسة إلى تقييم القيمة التشخيصية لفحص الموجات الصوتية للكتف فى تقييم التهاب المفاصل الروماتويدى مع آلام الكتف كمعامل نشاط مرضى مع الاستفادة من نظام التسجيل شبه الكمى لإلتهاب الغشاء المفصلى الذى يتيحه فحص الموجات الصوتية. كما أنه من الممكن إشراكه بشكل متكرر لمراقبة استجابة المريض للعلاج بالارتباط مع المقومات السريرية والمختبرية الأخرى.

تضمنت هذه الدراسة ٥١ مفصل كتف أحادى الجانب فى ٥١ مريضاً (٣٤ أنثى و ١٧ ذكر) بمتوسط عمر ٣٩.٨ سنة. تم تشخيص التهاب المفاصل الروماتويدى على جميع المرضى. تم إجراء الموجات فوق الصوتية لجميع المرضى الذين يعانون من آلام المفاصل بما فى ذلك المقياس الرمادى وأنماط دوبر الطاقة والفحص ديناميكى شبه الكمى لالتهاب الغشاء المفصلى ثم تكرر الفحص للمتابعة بعد ٣ إلى ٦ أشهر من العلاج.

أظهرت هذه الدراسة أن ٤٧ (٩٢.٢٪) من مرضى التهاب المفاصل الروماتويدى الذين تمت دراسته لديهم سماكة والتهاب فى الغشاء الزلاى لمفصل الكتف مع درجات متغيرة شبه كمية من الشدة. أظهر ٢٦ مريضاً تحسناً فى شدة الالتهاب وسماكة الغشاء الزلاى بعد العلاج من خلال تسجيل درجات أفضل مقارنة بما قبل العلاج. وجد التصوير بالموجات فوق الصوتية الديناميكى قبل العلاج أن معظم حالات الاصطدام (٤٥.١٪) تم تصنيفها على أنها من الدرجة الثانية و ١٣ مريضاً منهم تحسنوا بعد العلاج الطبيعى. فى دراستنا، تلقى ٤١ (٨٠.٤٪) من المرضى الكورتيكوستيرويد، وسجل ١٢ مريضاً زيادة فى شدة المرض ومضاعفات علاجية لاحقة.

ونستنتج من هذه الدراسة أن الموجات الصوتية لها دور مهم فى تقييم آلام الكتف لدى مرضى التهاب المفاصل الروماتويدى سواء كانت ثابتة أو ديناميكية كما أنها توفر نظام تسجيل شبه كمى لإلتهاب الغشاء المفصلى والتآكل. كما إنها فعالة فى تقييم تطور المرض والاستجابة للعلاج بالتوازى مع المعايير السريرية والمخبرية الأخرى. الموجات الصوتية هى أداة مفيدة، ولكن مع حساسية ضعيفة فى تقييم درجة إصابة العضلات المحيطة بالمفصل مقارنة بالتصوير بالرنين المغناطيسى.