

# Ultrasonographic clues for acuity/chronicity of rotator cuff tear

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## Abstract

**Objective:** To look prospectively for ultrasonographic clues for acuity/chronicity of rotator cuff tear (RCT) among patients with shoulder pain.

**Material and Methods:** Patients with shoulder pain who were referred for musculoskeletal ultrasonography and diagnosed with RCT were asked to participate in our study. After consent, demographic, clinical, laboratory, and ultrasonographic findings, including age, gender, history of trauma, type of tendon with tear, tendon tear size, tendon effusion, bursal effusion, calcification, tendon thickness, and duration of shoulder pain were documented. Shoulder pain duration of  $\leq 2$  months was considered as an acute case. Patients were divided into group 1 (with acute shoulder pain) and group 2 (patients with chronic shoulder pain; pain duration of  $> 2$  months), and the various parameters of the two groups were compared to look for significant differences between the two groups. Student's unpaired t-test and the chi-square test were used for continuous and categorical parameters, respectively.

**Results:** A total of 112 patients were diagnosed with RCT, and 132 tears were documented. Sixty-three patients (~56%) were male, and the mean age of all the patients was  $54.2 \pm 15.2$  years. A total of 44% of the patients belonged to group 1 (with acute pain). The existence of either a subdeltoid bursal effusion (SBE) or a biceps peritendon effusion (BPE) and thick tendon were observed significantly more among patients in group 1 compared to patients in group 2.

**Conclusion:** The existence of either an SBE or a BPE and thick tendon were signs of an acute RCT.

**Keywords:** Rotator cuff tear, clues, chronicity, ultrasonography



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## Introduction

A rotator cuff tear (RCT) is a common finding among patients with shoulder pain (1). It can be partial or complete and can be symptomatic or asymptomatic. Musculoskeletal ultrasonography (MSKUS) is one accepted modality for the diagnosis of an RCT (2). It has a sensitivity of 0.84 and 0.96 and a specificity of 0.89 and 0.93 for partial and full-thickness tears, respectively (3). The pathogenesis of an RCT is usually degenerative, with age being the most important risk factor for the development of such an entity (4). The estimated prevalence of RCTs in the general population is about 20%, mainly affecting patients older than 50 years (5).

An RCT can be associated with limited shoulder movement in addition to pain, and the treatment can include several strategies, such as non-steroidal anti-inflammatory drugs, local corticosteroid injections, local hyaluronic acid injections, and/or surgery (6). The chronicity of shoulder pain is one of the most important factors in the success of any treatment (1). Moreover, the estimation of the chronicity of shoulder symptoms can have an impact on a patient's claim toward an employer or health insurance agency.

There have been almost no studies in the literature assessing MSKUS clues for the duration or chronicity of RCTs. In one study, performed many years ago, it was found that the existence of bursal fluid was much more common among those patients with acute symptoms of a full RCT than those with chronic symptoms (7). Therefore, the aim of our study was to look prospectively for MSKUS clues for the acuity/chronicity of RCTs among patients with shoulder pain.

## Material and Methods

Those patients with shoulder pain who were referred and diagnosed with RCTs using MSKUS at the department of radiology at our hospital were asked to participate in our study. After obtaining the patient's consent, the demographic parameters, including age and gender, in addition to the clinical parameters, including the duration of shoulder pain and any history of trauma, were documented. The MSKUS features included the type of tendon involvement, type of tear (partial or complete), width of the tendon, existence of bursal fluid, existence of biceps tendon fluid, and any calcifications. The width of the tendon was calculated as the thickest portion of the tendon with the tear up to 1 cm away from either side of the tear. Diameters of 6-8 mm were considered to be normal, while anything larger was considered to be indicative of a thick tendon. Smaller diameters were considered to be atrophic.

The exclusion criteria included those patients with histories of shoulder surgery, local injections during the previous month, inflammatory arthritis, and those patients who had an ultrasound study without shoulder pain.

The patients were divided into two groups. Group 1 included patients with shoulder pain symptoms for  $\leq 2$  months (patients with acute shoulder symptoms), and group 2 included patients with shoulder pain symptoms for  $> 2$  months (patients with chronic shoulder pain). An unpaired Student's *t*-test or chi-square Fisher's exact test was used to compare the continuous or categorical parameters, respectively, of the two groups. The *p*-value in this study was two-tailed and was considered to be significant at  $\leq 0.05$ .

All of the MSKUS studies were done by the first author who is an experienced radiologist in the field of MSKUS. An HD 11 ultrasound machine (Philips; Nebraska, USA) with L12-3 MHz probes (Philips; Nebraska, USA) was used in our study. This research was approved by the local ethics committee of the hospital, and all of the patients signed consent forms.

## Results

One hundred and twelve patients were diagnosed with RCTs. Thirteen of these had tears in both shoulders, so a total of 125 shoulders were included in this study. The demographic, clinical, and MSKUS parameters are shown in Table 1. Sixty-three of the

patients (~56%) were male, and the mean age of the participants was  $54.2 \pm 15.2$  years old. There were 132 tears documented, of which 127 (96%) were partial tears, mostly involving the supraspinatus tendon (SST)

(Figure 1).

There were 49 patients in group 1 (acute shoulder pain), and the rest were in group 2 (Table 2). The existence of either a subdeltoid bursal effusion (SBE) (Figure 2) or a biceps peritendon

**Table 1.** Demographic and clinical parameters of all patients (112 patients with 125 shoulders with RCT)

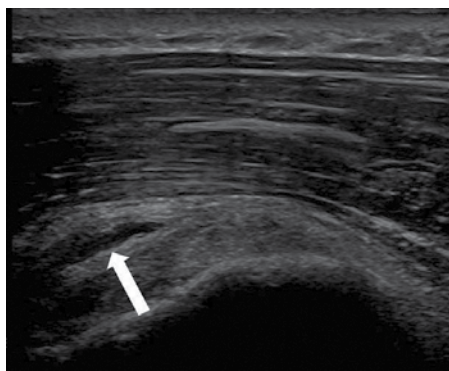
Parameter	Number (%)
- Age (years)	$54.2 \pm 15.2$ , 17-90.7
- Male gender	63 (56)
- Duration of pain (months)	$21.4 \pm 20.5$ , 0.25-100
- History of trauma	18 (16)
- Left-side tested	60 (48)
- SST tear	123 (~98)
- SSC tear	9 (~7)
- Other tendons	0 (0)
- Partial tears	128
Small	53
Moderate	40
Large	34
Any combination	11
- Full tear	5 (4)
- Subdeltoid bursal effusion (SBE)	27 (~22)
- Biceps peritendon effusion (BPE)	6 (~5)
- Calcifications	26 (~21)
- Calcifications + SBE	4 (~3)

SST: supraspinatus tendon; SSC: subscapularis tendon; SBE: subdeltoid bursal effusion; BPE: biceps peritendon effusion

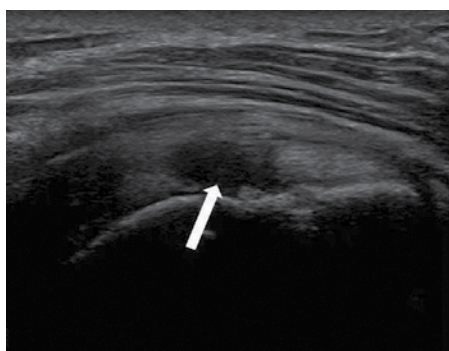
**Table 2.** Comparison of ultrasonographic findings between group 1 and group 2 patients

Parameter	Group 1 Symptoms $\leq 2$ mo. (49 patients) (51 shoulders)	Group 2 Symptoms $> 2$ mo. (63 patients) (74 shoulders)	<i>p</i>
- Age (years)	$52.7 \pm 15.7$ , 17-75.5	$55.4 \pm 15.0$ , 20-90.7	0.731
- Male gender	31	32	0.219
- Subdeltoid bursal effusion (SBE)	15	12	0.078
- Biceps peritendon effusion (BPE)	4	3	0.365
- SBE or BPE	19	15	0.035
- Thick tendon	21	12	0.002
- Atrophic tendon	5	23	0.005
- Calcification	12	15	0.663
- SST involvement	50	73	0.789
- SSC involvement	5	5	0.537
- Partial small tear	20	32	0.653
- Partial moderate tear	21	19	0.067
- Partial large tear	14	21	0.909
- Full tear	1	4	0.334

SBE: subdeltoid bursal effusion; BPE: biceps peritendon effusion; SST: supraspinatus tendon; SSC: subscapularis tendon



**Figure 1.** Arrow showing subdeltoid bursal effusion



**Figure 2.** Arrow showing partial tear of the supraspinatus tendon with evidence of thick tendon on the right side

**Table 3.** Patients with tears in both shoulders (13 patients)

Parameter	Number (%)
- Age (years)	58.6±15.6, 33-80.2
- Female:Male Gender	7:6
- Duration of symptoms (months)	25.9±26.1, 0.25-70
- Shoulders with acute symptoms	7/26 (27)
- Concordance in tear size	(75)

effusion (BPE) was seen significantly more often among the group 1 patients. In addition, significantly more patients in group 1 had tears with thick tendons.

Table 3 summarizes the demographic and clinical findings of the patients who had tears in both shoulders (13 patients).

## Discussion

One of the most important findings in our study was the existence of significantly more patients in group 1 (patients with symptoms of  $\leq 2$  months) with either SBEs or BPEs. However, an SBE alone was on the edge of significance. There have been few studies addressing the existence of SBEs among patients with RCTs, and only one of these studies has ad-

ressed the correlation between SBEs and the chronicity of symptoms among patients with RCTs (7). In this retrospective study, which included only patients with full-thickness tears (44 patients); an acute RCT was defined as when the clinical history revealed a distinct injury within 6 months of the time of the operation in a previously asymptomatic shoulder. It was found that SBEs were significantly more common among those patients with acute RCT tears than those with chronic tears (6). In another study, it was found that an SBE was more commonly associated with current or previous symptomatic tears compared to asymptomatic tears (8).

In some previous studies, BPEs were associated with a variety of shoulder abnormalities, including RCTs. However, the strength of these associations was dependent on the severity of the BPE. For instance, a full-thickness tear of the SST was significantly associated with the entire spectrum of BPEs, whereas subscapularis tendon tears were significantly associated with moderate and severe BPEs.

Another important finding in our study was the significant association between a thick torn tendon and the acuity of the symptoms. A thick tendon likely represents tendon edema as a result of the tear; however, additional inflammatory changes cannot be excluded. As expected, atrophic tears as a result of disuse and the resolution of edema were observed significantly more often in group 2. In the literature, we could not find any research addressing the issue of tendon thickness among the patients with RCTs.

The overwhelming majority of our patients had partial tears rather than full-thickness tears. However, most previous studies have reported a higher proportion of full-thickness tears (9). Both full-thickness tears and partial tears have been seen after acute injuries in the shoulder in about the same proportion of patients (10). In our study, there was no significant difference in the prevalence of the different types of tears between the two groups. Moderate partial tears were observed much more often, but not significantly more, in the group 1 patients (with acute symptoms) when compared to those in group 2.

No association was found in our study between tendon calcifications and the chronicity of the shoulder pain. In addition, we could not find any studies in the literature addressing this issue. However, it was found that tendon calcifications were significantly more often associated with symptoms among patients with

RCTs (11). It is interesting to note that only a few patients had both SBEs and tendon calcifications. It seems that tendon calcification is a late phenomenon, in contrast to an SBE, which develops early following a partial or complete tendon tear.

The patients with contralateral tears of both shoulders were not significantly different in terms of age ( $p=0.452$ ) or the duration of symptoms ( $p=0.312$ ) from the whole group of patients. This finding should not be surprising because the prevalence of simultaneous contralateral RCTs is relatively high, reaching ~40% in one study (12). In our study, we could not conclude anything about the prevalence of RCTs in both shoulders because our study was based on referred patients (from a general practitioner) with shoulder pain.

The concordance of the tear sizes between the two shoulders was relatively high in our patients (75%), but there are few studies in the literature addressing this topic. In one study, there was a significant difference regarding the tear size between the two shoulders, with concordance ranging between ~4% and ~36% (12).

The major drawback of our study was the assumption that the duration of the shoulder pain reflected the duration of the RCT. As mentioned, patients may have asymptomatic RCTs, and later on may develop symptoms or stay asymptomatic, especially among the elderly population (13). Therefore, the results of our study should be interpreted with caution. Future serial shoulder ultrasonography studies on a large cohort of patients could help shed some light on this issue.

**Ethics Committee Approval:** Ethics committee approval was received for this study from the Ethics Committee of the Nazareth Hospital, Nazareth.

**Informed Consent:** Written informed consent was obtained from all the patients who participated in this study.

**Peer-review:** Externally peer-reviewed.

**Author Contributions:** Concept - S.A., G.H.; Design - S.A., G.H.; Supervision - S.A., G.H.; Resources - S.A.; Materials - S.A.; Data Collection and/or Processing - S.A., G.H.; Analysis and/or Interpretation - S.A., G.H.; Literature Search - S.A., G.H.; Writing Manuscript - G.H.; Critical Review - S.A., G.H.

**Conflict of Interest:** No conflict of interest was declared by the authors.

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