

## Prevalence of Ultrasonographic Findings in Patients with Shoulder Pain: from the Chronic to the Hyperacute

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### Abstract

Many epidemiological studies have been performed to ascertain the prevalence of the different etiologies of shoulder pain. Most of them are based on secondary care units and do not take into account patients who present with acute or hyperacute shoulder pain. We conducted a cross-sectional study in an emergency unit to determine the prevalence of ultrasonographic findings in those patients. Superspinatus compromise was detected in 86.7% while subscapularis tendon involvement was assessed in 26.8%. Tendinosis was more frequent in patients with hyperacute shoulder pain. Tendon tear was higher (47.4%) in patients with acute shoulder pain rather than hyperacute (34.2%) or chronic (18.4%). Subacromial bursitis was higher in patient that consulted sooner. We evaluate several interpretations to our findings considering possible relationships between bursitis, tear and calcifications according to time of onset of symptoms.

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### Introduction

Shoulder pain is one of the most recurrent main complaints among people with musculoskeletal acute disorders not related to direct traumatism [1]. It is estimated that around 40% of people will develop shoulder pain at least once in a lifetime [2]. In recent epidemiological experiences in Spain, shoulder pain was considered one of the most prevalent chief complaints second only to knee pain in an emergency department [3].

Due to its established reliability, efficiency and easy access, ultrasonography has been identified as the best tool to assess shoulder pain among patients with chronic or subacute disease [4-7].

However, in our setting, acute shoulder pain is mostly assessed only by a semiology approach and to a lesser extent by conventional radiology. Traditional clinical examination maneuvers are of limited diagnostic value and X-ray plates have a low yield when assessing soft tissue. As a result, the number of patients who finally get access to an ultrasonographic evaluation is quite lower than the prevalence of shoulder pain. Peculiarly, the data available to perform epidemiological studies proceeds from patients with shoulder pain where ultrasound studies were ordered [6,8-11]. Most of these patients reach the diagnosis several weeks after the onset of symptoms.

Our hypothesis is that ultrasonographic findings in patients with acute shoulder pain differ from those found in patients with subacute or chronic disease. The purpose of the present study is to describe and compare ultrasonographic findings in patients with shoulder pain not related to a direct trauma (non traumatic) according to the evolution time since onset of symptoms.

### Method

We conducted a retrospective observational cross sectional study on a subset of ultrasonographic (USG) shoulder reports from the accident and emergency (A&E) department of Ramon y Cajal University Hospital, a high complexity teaching hospital in Madrid-Spain. All US shoulder examinations were performed by two rheumatologists with more than 5 years of experience in musculoskeletal ultrasound and soft tissue diseases with musculoskeletal complaints. Both rheumatologists belong to the rheumatology and musculoskeletal emergencies unit (RMEU) which started operations in 2013.

The records of the (RMEU) of the last two years (2013-2014) were reviewed. Notes of patients with shoulder pain were retrieved. Only files including a standard ultrasound assessment [12] were admitted for our analysis. Ultrasonographic reports followed the standard recommendations for general musculoskeletal USG [13,14] and shoulder USG [15,16].

A review of all the ultrasonography reports of the rheumatology and musculoskeletal emergencies unit (RMEU) of our A&E department was made. Demographic and epidemiological information, time from onset of symptoms until RMU assessment and ultrasonography report were obtained from the patients notes. Only records of patients who consulted due to shoulder pain were included. Data from two years was reviewed. No identity info was incorporated in the analysis.

Records included were classified according to the period of time since onset of symptoms. There is no general agreement about the period of time required to differentiate between chronic from acute shoulder pain [17-20], but some expert opinions consider a period of six weeks of symptoms as a useful cut off [19]. Also, we introduced the definition of hyperacute shoulder pain with an arbitrary time lapse of 1 week.

Results were expressed as average and standard deviation (SD), prevalence was expressed in percentage with 95% confidence intervals. Comparisons were made using Student T test and Chi Square Test.

## Results

Four hundreds and ninety-two consecutive RMEU registries of patients who consulted due to shoulder pain were reviewed. From those, 474 were suitable for inclusion and analysis. Excluded registries contained incomplete or not fully understandable data.

Average age of patients assessed was 59 SD 17 years old. Proportion of females was 67%. Hypertension background was found in 34.6%, diabetes in 5.91%, hypothyroidism in 0.85%, chronic renal failure in 2.53%. 13.5% of patients were under anticoagulant treatment with acenocumarol. Between both genders, hypertension diagnosis was more prevalent in women (53.7%) than men (46.3%) ( $P < 0.001$ ) and the use of acenocumarol was more prevalent in women (56.2%) than men (43.8%) ( $P < 0.01$ ). The rest of global comparisons by gender did not show statistically significant differences (data not showed). **Table 1** summarizes epidemiological data from registries included.

The findings of the reports of the ultrasonographic studies were as follow: Subacromial bursitis was detected in 134 examinations (28.3%). Superspinatus tendon assessment revealed 267 cases of tendinosis (56.3%), 152 cases of tear of any magnitude (32.1%) and 132 findings of at least a single calcification (27.8%). Subscapularis tendon assessment revealed 44 cases of tendinosis

(9.3%), 63 cases of tear of any magnitude (13.3%) and 40 findings of at least a single calcification (8.4%). Thirty-six cases of bicipital synovitis were diagnosed and 12 cases of bicipital tendinosis. Infraspinatus tendinosis was observed in 8 cases (1.7%). Teres minor tendon assessment did not show any pathology among our cases.

Considering the whole series of reports, supraspinatus tendon was affected in 411 shoulders explored (86.7%), subscapularis tendon in 127 shoulders (26.8%) and biceps tendon in 56 shoulders (11.8%).

According to age group, superspinatus tendon tear was diagnosed in 80 patients older than 70 years old (52.6% of all superspinatus tendon tear) and in 36 patients in the 61 to 70 years old range (23.7%). Subscapularis tendon tear was diagnosed in 32 patients over 70 years old (50.8%) and 19 patients within 61 to 70 years (30.2%). **Table 2A and 2B** shows the entire findings by age group and results of comparisons.

Considering the time since onset of symptoms, superpinatus tendon tear was more frequent in patients with acute (47.4%) than hyperacute (34.3%) or chronic shoulder pain (18.4%) ( $P < 0.001$ ). Finding of calcifications was more frequent in hyperacute shoulder pain (39.4%) due to affection of superspinatus tendon than acute (30.3%) or chronic (30.3), however it was not statistically significant. By the contrary, subscapularis calcification was more frequent in chronic (55.6%) than acute (31.7%) and hyperacute (12.7%) shoulder pain.

Subacromial bursitis was detected in 67 patients with less than a week of symptoms (50%), 47 patients with pain within a week and 6 weeks (35.1%) and 20 patients with pain of more than 6 weeks from onset (14.9%) ( $P < 0.001$ ). Subacromial bursitis was statistically less frequent in patients with onset of pain of less than 6 weeks ( $P < 0.0001$ ). Superspinatus tear as present in 52 (34.2%) studies of shoulders with hyperacute, 72 (47.4%) acute and 28 (18.4%) chronic pain. Distribution of superspinatus calcification as an ultrasonography diagnosis was not statistically different among three groups. Entire data and comparisons between proportions are expressed in **Table 3A and 3B**.

## Discussion

### Comorbidities and shoulder pain

Most studies about diagnostic and therapeutic techniques focus into the anatomic findings besides considering other factors when

**Table 1** Demographic data. Patients have been grouped according to onset of symptoms.

	Hyperacute		Acute		Chronic	
	Female	Male	Female	Male	Female	Male
Age (years)	56.88 SD 15.23	55.17 SD 13.84	63.04 SD 17.06	61.12 SD 22.15	52.54 SD 18.85	69.24 SD 7.71
Hypertension	32 (66.7%)	16 (33.3%)	44 (78.6%)	12 (21.4%)	12 (20%)	48 (80%) <sup>1</sup>
Diabetes	16 (100%)	-	-	4 (100%)	-	8 (100%)
Hypotiroidism	4 (100%)	-	-	-	-	-
Chronic renal failure	-	8 (100%)	-	-	4 (100%)	-
Acenocumarol user	20 (62.5%)	12 (37.5%)	12 (100%)	-	4 (20%)	16 (80%) <sup>2</sup>

$P < 0.001$ , between genders in patients with chronic shoulder pain.

$P < 0.01$ , between genders in patients with chronic shoulder pain.

**Table 2A** Ultrasonographic findings according to age group.

Ultrasonographic finding	Age group <sup>1</sup>											
	>70		21-30		31-40		41-50		51-60		61-70	
	Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %
Subacromial bursitis	44	32,8%	-	-	8	6,0%	20	14,9%	30	22,4%	32	23,9%
Superspinatus tendinosis	36	13,5%	16	6,0%	20	7,5%	36	13,5%	82	30,7%	77	28,8%
Superspinatus tear	80	52,6%	4	2,6%	-	-	16	10,5%	16	10,5%	36	23,7%
Superspinatus calcification	24	18,2%	-	-	16	12,1%	24	18,2%	36	27,3%	32	24,2%
Subscapularis tendinosis	12	27,3%	-	-	4	9,1%	12	27,3%	16	36,4%	-	-
Subscapularis calcification	-	-	-	-	4	10,0%	12	30,0%	20	50,0%	4	10,0%
Subscapularis tear	32	50,8%	-	-	4	6,3%	-	-	8	12,7%	19	30,2%
Bicipital tendinosis	4	33,3%	-	-	-	-	4	33,3%	4	33,3%	-	-
Bicipital sinovitis	20	55,6%	-	-	-	-	4	11,1%	-	-	12	33,3%
Bicipital tear	12	60,0%	-	-	-	-	4	20,0%	4	20,0%	-	-
Infraspinatus tendinosis	-	-	-	-	-	-	4	50,0%	-	-	4	50,0%

**Table 2B** Comparison of proportions using chi<sup>2</sup> test.

Ultrasonographic finding	Comparisons of Column Proportions <sup>b,1</sup>					
	Age group					
	>70 (A)	21-30 (B)	31-40 (C)	41-50 (D)	51-60 (E)	61-70 (F)
Subacromial bursitis		. <sup>a</sup>				
Superspinatus tendinosis		A	A	A	A	A
Superspinatus tear	B C E F		. <sup>a</sup>			E
Superspinatus calcification		. <sup>a</sup>	A	A	A	
Subscapularis tendinosis		. <sup>a</sup>				. <sup>a</sup>
Subscapularis calcification	. <sup>a</sup>	. <sup>a</sup>		F	F	
Subscapularis tear	E	. <sup>a</sup>		. <sup>a</sup>		
Bicipital tendinosis		. <sup>a</sup>	. <sup>a</sup>			. <sup>a</sup>
Bicipital sinovitis		. <sup>a</sup>	. <sup>a</sup>		. <sup>a</sup>	
Bicipital tear		. <sup>a</sup>	. <sup>a</sup>			. <sup>a</sup>
Infraspinatus tendinosis	. <sup>a</sup>	. <sup>a</sup>	. <sup>a</sup>		. <sup>a</sup>	

Results are based on two-sided tests with significance level ,05. For each significant pair, the key of the category with the smaller column proportion appears under the category with the larger column proportion.

Age group of less than 20 years old has been excluded due to complete absence of ultrasonographic findings.

<sup>a</sup>This category is not used in comparisons because its column proportion is equal to zero or one.

<sup>b</sup>Tests are adjusted for all pairwise comparisons within a row of each innermost subtable using the Bonferroni correction.

choosing a course of action and deciding on a treatment strategy. Hypertension, renal failure or the use of oral anticoagulation are main conditionings when choosing a therapeutic approach and treatment with non-steroidal anti-inflammatory drugs (NSAIDs) is limited in patients with these diagnosis [21]. In those patients, physiotherapy, analgesic therapy or local steroids injections

should be considered besides a prolonged NSAIDs treatment even in patients with normalized ratio index of anticoagulation over 1.0 [22]. In our series, both systemic hypertension and use of acenocumarol were higher in patients with chronic shoulder pain. Also, the chronic shoulder pain group of patients was older than other groups. Age was also a crucial condition when

**Table 3A** Ultrasonographic findings according to time since onset of symptoms.

Ultrasonographic findings	Time since onset of symptoms					
	Less than a week		1 to 6 weeks		More than 6 weeks	
	Count	Row N %	Count	Row N %	Count	Row N %
Subacromial bursitis	67	50,0%	47	35,1%	20	14,9%
Superspinatus tendinosis	103	38,6%	67	25,1%	97	36,3%
Superspinatus tear	52	34,2%	72	47,4%	28	18,4%
Superspinatus calcification	52	39,4%	40	30,3%	40	30,3%
Subescapularis tendinosis	28	70,0%	12	30,0%	-	-
Subescapularis calcification	8	12,7%	20	31,7%	35	55,6%
Subescapularis tear	8	66,7%	4	33,3%	-	-
Bicipital tendinosis	8	22,2%	16	44,4%	12	33,3%
Bicipital sinovitis	8	40,0%	4	20,0%	8	40,0%
Bicipital tear	4	50,0%	4	50,0%	-	-

**Table 3B** Comparisons of proportions using chi<sup>2</sup> test.

	Comparisons of Column Proportions <sup>b</sup>		
	Time since onset of symptoms		
	Less than a week	1 to 6 weeks	More than 6 weeks
	(A)	(B)	(C)
Subacromial bursitis	C	C	
Superspinatus tendinosis	B		B
Superspinatus tear		A C	
Superspinatus calcification			
Subescapularis tendinosis	B		. <sup>a</sup>
Subescapularis calcification		A	A
Subescapularis tear			. <sup>a</sup>
Bicipital tendinosis			
Bicipital sinovitis			
Bicipital tear			. <sup>a</sup>

Results are based on two-sided tests with significance level ,05. For each significant pair, the key of the category with the smaller column proportion appears under the category with the larger column proportion.

a. This category is not used in comparisons because its column proportion is equal to zero or one.

b. Tests are adjusted for all pairwise comparisons within a row of each innermost subtable using the Bonferroni correction.

considering the use of prolonged NSAIDs treatment so this fact should also be taken into account in the decision making process.

### Shoulder pain aetiology according to age

Subacromial bursitis was found with more frequency as the age of the group increased. The same observation was found in superspinatus tendinosis except for the group of patients older than 70 years. In this particularly group superspinatus tear was higher in frequency than the other ones.

This is a remarkable finding considering that previous clinical

studies have demonstrated that subacromial pain syndrome was more common in older patients [1]. Considering that both superspinatus (more than infraspinatus) tendinosis and tear are the most known causes of Subacromial pain syndrome and that we found a high prevalence of subacromial bursitis in those patients, it can truly be inferred that, those three anatomical conditions could be linked and, more important, its prevalence increases with the age of the patient. In patients of 70 years or older a tear was detected in more than 50% while tendinosis in less than 15%. The logical explanation of this finding would be that older tendons are prone to tear and that could be the reason why this group of patients has the higher proportion of subacromial bursitis as well.

Calcifications finding was, more frequent in older patients but its prevalence was lower than subacromial bursitis. It is clear that calcifications cannot be directly considered as causal agents of shoulder pain considering that most calcifications were formed several months or even years before the onset of pain. It is acceptable to think that calcification and shoulder pain are associated in terms of the disruption of the normal passage of the rotator cuff through the subacromial space due to a transitory –or definitive- inflammatory process. This fact explains that only less than 20% of patients with shoulder pain have tendon calcifications and that calcification prevalence is higher the older is the patient.

### Shoulder pain aetiology according to time of onset of symptoms

In general terms, subacromial bursitis was higher in patients with a shorter period of symptoms. It must be taken into account that patients decided freely when to be assessed so, the personal perception of pain and its impact is a considerable factor involved in this result. In patients that chose to be assessed later the finding of subacromial bursitis was lower. It could be interpreted in two ways: The intensity of pain is the most relevant factor for a patient to seek a medical assessment or/and the bursal distension is present only when pain is detected into the very first days of symptoms and it gets resolved within 1 to 6 weeks.

Superspinatus affection was present in almost 90% of all patients who described shoulder pain. This is consisting with most of the series described [1,11,23-26]. Tendinosis was by far the most

frequent finding in patients with hyperacute shoulder pain and there was no record of it in patients with chronic shoulder pain (excluding the 30.3% of patients with calcifications). Calcifications proportions seem not be affected by time of onset of symptoms. It supports the opinion that calcifications act as an implicated witness but not as direct cause of shoulder pain in most cases.

### Limitations of the study

This study has three limitations that must be considered to fully understand its results. First, despite the fact that almost the entirety of patients who presented to our emergency department with shoulder pain where assessed by ultrasonography, the decision to consult was made by each patient. So, it means that our group cut-off in terms of onset of symptoms depended in a great way in subjective considerations. In the same way, it should be said that the "onset of pain" as a variable will always be attached to this kind of considerations.

Another problem is the definition of tendinosis. In our study we chose to differentiate tendinosis and calcification tendinosis. To be fair, a tendon calcification is a kind of tendinosis. However, we decided to differentiate both concepts considering, as we explain before, that calcifications can be detected many weeks of months before development of symptoms.

Finally, this study is based on ultrasonography findings. Clinical counterpart was not take into account. Although our primary objective was to report the prevalence of ultrasonography findings in patients with shoulder pain according to the onset of symptoms, its relationship with clinical features could be an interesting study to help clarify the impact of subacromial bursitis, calcifications or tendon tear in patients with acute or hyperacute shoulder pain.

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