

# Shoulder pain: are there predictive factors of response to treatment and of ultrasound findings?

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## ABSTRACT

**Introduction:** Shoulder pain is a common cause of consultation in Primary Health Care, and may correspond to up to 30% of the reasons for consultation. Pathology of the rotator cuff is the most common cause of pain. Ultrasound is a valuable diagnostic tool in assessing shoulder disorders; it can be as effective as magnetic resonance imaging.

**Objective:** To determine the predictive factors of response to treatment and ultrasound findings in shoulder pain.

**Methods:** We performed an analysis of the patients' cases sent to the rheumatology consultation with shoulder pain. Every patient had an echography shoulder evaluation, and the rheumatologist decided treatment based on the guidelines for the treatment of shoulder tendinopathies. The use of nonsteroidal anti-inflammatory drugs (NSAIDs) and muscle relaxant medications as well as the following techniques: corticosteroids local injection, barbotage, capsular distension and physiotherapy programs were some of the variables assessed. Posteriorly, the patients were clinically assessed in a follow-up visit.

**Results:** A total of 119 patients were evaluated. There was a statistically significant relationship between the time from the beginning of the symptomatology and treatment response. Diabetes mellitus, arterial hypertension and dyslipidaemia were statistically significantly associated with some rotator cuff lesions and distention of the subscapular bursa. Age was the main predictor of rotator cuff ultrasound findings.

**Conclusion:** In patients with shoulder pain, early intervention positively influences the response to treatment. Thus, it is important that these patients are evaluated more promptly. Some comorbidities seem to be

associated with a higher risk of specific rotator cuff lesions. No relationship was found between response to treatment and age, sex, occupation, previous treatments or type of therapy selected. The associations found in this study seem to have clinical implications. Prevention of rotator cuff disease is a matter of major relevance as well as early institution of treatment.

**Keywords:** Chronic shoulder pain; Musculoskeletal ultrasonography; Treatment; Rotator cuff; Comorbidity.

## INTRODUCTION

Shoulder pain is a common cause of consultation in Primary Health Care, and may correspond to up to 30% of the reasons for consultation<sup>1</sup>. Shoulder disorders can significantly affect the patient's work capacity and daily activities. The shoulder consists of a complex set of bone, muscle, tendon and nerve structures<sup>1</sup>. Rotator cuff disease is a term encompassing tendinopathy, partial-thickness or complete tear of one or more of the rotator cuff tendons, also including subacromial bursitis. In general, the term rotator cuff disease is used synonymously with subacromial impingement syndrome<sup>1</sup>. Pathology of the rotator cuff is the most common cause of pain. Its prevalence increases with age and with some comorbidities such as obesity, diabetes mellitus (DM) and diseases that affect shoulder muscle strength, such as stroke<sup>2,3</sup>. The history of omalgia can have an abrupt onset or may present progressively<sup>4</sup>.

Ultrasound is a valuable diagnostic tool in assessing shoulder disorders; it can be as effective as magnetic resonance imaging (MRI) in detecting complete tendon tears (sensitivity of 92% and specificity of 94%) and partial tears (sensitivity of 67% and specificity of 94%)<sup>5</sup>. However, ultrasound is less expensive and better tolerated by patients than MRI<sup>6</sup>.

In the initial treatment of most non-traumatic shoul-

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der disorders, conservative treatment may be sufficient. However, early surgical intervention can be considered in cases of rotator cuff tendon tears in young patients with acute or chronic tears with minimal irreversible changes<sup>4</sup>. Those with chronic rotator cuff tears generally respond well to conservative management, but there is a high percentage of relapse<sup>7</sup>.

In Barbotage technique, calcifications are punctured and irrigated with a needle to break them down and once this is achieved the calcifications are aspirated<sup>8</sup>.

The objectives of this study were the clinical evaluation of patients with shoulder pain and the assessment of predictive factors associated with ultrasound findings of response to treatment. The use of nonsteroidal anti-inflammatory drug (NSAIDs) and muscle relaxant medications as well as the following techniques: corticosteroids local injection, barbotage, capsular distension and physiotherapy programs were some of the variables assessed.

## METHODS

We performed an analysis of the patients referred for shoulder pain to rheumatology consultation by general practitioners, orthopaedists or physiatrists to our department in a tertiary hospital, during a 6 months period (July to December of 2017).

In the first visit, a rheumatologist, experienced in musculoskeletal ultrasonography, with EULAR certification, performed a shoulder ultrasound in all patients, assessing the biceps long head tendon and rotator cuff tendons, the acromioclavicular joint, the subacromial-subdeltoid bursa and the glenohumeral joint (GE LOGIQ™ S8 machine and ML6-15 linear probe). The rheumatologist decided treatment based on the guidelines for the treatment of shoulder tendinopathies (calcifying tendinitis, rotator cuff rupture and tendonitis and bursitis)<sup>1,4,7,11,12,22</sup>. No surgical or chirurgical treatment was evaluated.

Posteriorly, the patients were clinically assessed in a follow-up visit (in a median of 2 months later) and a Constant score was assessed, if < 30 = unsatisfactory; 30-39 = fair; 40-59 = good; 60-69 = very good; and 70 and over = excellent.<sup>9</sup> Unsatisfactory or fair score corresponded to same state before treatment.

Patients with inflammatory rheumatic diseases and patients without follow-up were excluded.

Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS) version 24. De-

scriptive statistical analysis included the evaluation of absolute and relative frequencies for categorical variables and calculation of the mean, median and standard deviation (SD) for continuous variables. A Kolmogorov-Smirnov (KS) test were used to determine the distribution of continuous variables. In the comparison of means between groups, the Student t Test (t) was applied for the variables with normal distribution. In the case of variables without normal distribution, if the independent variable was binary the Mann-Whitney U test (U) was used, if the independent variable included more than 2 categories the Kruskal-Wallis H test (H) was performed. For the evaluation of the relationship between two categorical variables, the Chi-square test ( $\chi^2$ ) was performed, and if its assumptions were not assured, a Fisher's Exact Test was used. A multivariate analysis was performed to evaluate the prognostic value of the covariates in binary logistic regressions for tears, long head of the biceps tenosynovitis, calcific tendinopathy and subacromial or subscapularis bursitis in ultrasound evaluation (present or absent) and for treatment response (Constant score: very good/excellent/good or same state (unsatisfactory or fair)). In multivariate analyses we included the variables with association with outcome in univariate analysis and those that are described in the literature as predictors of response to conservative treatment. The p-values are two-tailed, with a value <0.05 indicating statistical significance.

## RESULTS

A total of 119 patients (130 shoulders) were evaluated, with a mean age of 58.8 years (SD = 12.8); 68.9% were female.

Table I shows the main clinical and epidemiological characteristics of the patients.

Shoulder pain involved the right shoulder more frequently (53.8%), being bilateral in 16% of the cases. In the patients with omalgia, 70% of patients had shoulder mobility limitation and 96.2% had abnormal findings in ultrasound. The most common rotator cuff tendon involved was the supraspinatus, followed by the long head of biceps tendon. Only 10.1% of patients with right omalgia and 11.5% with left omalgia did not have ultrasound changes in supraspinatus tendon. Subacromiodeltoid bursa was distended in 32.9% of cases with right omalgia and 15.4% with left omalgia, while only 8.9% and 7.7%, respectively, present-

**TABLE I. CLINICAL AND EPIDEMIOLOGICAL CHARACTERISTICS OF PATIENTS WITH OMALGIA**

Age (years)	Mean 58.8 (SD=12.8), minimum 23; maximum 83
Gender	
Male	31.1% (37/119)
Female	68.9% (82/119)
Portuguese classification of professions	
Representatives of the legislative and executive bodies, officers, directors	2.3%
Specialists in intellectual and scientific activities	2.3%
Technicians and mid-level professions	9.3%
Administrative staff	6.9%
Personal, security and safety personnel and vendors	10.3%
Farmers and skilled workers in agriculture, fisheries and forestry	2.3%
Skilled workers in industry, construction and craftsmen	2.3%
Installations and machine operators and assembly workers	3.4%
Unskilled workers	60.9%
Professional status	
Employee	46.6%
Unemployed	16.5%
Reformed	32.0%
Certificate of Temporary Disability	4.9%
Number of comorbidities	Median 1 (IQR:3), minimum 0; maximum 8
Comorbidities	
Weight excess or obesity	5.9%
Diabetes mellitus type 2	16.8%
Hypertension	39.5%
Dyslipidaemia	32.8%
Hyperuricemia	4.2%
Hypothyroidism	4.2%
Depression	18.5%
Osteoarthritis	10.1%
Osteoporosis	0.8%
Cardiac disease:	
HF	4.2%
AF	4.2%
Unspecified	1.6%
Pulmonary disease:	
Asthma	1.7%
COPD	1.7%
SAS	0.8%
Cerebrovascular disease	2.5%
Others	15.1%

AF: Atrial fibrillation; HF: heart failure; COPD: Chronic obstructive pulmonary disease; SAS: Sleep apnoea syndrome; SD: Standard deviation; IQR: Interquartile range

ed with distension of subscapular bursa. Glenohumeral joint changes were found in 7.6% of right and 9.6% of left shoulder ultrasounds.

The most frequent finding in supraspinatus and subscapular tendons was a heterogeneous tendon pattern, in long head of biceps tendon was tenosynovitis and in

**TABLE II. CLINICAL AND ULTRASOUND CHARACTERISTICS OF SHOULDER PAIN**

	Clinical and ultrasound features at baseline
Laterality	Right: 53.7%; Left: 30.3%; Bilateral: 16.0%
Time since symptom onset (months)	Median 12 (IQR= 6.5); minimum 1; maximum 90
Mobility	Decreased: 70.0%; Normal: 30.0%
Treatment performed prior to referral	Yes: 74.8% NSAIDs: 59.7%; Physiotherapy: 42.0%; Infiltration: 10.9%
Treatment prescribed in the consultation	Yes: 95.8% Corticosteroids local injection: 77.3%; Physiotherapy: 30.3%; NSAIDs: 24.4% Barbotage: 10.9%; Capsular distension: 4.2%; Muscle relaxant: 0.8%
Follow-up (months)	Median 2 (IQR:1); minimum 1; maximum 13
Treatment outcome (Constant score)	Very good/excellent: 44.4% ; good: 41.9%; Same state (unsatisfactory or fair): 13.7%
Abnormal findings in ultrasound	Right shoulder: 75/78 ultrasounds Left shoulder: 50/52 ultrasounds
Long head of the biceps tendon	No changes: Right: 59.9%; Left: 57.7% Tenosynovitis: Right: 25.3%; Left: 23.1% Subluxation / dislocation: Right: 6.3%; Left: 11.5% Heterogeneity: Right: 3.8%; Left: 1.9% Partial tear: Right: 0.0%; Left: 3.8% Complete tear: Right: 3.8%; Left: 0.0% Not displayed: Right: 1.3%; Left: 1.9%
Supraspinatus tendon	No changes: Right: 10.1%; Left: 11.5% Heterogeneity: Right: 30.4%; Left: 23.1% Partial tear: Right: 15.2%; Left: 17.3% Complete tear: Right: 16.5%; Left: 9.6% Calcification: Right: 7.6%; Left: 19.2% Heterogeneity and calcification: Right: 5.1%; Left: 7.7% Heterogeneity and partial tear: Right: 13.9%; Left: 7.7% Heterogeneity and complete tear: Right: 0.0%; Left: 1.9% Heterogeneity, calcification and partial tear: Right: 1.3%; Left: 1.9%
Infraspinatus tendon	No changes: Right: 93.7%; Left: 96.2% Heterogeneity: Right: 2.5%; Left: 0.0% Partial tear: Right: 1.3%; Left: 3.8% Complete tear: Right: 1.3%; Left: 0.0% Calcification: Right: 1.3%; Left: 0.0%
Subscapular tendon	No changes: Right: 77.2%; Left: 82.7% Heterogeneity: Right: 10.1%; Left: 11.5% Partial tear: Right: 5.1%; Left: 3.8% Complete tear : Right: 3.8%; Left: 0.0% Calcification: Right: 2.5%; Left: 1.9% Heterogeneity and calcification: Right: 1.3%; Left: 0.0%
Glenohumeral joint	No changes: Right: 92.4%; Left: 90.4% Effusion in the posterior recess: Right: 6.3%; Left: 7.7% Thickening of the capsule: Right: 1.3%; Left: 1.9%
Subacromiodeltoid bursa	No changes: Right: 67.1%; Left: 84.6% Distension: Right: 32.9%; Left: 15.4%
Subscapular bursa	No changes: Right: 91.1%; Left: 92.3% Distension: Right: 8.9%; Left: 7.7%
Others findings	Right: Supraspinatus muscle contracture: (1); Atrophy of the long head of the biceps tendon, supra and infraspinatus tendon: (1) Left: deltoid muscle edema: (1)

NSAIDs: Nonsteroidal anti-inflammatory drug

infraspinatus tendon was heterogeneity of ultrasound (US) pattern on right and partial tear on left side.

Supraspinatus calcification was present in 7.6% of the cases with right omalgia and 19.2% with left omalgia.

Before being referred to our rheumatology department, 59.7% of patients had taken NSAIDs and 42.0% had done physiotherapy. A median of 12 months was found regarding the time between the beginning of the symptomatology and the first rheumatology visit. In this appointment, a rheumatologist performed a complete shoulder ultrasound examination to all patients. In relation to treatments, a corticosteroid local injection was performed to 77.3% of patients and a capsular distension was done in 4.2%. Additionally, physiotherapy was recommended to 30.3% of patients and Barbotage technique was used in 10.9%. Finally, NSAIDs were prescribed to 24.4% of patients and muscle relaxant medications to 0.8%.

The follow-up visit occurred a median of 2 months after the first assessment. At this visit, patient's complaints had improved in 86.3% of patients, with very good/excellent Constant score in 44.4% and good in 41.9%.

Table II shows the main clinical characteristics of shoulder pain and ultrasound findings of the patients.

There was a statistically significant relationship between the time from the beginning of the symptomatology to the first evaluation and treatment response ( $p=0.043$ ); patients who were referred earlier to the Rheumatology Department had a better response. On the other hand, patients with higher number of comorbidities presented a worse response to treatment ( $p=0.028$ ); the median of comorbidities was 1, with a maximum of 8 and a minimum of 0. However, none of the comorbidities identified, alone, significantly influenced treatment response.

In multivariate analysis including age, sex, rotator cuff tears at echographic evaluation, manual labor, number of comorbidities and time from the beginning of the symptomatology to the first evaluation and alcohol consume. Number of comorbidities ( $B=-0.59$ ,  $OR: 0.56$  (95%CI: 0.33-0.94),  $p=0.029$ ) and time from the beginning of the symptomatology to the first evaluation ( $B=-0.95$ ,  $OR: 0.95$  (95%CI: 0.91-0.99),  $p=0.040$ ) were the main predictors of treatment response.

There were no association between the response to treatment and variables such as age, sex, occupation, professional status, laterality, joint mobility, treatments

performed before the appointment or type of therapy selected at the visit.

Age was associated with tendon tears ( $p<0.001$ ), long head of the biceps tenosynovitis ( $p=0.005$ ) and subscapular bursitis ( $p=0.004$ ) but not with subacromial bursitis or calcific tendinopathy.

DM was associated with an increased risk of complete tendon tears and calcification of subscapular tendon ( $p=0.011$ ). The presence of arterial hypertension was associated with the isolated finding of a heterogeneous tendon pattern, an isolated complete tear or a heterogeneous tendon pattern plus partial tear of the supraspinatus ( $p=0.002$ ); partial and complete tears of the subscapular ( $p=0.003$ ) and distention of the subscapular bursa ( $p=0.030$ ). Regarding the latter, patients with arterial hypertension were 5.75 times more likely to develop subscapularis distention (95% CI: 1.02-31.57) than patients without hypertension. In patients with dyslipidaemia, there was an association between complete subscapular tear ( $p=0.032$ ) and distention of the subscapular bursa ( $p=0.030$ ).

Men presented a higher risk than women of distention of the subscapular bursa ( $p=0.001$ ,  $OR=17.9$ , 95%CI: 2.03-167).

In multivariate analysis including age, gender, manual labor, DM, dyslipidaemia, arterial hypertension and obesity, only age are still associated with rotator cuff tears ( $B= 0.11$ ,  $OR:1.1$  (95%CI: 1.05-1.18),  $p=0.001$ ) and with long head of the biceps tenosynovitis ( $B= 0.09$ ,  $OR:1.1$  (95%CI: 1.03-1.18),  $p=0.004$ ). None of previously variates remains associated, with calcific tendinopathy and subacromial or subscapularis bursitis in echographic evaluation.

## DISCUSSION

Rotator cuff pathology is the most common cause of shoulder pain seen in clinical practice.<sup>3</sup> The prevalence of calcified rotator cuff disease in this study was similar to that reported in literature, for adults with or without pain (7.5 to 20%). Le Goff *B et al.* found that larger and fragmented calcifications were often associated with pain<sup>10</sup>.

In this study, as in the literature, supraspinatus was the most common tendon involved in rotator cuff injury.<sup>1,11</sup> Rotator cuff injuries can frequently be managed effectively with nonoperative care. Excellent results have been demonstrated throughout the literature with nonoperative management of partial-thickness rotator

cuff tears<sup>11,12</sup>. Patients in our study experienced a decrease of shoulder pain after treatment; this was also demonstrated by Gialanella and Bertolinelli in their study: patients that received corticoid injection showed higher effectiveness and improvement in pain during activities and pain at night than those of the control group<sup>13</sup>.

In the literature there are reports on the effect of dyslipidaemia, DM and arterial hypertension on rotator cuff disease<sup>14</sup>. Besides that, a recent study demonstrated that atraumatic posterolateral rotator cuff tears were significantly associated with age, dominant-side involvement, manual labor, DM, body mass index, hypo-HDLemia, and metabolic syndrome<sup>15</sup>. We show that age is the main predictor to rotator cuff tears and long head of the biceps tenosynovitis.

We found that patients with a higher number of comorbidities, and a higher time from the beginning of the symptomatology to the first evaluation have a worst outcome. A shorter duration of symptoms to treatment is a predictor of conservative treatment response already described in literature<sup>16</sup>. No studies were found regarding effect of number of comorbidities in conservative treatment options for cuff rotator disease, but a high number of studies assessed surgical treatment. A higher number of comorbidities had a negative effect on general health status outcomes but not on shoulder function<sup>17,18</sup>.

Others factors that showed to be significant predictors to non-surgical treatment in literature like manual labor, alcohol use and thickness of rupture don't show same association in our study. It can be because higher manual labor in our study (35% vs 17% in others studies) and in relation to alcohol use, we just have two patients with excessive consumption and none with 2-3 times per month or less<sup>16</sup>.

Total cholesterol, triglycerides, and low-density lipoprotein cholesterol concentrations of patients with rotator cuff tendon tears were higher, and their high-density lipoprotein cholesterol showed a tendency to be lower than the control group<sup>19</sup>. DM was an important risk/causative factor for the development or poor prognosis of chronic tendinopathy/tendon tears<sup>20</sup>. Hypertension was associated with a two-fold higher risk of tear occurrence<sup>21</sup>.

## CONCLUSION

In patients with shoulder pain, early intervention po-

sitively influences the response to treatment. Thus, it is important that these patients are evaluated more promptly.

Some comorbidities seem to be associated with a higher risk of specific rotator cuff lesions.

No relationship was found between response to treatment and age, sex, occupation, previous treatments or type of therapy selected.

The associations found in this study seem to have clinical implications. Prevention of rotator cuff disease is a matter of major relevance as well as early institution of treatment. However, larger studies must be done to corroborate these results.

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