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BRIEF REPORT

Ultrasound assessment of new onset bilateral painful shoulder in patients with polymyalgia rheumatica and rheumatoid arthritis

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Abstract The aim of our study was to investigate by ultrasound (US) the anatomical structures affected during a new episode of bilateral painful shoulder in patients with polymyalgia rheumatica (PMR) and rheumatoid arthritis (RA) and to compare the findings between these two conditions. PMR and RA patients complaining of new onset bilateral painful shoulder were included. Subjects without any known rheumatic condition with a new onset unilateral painful shoulder were assessed as a control group. US evaluation includes the depiction subacromial–subdeltoid (SAD) bursitis, long head biceps (LHB) tenosynovitis and/or gleno-humeral (GH) synovitis. Thirty patients with PMR, 30 with RA, and 60 controls were included for a total of 60 shoulders per group. Unilateral SAD bursitis and LHB tenosynovitis were significantly more frequent in patients with PMR when compared to those with RA ($p<0.0001$ and $p<0.01$, respectively) and controls ($p<0.001$ and $p<0.01$, respectively). Unilateral GH synovitis was more common in RA than in PMR and controls ($p<0.05$ and $p<0.01$, respectively). Bilateral SAD bursitis was significantly more frequent in patients with PMR than in those with RA ($p<0.01$) as was bilateral LHB tenosynovitis ($p<0.01$). No significant differences were found in bilateral GH synovitis. US-detected periarticular inflammatory involvement more frequently in PMR both unilaterally and bilaterally and intra-articular inflammatory involvement was commonly in RA but only unilaterally.

Keywords Bursitis · Painful shoulder · Polymyalgia rheumatica · Rheumatoid arthritis · Synovitis · Tenosynovitis · Ultrasound

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Introduction

Painful shoulder is one of the most common conditions in rheumatology and represents an important source of referral for rheumatologic consultation. Shoulder pain may be caused by different intra-articular, periarticular and/or extra-articular mechanisms which in turn can be present in a broad range of inflammatory and noninflammatory diseases, such as polymyalgia rheumatica (PMR), rheumatoid arthritis (RA), or degenerative disorders [1].

Bilateral painful shoulder is a distinctive characteristic in patients with PMR and the typical proximal symptoms are one of the hallmarks for the diagnosis of this disease. Although the cause of symptoms has remained unclear, a number of studies with imaging techniques have shown synovial intra-articular and periarticular inflammation in the proximal joints [2–10].

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Inflammation of subacromial and subdeltoid (SAD) bursae in association with synovitis of the glenohumeral (GH) joints and long head biceps (LHB) tenosynovitis represents a likely basis for the diffuse discomfort in the shoulder girdle that is observed in PMR patients [10]. However, these features also occur in RA, mainly elderly onset RA (EORA), and to date cannot be used to differentiate PMR from RA [11–14].

Ultrasound (US) has become an effective, noninvasive, reproducible [15], low-cost, and readily available tool to assess joints and surrounding areas in patients with different rheumatic conditions. It allows visualization of soft tissue and detects fluid collection and can discriminate between intra-articular and periarticular involvement in different anatomical areas [16, 17]. Furthermore, previous studies have demonstrated the high sensitivity and specificity of US for detecting PMR inflammatory findings compared with magnetic resonance imaging (MRI) as a gold standard [5, 6].

Some patients have a chronic relapsing course in both PMR and RA and can complain of bilateral painful shoulder during the flares, even while on treatment. Data on US examination in these cases are lacking.

Taking into account the different anatomical structures that could be affected (periarticular and/or intra-articular inflammatory involvement) in shoulder pain in PMR and RA patients, we designed the present study. The purpose was to investigate by US which of the musculoskeletal structures are affected during an episode of new onset bilateral painful shoulder in patients with previously diagnosed and treated PMR and RA and to compare the findings between these two conditions and with nonrheumatic controls with unilateral painful shoulder.

Methods

Patients

Patients consecutively attending the rheumatology unit of the Hospital Italiano de Buenos Aires with previous diagnosis of PMR (1984 Healey's classification criteria) [18] and RA (2010 ACR/EULAR criteria) [19] were included in the present study. All patients had to complain of new onset bilateral painful shoulder considered by the treating rheumatologist as a disease relapse or flare. Exclusion criteria were: under18 years of age, oral prednisone dose >10 mg per day, presence of other concomitant inflammatory rheumatic condition (particularly microcrystalline arthropathies), history of shoulder surgery or fracture, severe shoulder deformities, and corticosteroid injection within the last 2 months. Subjects without any known inflammatory and/or degenerative rheumatic conditions with new onset unilateral painful shoulder were included as control group. We did not include subjects with bilateral painful shoulder as control group to avoid the inclusion of possible undiagnosed PMR or RA patients.

The study was conducted according to the Declaration of Helsinki and local regulations. Ethical approval for the study was obtained from the hospital local ethics committee, and informed consent was obtained from both PMR and RA patients and controls.

Ultrasound assessment

US shoulder evaluation was performed bilaterally in PMR and RA patients and unilaterally at symptomatic shoulder in control subjects. All US examinations were carried out by the same rheumatologist sonographer using a My Lab 70 X-Vision (Esaote Biomedica S.p.A, Genoa-Italy) machine equipped with 6–18 MHz broadband multifrequency linear transducer. The operator was blinded to clinical data, and patients and controls were asked not to talk with the operator about their clinical condition. A standardized scanning method was used [7, 20]. The biceps tendon groove was examined with the patient seated with the arm held in neutral position, the elbow flexed to 90° and the forearm in a supinated position on the thigh. Next, the subscapularis tendon was examined in the same position but with maximal external rotation of the shoulder. After that the transducer was moved laterally to scan the supraspinatus and infraspinatus tendons with the patient's shoulder in hyperextension and internal rotation in order to expose the supraspinatus from underneath the acromion. SAD bursae were evaluated during all the ultrasound examination paying particularly attention in this position. Finally, 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 following US inflammatory findings were investigated by a dichotomous evaluation (presence/absence):

- SAD bursitis: hypoechoic fluid-filled bursa greater than 2 mm thickness [7]
- LHB tenosynovitis: thickness of the hypoechoic halo of fluid surrounding the biceps tendon greater than 2 mm [7]
- GH synovitis: distance from the posterior labrum to the posterior infraspinatus tendon greater than 2 mm [7]

In addition, the presence of abnormalities at the rotator cuff , such as tendinitis (tendon hypoechogenicity or tendon thickening with or without internal hypo or hyperechoic foci) and/or partial or full thickness tear (partial fiber discontinuity and non-visualization of tendon or complete fiber discontinuity, respectively) were also examined. The power Doppler technique was not used.

Statistical analysis

Continuous variables are presented as means and standard deviation (SD) if normally distributed and medians and interquartile range (IQR) if not normally distributed. Independent *t* test and Mann–Whitney *U* test were applied, as appropriate. Ordinal and dichotomous variables are presented as frequencies and percentages and were compared by χ^2 test or Fisher's exact test. Summary statistics for diagnostic tests were calculated with their 95 % exact binomial confidence intervals for each one of the ultrasound features investigated. Statistical tests were two-sided and a p value <0.05 was considered significant.

Results

Demographic and clinical data

Thirty PMR patients (mean age, 74; SD, 8 years; 26 females/4 males; median of disease duration, 54; IQR, 36–66 months), 30 RA patients (mean age, 64; SD, 12 years; 24 females/6 males; median of disease duration, 54; IQR, 36–72 months) and 60 controls (mean age, 69; SD, 15; 48 females/12 males) were included for a total of 60 shoulders evaluated by US in each group.

Mean erythrocyte sedimentation rate at time of inclusion in the study was 39 mm/h (SD, 14) and 33 mm/h (SD, 14) in PMR and RA patients, respectively. Twenty (66.6 %) RA patients had positive rheumatoid factor and 22 (73.3 %) had positive anti-cyclic citrullinated peptide antibody. Twenty-five (83.3 %) PMR patients were under treatment with prednisone alone (<10 mg per day) and 5 (16.6 %) were not receiving any treatment due to previous clinical remission. All RA patients were under treatment with disease modifying anti-arthritic drugs and 15 (50 %) were also receiving prednisone.

Ultrasound findings

Forty-eight out of 60 (80 %) evaluated shoulders in PMR patients had at least one US inflammatory findings (SAD bursitis, LHB tenosynovitis, or GH synovitis) while 26 out of 60 (43.3 %) and 20 out of 60 (33.3 %) examined shoulders shown at least one US inflammatory findings in PMR patients and control group, respectively.

Unilateral findings Unilateral SAD bursitis and unilateral LHB tenosynovitis were significantly more frequent in PMR patients than in both RA patients ($p<0.0001$ and $p<0.01$, respectively) and controls ($p<0.001$ and $p<0.01$, respectively). No significantly statistical differences were found in unilateral SAD bursitis and unilateral LHB tenosynovitis between RA patients and controls. Unilateral GH synovitis was more common in RA patients than in both PMR patients ($p<0.05$) and controls ($p<0.01$) while no statistically significant differences were found between PMR and controls (Table 1).

Bilateral findings Bilateral SAD bursitis was detected in 11 out of 30 (36.6 %) patients with PMR and in only one out of 30 (3.3 %) RA patients ($p<0.01$) while bilateral LHB tenosynovitis was found in nine out of 30 (30 %) PMR patients in contrast with none (0/30) of RA patients ($p<0.01$). No significantly statistical differences were found on bilateral GH synovitis between PMR and RA patients (Table 2).

Table 1 Unilateral abnormal findings detected by ultrasound and comparison between polymyalgia rheumatica, rheumatoid arthritis and control group

		Polymyalgia rheumatica vs rheumatoid arthritis	Polymyalgia rheumatica vs control group	Rheumatoid arthritis vs control group
Subacromial–subdeltoid bursitis, shoulder affected/shoulder evaluated (%)		33/60 (55 %) vs 11/60 (18.3 %), $p<0.0001$	33/60 (55 %) vs 15/60 (25 %), $p<0.001$	11/60 (18.3 %) vs 15/60 (25 %), p=NS
Long head biceps tenosynovitis, shoulder affected/shoulder evaluated (%)		28/60 (46.6 %) vs 14/60 (23.3 %), $p<0.01$	28/60 (46.6 %) vs 12/60 (20 %), $p<0.01$	14/60 (23.3 %) vs 12/60 (20 %), p=NS
Glenohumeral synovitis, shoulder affected/shoulder evaluated (%)		7/60 (11.7 %) vs 16/60 (26.7 %), $p<0.05$	7/60 (11.7 %) vs 4/60 (6.6 %), p=NS	16/60 (26.7 %) vs 4/60 (6.6 %), $p<0.01$
Rotator cuff abnormalities, shoulder affected/shoulder evaluated (%)	Tendinitis	41/60 (68.3 %) vs 39/60 (65 %), p=NS	41/60 (68.3 %) vs 42/60 (70 %), p=NS	39/60 (65 %) vs 42/60 (70 %), p=NS
	Rotator cuff partial tear	19/60 (31.6 %) vs 21/60 (35 %), p=NS	19/60 (31.6 %) vs 21/60 (35 %), p=NS	21/60 (35 %) vs 21/60 (35 %), p=NS
	Rotator cuff complete tear	7/60 (11.6 %) vs 6/60 (10 %), p=NS	7/60 (11.6 %) vs 8/60 (13.3 %), p=NS	6/60 (10 %) vs 8/60 (13.3 %), p=NS

NS not significant

Table 2 Bilateral inflammatory findings detected by ultrasound and comparison between polymyalgia rheumatica and rheumatoid arthritis patients

NS not significant

	Polymyalgia rheumatica	Rheumatoid arthritis	*P*
Subacromial-subdeltoid bursitis, patients (%)	11/30 (37 %)	1/30 (3 %)	<0.01
Long head biceps tenosynovitis, patients (%)	9/30 (30 %)	0/30 (0 %)	<0.01
Glenohumeral synovitis, patients (%)	1/30 (3 %)	3/30 (10 %)	NS

Additional findings The presence of rotator cuff abnormalities were seen in 72.7 % (48/60), 68.2 % (45/60), and 83.3 % (50/60) of evaluated shoulders in PMR, RA, and control group, respectively (no statistical differences were found between the different study groups) (Table 1). Figure 1 shows some representative US images obtained during the study.

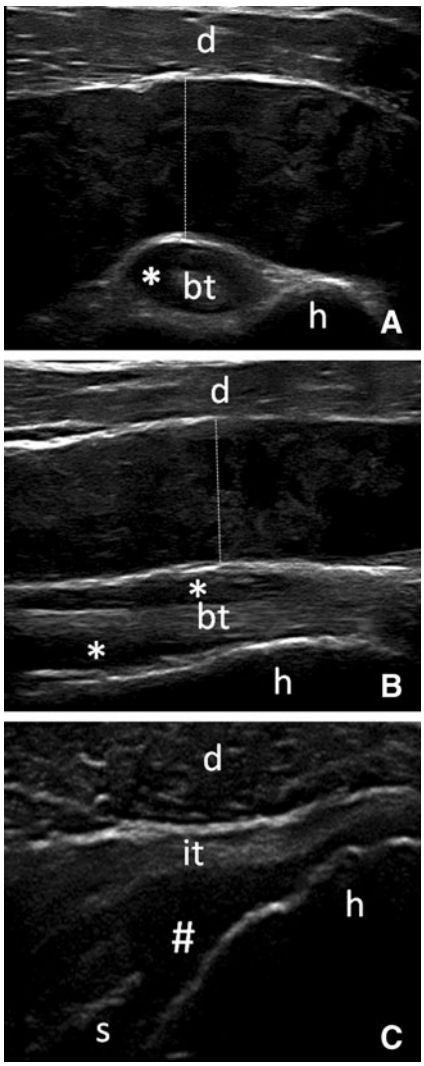

Fig. 1 Representative images obtained during the study. **a**, **b** Anterior transversal and longitudinal scans of the shoulder, respectively. Subacromial–subdeltoid bursa filled with fluid (*dotted line*) and long head biceps tenosynovitis (*asterisk*). **c** Posterior transverse scan of the shoulder. Glenohumeral synovitis (*number sign*). *d* deltoid muscle, *bt* biceps tendon, *h* humerus, *it* infraspinatus tendon, *s* scapula

Discussion

Previous studies analyzing imaging (US and MRI) findings in PMR and EORA mainly at the beginning of the disease have shown controversial results related to the musculoskeletal structures affected by the inflammatory process [4, 6, 7, 9, 10]. Cantini et al. studying US in 57 patients with untreated PMR and 114 controls (bilateral painful shoulder) found unilateral SAD bursitis in 96 % of PMR patients and in 22 % of controls ($p<0.001$) while bilateral SAD bursitis was detected in 96 % of PMR patients and in 4 % of controls ($p<0.001$). However, they did not find significant differences regarding LHB tenosynovitis and GH synovitis between PMR patients and controls [6]. On the other hand, Lange et al. studying 22 PMR patients and 29 patients with EORA detected GH synovitis in 40.9 % of PMR patients and in 65.5 % of EORA patients. Moreover, both SAD bursitis and LHB tenosynovitis were more common in EORA patients [9]. Falsetti et al. did not find statistical differences in the prevalence of GH synovitis, LHB tenosynovitis, and SAD bursitis between PMR and RA patients [4]. More recently, Jimenez-Palop et al. found bilateral SAD bursitis in 65 % of PMR patients prior to starting treatment with corticosteroids and bilateral LHB tenosynovitis and bilateral GH synovitis in 45 % and in 30 % of the same patients, respectively [7]. So, periarticular involvement appears to be more frequent in PMR and intra-articular involvement more common in RA; however, these findings have not been consistent and data are therefore conflictive. In addition, in most of these previous series, patients have been studied at disease onset before treatment has been instituted. To the best of our knowledge, this is the first US experience in patients with established and treated PMR and RA with a recent onset of bilateral painful shoulder.

The present study showed some differences in the shoulder musculoskeletal structure affected by inflammatory involvement detected by US between PMR and RA patients. To begin with, US abnormal findings were more common unilaterally than bilaterally, both for periarticular and intra-articular structures. Periarticular inflammatory involvement (SAD bursitis and LHB tenosynovitis) was more common in PMR patients than in RA patients both unilaterally and bilaterally, while intra-articular inflammatory involvement (GH synovitis) was more frequent in RA patients than in PMR patients but only unilaterally. No differences were found in the intra-articular inflammatory involvement

between PMR and RA patients concerning bilateral US examination. In relation to the rotator cuff abnormalities, we did not found any difference between the study groups which might suggest that these findings are common in the majority of subjects complaining shoulder pain irrespective of the rheumatic condition.

An important limitation of the present study was that we classified US inflammatory findings only as present or absent. To graduate and score, these US findings might be helpful to obtain more detailed descriptions and to evaluate the distribution of the inflammatory findings between these different rheumatic conditions. An added limitation could be the fact that our patients were undergoing treatment at the time of US evaluation which might explain the lower prevalence of our US inflammatory findings compared to other series. Indeed, the papers by Machioni et al. and Jiménez-Palop et al. show marked decrease in inflammatory findings after starting treatment [3, 7]. Finally, another important limitation was the fact that we did not include power Doppler technique in the assessment of inflammatory involvement of the shoulder. Although power Doppler could lead to a better characterization of the abnormal US findings in special to difference the presence of tenosynovitis from fluid around the tendon due to joint involvement, we found both features very rarely in our patients.

In conclusion, the present study demonstrates some differences in shoulder inflammation involvement detected by US between established and treated PMR and RA patients having a new onset of bilateral painful shoulder being, mainly unilaterally, periarticular inflammatory involvement more common in PMR and intra-articular inflammatory involvement more frequent in RA.

Disclosures None.

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