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Inflammatory Versus Degenerative (Non Inflammatory) Ultrasound Detected Shoulder Abnormalities in Rheumatoid Arthritis Patients with Shoulder Pain

MERVAT ABO GABAL, M.D. and SHERIN HOSNY, M.D.

The Department of Internal Medicine and Rheumatology, Ain Shams University Hospital, Cairo, Egypt

Abstract

Background: The early and definitive diagnosis of a chronic inflammatory joint disease in Rheumatoid Arthritis (RA) is crucial for initiating optimal treatment. Conventional radiography detects late changes such as joint destruction, but fails to visualize inflammation in synovial membrane.

Aim of Study: To compare type and frequency of Ultrasound (US) abnormal findings (inflammatory versus degenerative (non inflammatory)) detected in shoulders of RA patients with shoulder pain in relation to disease characteristics.

Patients and Methods: Musculoskeletal US (MSUS) shoulder examination and plain radiography were performed bilaterally for 45 RA patients and 45 controls with only painful shoulder and compared.

Results: Comparison between RA patients and controls in number (No) and frequency of inflammatory shoulder findings detected by MSUS (active bursitis, synovitis, tenosynovitis, erosions) revealed statistical significant difference (43 (47.8%) versus 18 (20.0%), respectively), p=0.000. There was no statistical significant difference between RA patients and controls in No. and frequency of non-inflammatory findings detected by MSUS (chronic bursitis, tendinopathy, tendon tears, osteophytes), (65 (72.2%) versus 60 (66.7%), respectively), p=0.418. In RA patients, inflammatory MSUS findings were significantly related to shoulder pain, older ages and higher ESR p<0.05. MSUS detected erosions in 42 (180) shoulders versus 6 (180) by X-ray, of the 42 MSUS detected erosions, X-ray detected only 4 (9.5%). Of the 138 MSUS-ve erosions, X-ray agreed in 136 (98.6%), kappa=0.115, p=0.01.

Conclusion: MSUS detected shoulder inflammatory abnormalities are more frequent, symptomatic, usually bilateral in RA patients. They are related to shoulder pain, old age and disease activity. Early diagnosis of joint lesions by MSUS, proved superiority to conventional radiography, is crucial for initiating optimal treatment.

Key Words: *Ultrasound shoulder – Rheumatoid arthritis – Inflammatory lesions – Pain.*

Correspondence to: Dr. Mervat Abo Gabal, The Department of Internal Medicine and Rheumatology, Ain Shams University Hospital, Cairo, Egypt

Introduction

SHOULDER involvement is frequent during the natural history of Rheumatoid Arthritis (RA). Several structures can be targeted by the disease; especially the glenohumeral joint (GH) [1]. In addition to the synovitis of the glenohumeral joint, shoulder pain in RA arises from pathologies involving diverse periarticular soft tissues and the involvement of more than one anatomical structure is common [2].

Only a small proportion of patients has clinically detectable shoulder tenderness and swelling, whereas up to 5% of patients after 2 years and 96% after 12 years show erosive damage at the shoulder [3,4]. Thus, clinical evaluation of shoulder does not offer an accurate assessment of this joint [5]. Moreover, conventional radiography ascertains tardily the diagnosis. Owing to the necessity of early treatment in RA patients before the damage occurrence [6], ultrasound and Magnetic Resonance (MR) imaging have already been compared with conventional radiography for the assessment of the peripheral joints of RA patients in several studies, and both have been found to have a higher sensitivity than radiography in detecting erosions [7-10].

Little attention has so far been paid to the proximal joints of the arms, although the shoulder joints tend to show abnormal changes in a high percentage of patients when RA first becomes manifest. Clinical symptoms, such as pain and restriction of movement, may not occur before the destructive changes of the joints can be demonstrated [11].

Musculoskeletal Ultrasonography (MSUS) has a great role in detecting subclinical abnormalities

in rheumatoid shoulder in order to achieve a low disease status and eventually remission [12]. In comparison with the various modalities currently available for diagnosing rotator cuff disorders, ultrasonography has a series of advantages, including the following: It is more widely available and far more cost-effective; it allows dynamic examination of the structures; comparison can be easily made between the affected shoulder and the contralateral side; and finally, it provides immediate feedback for the patient/clinician [1].

The aim of the present study was to compare types and frequency of MSUS detected shoulder inflammatory versus degenerative (non-inflammatory) abnormalities in RA patients with shoulder pain in relation to disease characteristics.

Patients and Methods

This cross sectional case control study was performed on 45 consecutive RA patients with unilateral or bilateral shoulder pain visiting Ain Shams University Rheumatology Clinic diagnosed according to ACR/EULAR 2010 criteria [13] in the period between January 2017 and January 2018. In addition 45 age and sex matched patients with only unilateral or bilateral shoulder pain were enrolled serving as controls. Patients with other rheumatologic disorders (SLE, Spondyloarthropathy) or evidence of endocrine or traumatic diseases affecting shoulder were excluded from the study. Oral consents were obtained from all participants after explaining the nature of the study. The study was approved by the Local Research Ethical Committee of Ain Shams University and conforms to the provisions of the Declaration of Helsinki in 1995.

For all patients, detailed history taking and thorough clinical and musculoskeletal examination were performed. Calculation of BMI=weight/height^2. Measurement of Erythrocyte Sedimentation Rate (ESR), C-Reactive Protein (CRP) was performed. Serum Rheumatoid Factor (RF) and anti-CCP antibodies positivity and levels were done by ELISA. Rheumatoid arthritis activity was assessed using DAS 28-ESR score [14]. Plain X-ray shoulder region (postero-anterior view) was performed bilaterally. High resolution Musculoskeletal Ultrasonography (MSUS) examination (by gray scale and power Doppler both in longitudinal and transverse planes) was performed by a single experienced operator (senior rheumatologist) by using a 6-18-MHz linear-array transducer and E-Zaote MyLab six machine, according to the technical guidelines of systematic and standardized protocol [15]. The following structures were examined: Rotator cuff tendons (T) (supraspinatus (supra-sp), infraspinatus (infra-sp)/teres minor, and subscapularis (subscap.), long head of the biceps tendons, Subacromial and Subdeltoid Bursa (SASD B), Glenohumeral (GHJ) and Acromioclavicular Joints (ACJ). Tendon lesions (Tenosynovitis (TS), Subluxation (SL), Tendinopathy (TP) and full (T-tear F) or partial tear (T-tear P), tendon calcifications (calc.), bursitis (B), impingement (imp.) and all other morphological and degenerative abnormalities such as arthritic alterations of the Glenohumeral (GHJ) and Acromioclavicular Joints (ACJ) were registered [16,17]. In all patients, images of the shoulder were obtained bilaterally for comparison and correlations.

Statistical analysis:

Data were collected, tabulated and statistically analyzed using SPSS program (Statistical Package for Social Sciences) software Version 18. Quantitative variables were described as mean, Standard Deviation (SD), median and range. Qualitative variables were described as number (No.) and percentage (%). Chi-square, Fisher's Exact, Mann-Whitney, independent *t*-tests were used for comparison. Kappa agreement measure was used. *p*-value was considered significant if ≤ 0.05.

Results

This cross sectional study included 90 subjects with shoulder pain divided into 2 groups; patients group included 45 rheumatoid arthritis patients they were 39 (86.7%) females and 6 males (13.3%), their mean age was 43 ± 11.86 years. Their mean disease duration was 3.8 ± 1.99 years. Their median shoulder pain duration was 4 (1-12) months. Eighteen (40%) of RA patients had moderate disease activity by DAS-28 ESR score and 27 (60%) had severe activity. Forty five (100%) of patients were on DMARDs, 30 (66.3%) on corticosteroids and 25 (55.5%) on NSAIDs. Control group included 45 patients who had shoulder pain only; they were 34 females (75.6%) and 11 male (24.4%) with a mean age of 38.89 ± 12.18 years. Their median pain duration was 6 (2-11) months. Comparison between both groups as regards age, sex, BMI, shoulder pain characteristics, NO. and frequency of inflammatory and non inflammatory abnormalities detected in shoulders by MSUS are presented in (Table 1).

Comparison between RA patients and controls as regards the presence of painful shoulders (64

(71%) Vs. 51 (56.7%) respectively) and bilateralism of pain (19 (42%) Vs. 6 (13.3%) respectively) revealed statistical significant difference, χ^2=4.07, p=0.044 and χ^2=9.36, p=0.002 respectively.

Regarding MSUS abnormalities, 43/45 (95.5%) RA patients had shoulder MSUS abnormalities, unilateral in 13 (28.9%) and bilateral in 30 (66.7%). On the other hand 41/45 (91.1%) of the controls had MSUS shoulder abnormality, unilateral in 16 (35.6%) and bilateral in 25 (55.6%) with no statistical significant difference, χ^2=1.432, p=0.489.

Comparison between RA patients and controls as regards the number and frequency of total inflammatory (active bursitis, synovitis, tenosynovitis, erosions) MSUS shoulder findings (43/47.8% versus 18/20%, respectively) revealed statistical significant difference, p=0.0001. On the other hand there was no statistical significant difference between both groups regarding the number (No.) and frequency (65/72.2% versus 60 (66.7%)) of total non-inflammatory (chronic bursitis, tendinopathy, tendon tears, osteophytes) MSUS shoulder findings, p=0.418, Table (1).

Comparison between RA patients and controls regarding the number (No.) and % (frequency) of each shoulder MSUS abnormalities revealed statistical significant higher values in chronic SASD B, subcoracoid B, subcoracoid impingement, humeral head erosions, ACJ synovitis and ACJ erosions in RA patients compared to controls (p=0.007, 0.047, 0.023, 0.0001, 0.001 0.0001 respectively), but lower in supraspinatus tendon calcification p= 0.034 (Table 2).

Table (1): Comparison between RA patients and controls with shoulder pain as regards demographic and clinical characteristics and inflammatory & non- inflammatory MSUS lesions.

	RA patients (45)	Controls with shoulder pain (45)	χ^2 / *t* / Z	*p*
Age (yrs)	43±11.86	38.89±12.1	1.631	0.106
Sex:				
Females	39 (86.7%)	34 (75.6%)	0.178	1.813
Males	6 (13.3%)	11 (24.4%)		
BMI kg/m^2	28±5.06	27.7±5.59	0.253	0.801
Shoulder pain + (90 shoulders)	64 (71%)	51 (56.7%)	4.070	0.044
Shoulder pain duration (month)	4 (1-12)	6 (2-11)	–1.500-	0.133
bilateralism of shoulder pain	19 (42%)	6 (13.3%)	9.36	0.002
MSUS abnormalities				
Inflammatory US shoulder lesions:				
+	43 (47.8%)	18 (20%)	15.498	0.000
–	47 (52.2%)	72 (80%)		
Non inflammatory US shoulder lesions:				
+	65 (72.2%)	60 (66.7%)	0.655	0.418
–	25 (27.8%)	30 (33.3%)		

Inflammatory findings: (Active bursitis, synovitis, tenosynovitis, erosions).
Non-inflammatory findings: (Chronic bursitis, tendinopathy, tendon tears, osteophytes).

There were +ve (presence) inflammatory shoulder abnormalities detected by MSUS in 43/90 RA patient shoulders versus 47/90 shoulders with –ve (absence) inflammatory lesions. On the other hand non inflammatory MSUS findings were +ve in 65/90 RA patient shoulders versus 25/90 shoulders with –ve (absence) non inflammatory lesions. Studying the relation between inflammatory and non-inflammatory MSUS shoulder abnormalities in RA patients and different demographic and disease parameters revealed that, inflammatory MSUS findings were significantly more prevalent in older age (p=0.006) and with higher ESR (p= 0.012), while non-inflammatory lesions were significantly more frequent in older ages (p=0.01) (Table 3).

Table (2): Display and comparison of individual shoulder MSUS abnormalities in RA patients (90 shoulders) and controls with shoulder pain (90 shoulders).

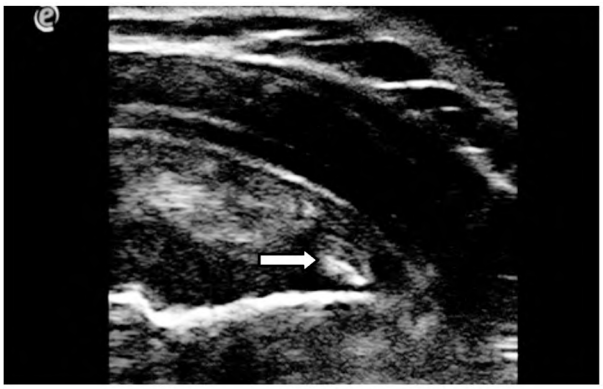
MSUS findings	RA patients	Controls	χ^2	*p*	MSUS findings	RA patients	Controls	χ^2	*p*
Biceps TP:					*Subscap. TP:*				
+	9 (10%)	12 (13.3)	0.485	0.486	+	6 (6.7%)	6 (6.7%)	0.000	1.000
–	81 (90%)	78 (86.7%)			–	84 (93.3%)	84 (93.3%)		
Biceps TS:					*Subscap. T-calc:*				
+	10 (11.1)	8 (8.9%)	0.247	0.619	+	0 (0%)	3 (3.3%)	3.051	0.246
–	80 (88.9%)	82 (91%)			–	90 (100%)	87 (96.7%)		
Biceps T SL:					*Subscap. T tear-F:*				
+	4 (4.4%)	5 (5.6%)	0.117	1.000	+	2 (2.2%)	4 (4.4%)	0.690	0.682
–	86 (95.6%)	85 (94.4)			–	88 (97.8%)	86 (95.6%)		
Biceps T tear-F:					*Subscap. T tear-P:*				
+	1 (1.1%)	0 (0%)	1.006	1.000	+	6 (6.7%)	4 (4.4%)	0.424	0.515
–	89 (98.9%)	90 (100%)			–	84 (93.3%)	86 (95.6)		
Biceps T tear-P:					*Supra sp. TP:*				
+	3 (3.3%)	1 (1.1%)	1.023	0.621	+	32 (35.6%)	32 (35.6%)	0.000	1.000
–	87 (96.7%)	89 (98.9%)			–	58 (64.6%)	58 (64.6%)		
SASD-B active:					*Supra sp. T-calc:*				
+	3 (3.3%)	0 (0%)	3.051	0.246	+	8 (8.9%)	18 (20%)	4.496	0.034
–	87 (96.7%)	90 (100%)			–	82 (91.1%)	72 (80%)		
SASD-B chronic:					*Supra sp. T tear-F:*				
+	38 (42.2%)	21 (23.3%)	7.287	0.007	–	10 (11.1%)	6 (6.7%)	1.098	0.295
–	52 (57.8%)	69 (76.7%)			+	80 (88.9%)	84 (93.3%)		
Subacro imp.:					*Supra.sp. T tear-P:*				
+	29 (32.2%)	19 (21.1%)	2.841	0.092	+	14 (15.6)	15 (16.7%)	0.041	0.839
–	61 (67.8%)	71 (78.9%)			–	76 (84.4%)	75 (83.3%)		
Subcoracoid B:					*Infra-sp. TP:*				
+	13 (14.4%)	5 (5.6%)	3.951	0.047	+	2 (2.2%)	7 (7.8%)	2.924	0.169
–	77 (85.6%)	85 (94.4%)			–	88 (97.8%)	83 (92.2%)		
Subcoracoid imp:					*Infra-sp. T-Calc:*				
+	16 (17.8%)	6 (6.7%)	5.178	0.023	+	0 (0%)	1 (1.1)	1.00	0.316
–	74 (82.2%)	84 (93.3%)			–	90 (100%)	89 (98.9)		
Humeral-osteophyte:					*Infra-sp. T tear-F:*				
+	5 (5.6%)	3 (3.3%)	0.523	0.720	+	3 (3.3%)	0 (0%)	3.051	0.246
–	85 (94.4%)	87 (96.7%)			–	87 (96.7%)	90 (100%)		
Humeral-erosion:					*Infra-sp. T tear-P:*				
+	26 (28.9%)	4 (4.4%)	19.36	0.000	+	2 (2.2%)	3 (3.3%)	0.206	1.000
–	64 (71.1%)	86 (95.6%)			–	88 (97.8%)	87 (96.7%)		
GHJ-effusion:					*ACJ-effusion:*				
+	35 (38.9%)	24 (26.7%)	3.051	0.081	+	2 (2.2%)	1 (1.1%)	0.339	1.000
–	55 (61.1%)	66 (73.3%)			–	88 (97.8%)	89 (98.9%)		
GHJ-synovitis:					*ACJ-synovitis:*				
+	2 (2.2%)	0 (0%)	2.022	0.155	+	20 (22.2%)	5 (5.6%)	10.45	0.001
–	88 (97.8%)	90 (100%)			–	70 (77.8%)	85 (94.4%)		
ACJ-erosion:					*ACJ-osteophyte:*				
+	18 (20%)	3 (3.3%)	12.12	0.000	+	32 (35.6%)	38 (42.2%)	0.842	0.359
–	72 (80%)	87 (96.7%)			–	58 (64.4%)	52 (57.8%)		

TP : Tendinopathy. T : Tendon. TS : Tenosynovitis. SL : Sublaxation.
Calc. : Calcification. Tear-F : Full thickness tear. Tear-P : Partial thickness tear. SASD : Subacromial Subdeltoid.
B : Bursa. Imp. : Impingement. Supra sp. : Supraspinatus. Infra-sp. : Infraspinatus.
Subscap. : Subscapularis. GHJ : Glenohumeral Joint. ACJ : Acromioclavicular Joint.

Table (3): Relation between inflammatory and non-inflammatory MSUS shoulder abnormalities in RA patients and different demographic and disease parameters.

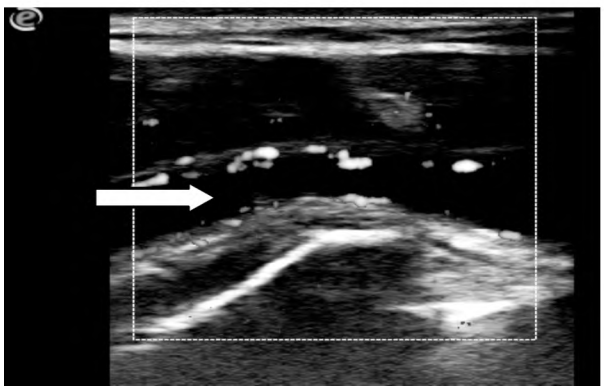
Parameter	RA patients							
	Inflammatory MSUS findings (90 shoulders)		χ^2 / Z	*p*	Non inflammatory MSUS findings (90 shoulders)		χ^2 / Z	*p*
	Presence 43 shoulder	Absence 47 shoulder			Presence 65 shoulder	Absence 25 shoulder		
Age (yrs)	46.6± 12.8	39.72±9.80	–2.854	0.006	44.8± 12.17	38.40±9.46	–2.645	0.01
Sex:								
F	37 (86%)	41 (87.2%)	0.027	0.869	57 (87.7%)	21 (84%)	0.213	0.732
M	6 (14%)	6 (12.8%)			8 (12.3%)	4 (16%)		
Dis. dur. (ys)	5 (1-10)	3 (2-10)	–0.707-	0.480	5 (1-9)	3 (2-10)	–0.082	0.935
Pain dur. (month)	3 (1-12)	5 (1-12)	–0.163	0.871	4 (1-11)	3 (1-12)	–.372	0.710
BMI	27.48±4.47	28.29±5.50	0.947	0.346	27.92±4.68	28.22±5.95	0.253	0.801
DAS 28 ESR	5.43± 1.04	5.08± 1.2	–1.473	0.144	5.27± 1.13	5.17± 1.19	–.373	0.710
VAS (0-100)	70 (60-70)	60 (50-80)	–0.946	0.344	70 (60-75)	60 (50-80)	–1.463	0.144
ESR (mm/hr)	35 (25-50)	26 (21-36)	–2.501	0.012	30 (21-46)	30 (23-40)	–.108	0.914
CRP (mg/dl)	7 (4-22)	10 (4-21)	–0.502	0.616	7 (4-21)	10 (4-20)	–.713	0.476
Anti-CCP (IU/mL)	66 (37-200)	89 (46-160)	–0.186	0.853	89 (37-185)	99 (46-141)	–.252	0.801
RF (IU/mL)	22 (12-64)	32 (14-83)	–.800	0.423	32 (13-82)	28 (13-79)	–.117	0.907

BMI : Body Mass Index.
Dis. dur : Disease duration.
VAS : Visual Analogue Scale.
ESR : Erythrocyte Sedimentation Rate.
CRP : C-Reactive Protein.
Anti-CCP (tit) : Anti-cyclic citrullinated antibody titre.
RF : Rheumatoid Factor.

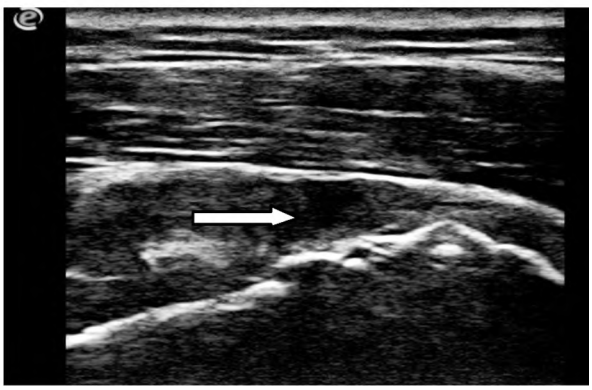


Supra-sp T calcification

Greater trochanter erosion



Active SASD-B inflammation



Supra-sp T tear-F

Fig. (1): MSUS images of shoulder abnormalities in Rheumatoid Arthritis patients.

Supra-sp T calcification : Supraspinatus tendon calcification.
Active SASD-B inflammation : Active (acute) subacromial subdeltoid bursa inflammation.
Supra-sp T tear-F : Supraspinatus tendon full thickness tear.

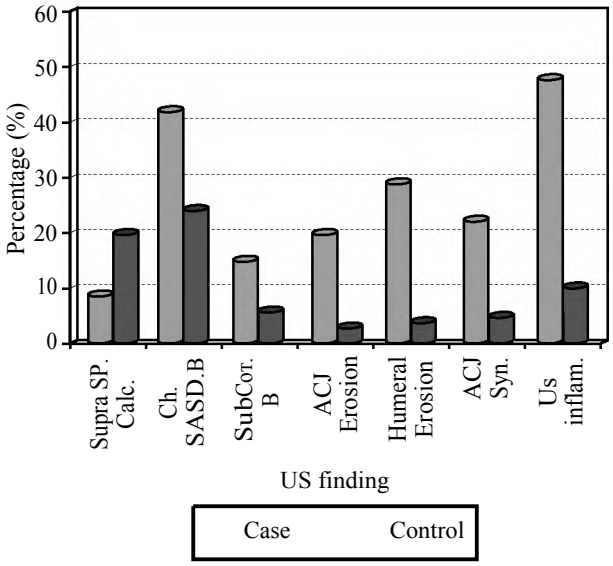


Fig. (2): Comparison between RA patients and controls as regards some US-detected shoulder lesions.

Supra sp. Calc. : Supraspinatus tendon calcification.
Ch. SASD B. : Chronic subacromial subdeltoid bursa inflammation.
Sub cor. B : Subcoracoid bursitis.
ACJ : Acromioclavicular Joint.
US inflam. : Ultrasound inflammatory findings.

On studying the relation between US abnormalities and shoulder pain in RA patients, there was no statistical significant association between shoulder pain and individual MSUS findings except ACJ irregularities and GH effusion. However, there was statistical significant association between shoulder pain and all inflammatory lesions combined, all non-inflammatory lesions combined and all erosions, $p<0.05$ (Table 4).

Table (4): Relation between US abnormalities and shoulder pain in RA patients (45).

MSUS abnormalities (90 shoulders)	Shoulder pain		χ^2	p
	Presense (+ve)	Presense (–ve)		
GH effusion:				
–	20 (36.4%)	6 (17.1%)	3.846	0.05
+	35 (36.6%)	29 (82.9%)		
ACJ irregularities:				
–	22 (37.3%)	4 (12.9%)	5.882	0.015
+	37 (62.7%)	27 (87.1%)		
All inflammatory:				
–	20 (42.6%)	6 (14%)	8.941	0.003
+	27 (57.4%)	37 (86%)		
All non-inflammatory:				
–	11 (44%)	15 (23.1%)	3.848	0.05
+	14 (56%)	50 (76.9%)		
All erosions:				
–	20 (36.4%)	6 (17.1%)	3.846	0.05
+	35 (63.6%)	29 (82.9%)		

Comparison between RA patients with unilateral versus bilateral shoulder MSUS abnormalities in gender, age, BMI, DAS-28 score, disease duration, pain duration, VAS, ESR, CRP, RF titre, anti-CCP antibodies titre revealed no statistical significant difference (χ^2=0.355, t=0.287, 1.313 and 0.716, z =0.638, 0.200, 0.055, 1.630, 0.165, 1.310, and 0.344 respectively), p=0.837, 0.775, 0.196, 0.478, 0.524, 0.842, 0.957, 0.103, 0.244, 0.190, 0.731, respectively (data not shown).

Regarding X-ray shoulder findings, osteoporosis, joint space narrowing, osteophytes, erosions, calcifications were detected in 5 (5.6%), 12 (13.3%), 7 (7.8%), 6 (6.7%), zero% of RA patients respectively versus zero %, 4 (4.4%), 4 (4.4%), zero%, 2 (2.2%) in controls with only significant statistical difference as regards joint space narrowing and erosions, p=0.032 and p=0.029 respectively (data not shown).

On studying agreement between MSUS and X-ray in detecting osteophytes, erosions and calcifications in 180 shoulders (RA patients and controls) using Kappa agreement measure, MSUS detected erosions in 42/180 versus 6/180 by X-ray, of the 42 MSUS detected erosions X-ray detected only 4 (9.5%), on the other hand of the 138 MSUS –ve erosions, X-ray agreed in 136 (98.6%), kappa= 0.115, p=0.01. MSUS detected osteophytes in 73/180 shoulders versus 11/180 by X-ray with +ve agreement in 6 (8.2%) and –ve agreement in 102 (95.3%), kappa=0.04, p=0.329. Calcifications detected by MSUS in 27/180 shoulders versus 2/180 by X-ray.

Discussion

The early and definitive diagnosis of a chronic inflammatory joint disease is crucial for initiating optimal treatment [18].

The current study included 45 RA patients and 45 age and sex matched patients serving as controls both had unilateral or bilateral shoulder pain. Our study participants were homogenous with no statistical significant difference between RA patients and controls regarding age, sex, BMI or shoulder pain duration, p>0.05.

In our study MSUS abnormalities were detected in 43/45 (95.5%) in RA patients, unilateral in 13 (28.9%) and bilateral in 30 (66.7%) versus 41/45 (91.1%) of controls, unilateral in 16 (35.6%) and bilateral in 25 (55.6%) with no statistical significant difference p>0.05. Shoulder pain was reported in 64 (71%) RA shoulders Vs. 51 (56.7%) in controls and pain was bilateral in 19 (42%) in RA shoulders

Vs. 6 (13.3%) in controls with statistical significant difference $p<0.05$. The commonest MSUS shoulder abnormality in our RA patients versus controls was SASD bursitis in 38 (42.2%) versus 21 (23.3%) followed by GH effusion 35 (38.9%) Vs. 24 (26.7%), supraspinatus TP 32 (35.6%) Vs. 32 (35.6%), ACJ osteophytes 32 (35.6%) Vs. 38 (42.2%), humeral head erosions 26 (28.9%) Vs. 4 (4.4%), ACJ synovitis 20 (22.2%) Vs. 5 (5.6%) in controls. There was statistical significant difference between RA patients and controls as regards frequency of supraspinatus calcification, ch.SASD B, subcoracoid B, ACJ erosion, ACJ synovitis, humeral head erosion, $p<0.05$.

The frequency of abnormal MSUS 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 years, subacromial bursitis was the most frequent finding that agreed with our results, followed by GH joint synovitis [19]. In another MSUS study evaluating 100 patients with RA with mean disease duration of 4.5 years, 14 cases presented with involvement of the GHJ and 22 with inflammatory abnormalities of the SAD bursa [20]. In Elbinoune et al., study [21] MSUS abnormalities were found in 83.8% of RA patients; bilateral in 59.5% of them. The most frequent MSUS findings were erosion (64.9%) followed by effusion (54.1%) and synovial hypertrophy (43.2%) in GHJ, SAD bursitis (37.8%) and Doppler signal in GHJ (10.8%). Fuda et al., study [22] detected that 21 (52.5%) of RA patients had erosions, 18 (45%) had synovitis, 21 (52.5%) had Long Head Of Biceps (LHB) tenosynovitis, 7 (17.5%) bursitis, and 18 (45%) supraspinatus tendinopathy by MSUS on shoulders. Kim et al., [2], found that 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. Biceps tendon rupture and subdeltoid effusion were detected in 14.3% of painful shoulders, respectively. Among the rotator cuff tendons, subscapularis was the most frequently involved, followed by supraspinatus and infraspinatus tendon.

In our study, inflammatory MSUS shoulder abnormalities (TS, S, active bursitis, erosions) were reported in 43 (47.8%) of RA patients Vs. 18 (20.0%) in controls with statistical significant difference $p<0.05$. On the other hand despite more frequent non inflammatory (degenerative) MSUS findings (TP, tears, ch. bursitis, osteophytes) in RA patients Vs. controls (65 (72.2%) Vs. 60 (66.7%)) no statistical significant difference was present $p>0.05$. Strunk et al., showed that power Doppler sonography helps to differentiate between degenerative shoulder disorders and rheumatoid shoulder [23]. Elbinoune et al., [21] assessed the sites of inflammation in painful rheumatoid shoulder by ultrasound and power Doppler, the most common MSUS finding was effusion or synovitis in 59% of painful GHJ accompanied or not with subdeltoid bursitis, detectable in the posterior scan in 87% of shoulders. MSUS joint erosions on the humeral head were detected in 59% of joints with longer disease duration [24]. This is partially consistent with our results. In Fuda et al., study [22], shoulders US inflammatory findings were as follows: 21 (52.5%) RA patients studied had erosions, 18 (45%) synovitis, 21 (52.5%) Long Head of Biceps (LHB) tenosynovitis, seven (17.5%) bursitis.

On studying the association between the frequency of these inflammatory MSUS shoulder abnormalities with various clinical and laboratory parameters in RA patients, they were significantly related to older ages and higher ESR (reflects disease activity). On the other hand degenerative MSUS shoulder abnormalities were significantly related to older ages. These results almost agreed with those of Elbinoune et al., [21], where in particular, synovial hypertrophy was associated with advanced age, and signal Doppler with advanced age, shorter disease duration and with higher disease activity assessed by Simple Disease Activity Index (SDAI). Presence of SAD bursitis was not linked to disease activity as in our study. Against our findings, abnormalities in anterior recess GHJ were associated with elevated synovial index and rheumatoid factor level. In a study done by Sakellariou et al., [25] patients with MSUS inflammatory involvement had longer median disease duration, were more frequently RF positive, had a higher disease activity and higher acute phase reactants, a higher level of disability and more pain. However, Fuda et al., [22], reported absence of relation between each of shoulder erosion, TS or bursitis with ESR or DAS 28 score. While, there were significant relation between supraspinatus TP, ESR and DAS-28. Bursitis was related to CRP.

Absence of RA patients in remission or with mild disease activity in our study in addition to small sample size may account for lack of strong relation between MSUS inflammatory findings and other parameter of disease activity except ESR. Also, SDAI as an index of RA activity was been shown superior over DAS-28 by Balsa et al., [26]. Some other studies included joint effusion and supraspinatus tendinopathy as inflammatory findings. Also, we studied the relation between MSUS

detected inflammatory (total No. and %) shoulder abnormalities and different clinical and laboratory disease characteristics including that of disease activity, while other studies evaluated the relation of each MSUS finding to these characteristics. In addition, different equipment or MSUS protocols may account for different results.

On studying the relation between MSUS abnormalities and shoulder pain in RA patients, there was no statistical significant association between shoulder pain and individual MSUS findings except ACJ irregularities and GH effusion $p<0.05$. However, there was statistical significant association between shoulder pain and all (combined) inflammatory lesions, all (combined) non inflammatory lesions and all erosions, $p<0.05$, which confirmed the limitation of small sample size in our work.

The study done by Fuda et al., **[22]**, reported significant relation between supraspinatus tendinopathy and shoulder TS but not shoulder erosions, bursitis or synovitis with shoulder pain. Gill et al. **[27]**, detected that MRI shoulder pathology was apparent in both symptomatic and asymptomatic shoulders and clinical symptoms may not match radiological findings. Sakellariou et al., found that patients with MSUS inflammatory involvement had increased frequency of spontaneous shoulder pain and higher median VAS pain **[25]**.

In our study X-ray detected statistically significant more joint space narrowing and erosions in RA patients compared to controls, $p=0.032$ and 0.029 respectively. On studying agreement between MSUS and X-ray in detecting osteophytes, erosions and calcifications in 180 shoulders (patients and controls) using Kappa agreement measure, MSUS detected erosions in 42/180 (23.3%) Vs. 6/180 (3.3%) by X-ray with + agreement only in 4 (9.5%) and –ve agreement in 136 (98.6%), kappa=0. 115, $p=0.01$. MSUS detected osteophytes in 73/180 (40.5%) shoulders versus 11/180 (6.1%) and calcifications in 27/180 (15.0%) shoulders versus 2/180 (1.11%) by X-ray with non-significant agreement. These findings indicate general superiority of MSUS over X-ray in better detection of erosions, osteophytes, and calcifications. The data published in the literature show ultrasound to have a higher sensitivity than radiography **[28-30]**. Wakefield et al. **[31]**, documented that MSUS is a reliable technique that detects more erosions compared with conventional radiography, especially in early RA. A study by Babini et al., **[32]** that investigated the shoulder by conventional radiography demonstrated erosions in the superolateral area of the glenohumeral joint in 20% of 56 patients with RA. Fuda et al., **[22]**, demonstrated erosion in the shoulder using MSUS in 21 (52.5%) cases and using conventional radiography in 18 (45%) cases; and concluded that MSUS was more diagnostic for erosion in RA. Hermman et al., **[18]**, identified erosions in 60% of RA patients. Their results show that the detection rate of ultrasound is higher than that of conventional radiography, but the difference was not statistically significant.

In Conclusion MSUS detected shoulder inflammatory abnormalities are more frequent, symptomatic, and usually bilateral in RA patients. They are related to shoulder pain (which is more frequent and bilateral compared to controls), old age and disease activity. Early diagnosis of a chronic inflammatory joint disease by US, proved superiority to conventional radiography, is crucial for initiating optimal treatment.

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التغيرات الغير طبيعية المصحوبة بإلتهاب فى مقابل الغير مصحوبة بإلتهاب كما إلتقطتها آشعة الموجات فوق الصوتية فى كتف مرضى الروماتويد المفصلى الذين يعانون من آلم بالكتف

يعتبر التشخيص الدقيق والمبكر للإلتهاب المفصلى المزمن فى مرض الروماتويد المفصلى آساس لبدء العلاج الآمثل. وفى حين تلتقط الآشعة السينية التغيرات المتآخرة كتدمر المفصل فهى تفشل فى إلتقاط الإلتهاب فى الغشاء المبطن للمفصل.

قد كان الهدف من هذه الدراسة هو مقارنة نوع ونسبة التغيرات غير الطبيعية المصحوبة بإلتهاب فى مقابل الغير مصحوبة بإلتهاب كما إلتقطتها آشعة الموجات فوق الصوتية فى كتف مرضى الروماتويد المفصلى الذين يعانون من آلم بالكتف وعلاقتها بالخواص المميزة للمريض.

وقد تم فحص آكتاف ٤٥ من مرضى الروماتويد المفصلى و٤٥ من المتطوعين المصابين بآلم الكتف كمجموعة ضابطة بواسطة آشعة الموجات فوق الصوتية على العضلات والمفاصل وبالآشعة السينية ومقارنتهم، وكانت النتائج كالتالى:

- كان هناك فرق ذو دلالة إحصائية بين مرضى الروماتويد المفصلى والمجموعة الضابطة فى عدد ونسبة التغيرات غير الطبيعية المصحوبة بإلتهاب كما إلتقطتها آشعة الموجات فوق الصوتية على العضلات والمفاصل (٤٣ (٤٧.٨٪) مقابل ١٨ (٢٠٪) على التوالى).
- لم يكن هناك فرق ذو دلالة إحصائية بين مرضى الروماتويد المفصلى والمجموعة الضابطة فى عدد ونسبة التغيرات غير الطبيعية الغير مصحوبة بإلتهاب كما إلتقطتها آشعة الموجات فوق الصوتية على العضلات والمفاصل (٦٥ (٧٢.٢٪) مقابل ٦٠ (٦٦.٧٪) على التوالى).
- فى مرضى الروماتويد المفصلى، كان هناك علاقة ذات دلالة إحصائية بين وجود التغيرات غير الطبيعية المصحوبة بإلتهاب كما إلتقطتها آشعة الموجات فوق الصوتية على العضلات والمفاصل وآلم الكتف والآعمار الآكبر للمرضى وسرعة الترسيب الآعلى.
- كما آن تآكل العظم تم إلتقاطه بواسطة آشعة الموجات فوق الصوتية فى ٤٢ من ١٨٠ كتف (مرضى روماتويد ومجموعة ضابطة) مقابل ٦ من ١٨٠ كتف تم إلتقاطهم بواسطة الآشعة السينية. ومن ال ٤٢ تآكل بالعظم التى تم إلتقاطهم بواسطة آشعة الموجات فوق الصوتية كان هناك ٤ (٩.٥٪) فقط توافق إلتقاطهم بالآشعة السينية. فى حين آن ال ١٣٨ كتف الباقية التى نفت آشعة الموجات فوق الصوتية وجود تآكل بالعظم فيهم توافقت معها الآشعة السينية بالنفى فى ١٣٦ كتف (٩٨.٦٪).

من هذا نستنتج آن: التغيرات غير الطبيعية المصحوبة بإلتهاب كما إلتقطتها آشعة الموجات فوق الصوتية بكتف مرضى الروماتويد المفصلى شائعة وغالباً تحدث فى الكتفين. كما آن لها علاقة بآلم الكتف وبالآعمار الآكبر للمرضى وبشدة نشاط المرض. كما آن التشخيص المبكر للإلتهابات المزمنة فى المفصل بإستخدام الآشعة التليفزيونية التى آثبتت تفوقاً على الآشعة السينية ضرورى لبدء العلاج المثالى.