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Incidence of Partial Thickness Articular Versus bursal side Rotator Cuff Tear

Prabhakar V[1], Srinivas Nagendra G.[2]

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Abstract

Background and Purpose: Partial thickness rotator cuff tears (PTRCTs) are a common pathology that may significantly impact a spectrum of patients including sedentary individuals, workers, and athletes. Despite their high prevalence, the majority of studies on the treatment of rotator cuff tears have focused on full thickness tears. PTRCTs have been relatively ignored and subsequently the treatment of PTRCTs remains controversial. The purpose of this review was to evaluate the current state of knowledge regarding PTRCTs including etiology, incidence of site of tear (articular, bursal and interstitial).

Patient and Methods: During the period June 2019 through June 2021, we prospectively studied all patients aged 18–75 years with acute onset of pain after shoulder trauma, with limited active abduction, and with normal conventional radiographs. 171 consecutive patients met these inclusion criteria. The patients had a median age of 51 (18–75) years 65% were males. The patients were divided into 3 groups according to the clinical findings: group I, suspected Rotator Cuff tear (RCT); group II, other specific diagnoses; and group III, sprain. Semi-acute MRI was performed in all patients in group I and in patients in group III who did not recover functionally. Based on MRI findings Incidence on site (articular, bursal, interstitial) of partial thickness rotator cuff tear was found.

Results: We identified 75 patients with PTRCTs. The estimated annual incidence of MRI-verified acute PTRCT was 16 (95% CI: 11–23) per 105 inhabitants for the population aged 18–75 years and 25 (CI: 18–36) per 105 inhabitants for the population aged 40–75 years. The prevalence of acute PTRCT in the study group was 75/171 (23%, CI: 18–28). The tears were usually large and affected more than 1 tendon in 36 of these 60 patients. The subscapularis was involved in 38 of the 60 patients

Interpretation: Acute partial thickness rotator cuff tears are common shoulder injuries especially in men ,throwing athletes. They often involve supraspinatus tendon and common site being the articular side.

Keywords: Partial thickness rotator cuff tears; Bursal; Supraspinatus; Subscapularis.

Author Affiliation: [1]Associate Professor, [2]Professor, Department of Orthopedics, Apollo Institute of Medical Sciences and Research, Chittoor 517127, Andra Pradesh, India.

Corresponding Author: Srinivas Nagendra G., Professor, Department of Orthopedics, Apollo Institute of Medical Sciences and Research, Chittoor 517127, Andra Pradesh, India.

E-mail: dr.prabhakr.venkat@gmail.com

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INTRODUCTION

The epidemiology of degenerative rotator cuff tears has been studied for decades[1], but little attention has been given to acute ruptures. To our knowledge, there has only been 1 prospective

epidemiological study on acute soft-tissue injury of the shoulder.[2] That study found a prevalence of 32% of full-thickness rotator cuff tears (FTRCTs) in patients who were unable to abduct their arm above 90 degrees following an acute trauma of the shoulder.

Most rotator cuff tears are considered to be degenerative in nature.[3] Differentiation between an acute traumatic tear in a previously healthy tendon, acute symptoms of a chronic tear, and traumatic extension of a chronic tear is difficult, even after advanced imaging techniques or surgery. Physical examination of the shoulder joint in the acute setting is difficult, and lacks accuracy.[4] Specific diagnostic tests have been developed for rotator cuff tears. However, none of these tests have been developed for acute tears.

We started the Acute Shoulder Assessment Protocol (ASAP) in 2016 for our study. This is a screening system where Orthopedic Surgeons in the out patient clinic of our hospital being the first line practitioners who diagnose traumatic soft tissue injuries of the shoulder in patients with normal conventional radiographs. We estimated the population based incidence of acute FTRCT using this new diagnostic screening model.

Patients and methods: It is a prospective study conducted in our hospital, Department of Orthopaedics, Apollo Institute of Medical Sciences and Research, Chittoor, Andrapradesh, India with source of data being the patients who present at the out patient clinic who had sustained shoulder injuries. The patients who are satisfying the inclusion criteria have been taken up for this study conducted between June 2019 to June 2021.

Inclusion criteria

1. Patients with acute trauma to shoulder with acute onset of shoulder pain
2. Limitation of range of movement at involved shoulder joint
3. Normal conventional radiographs after physical examination

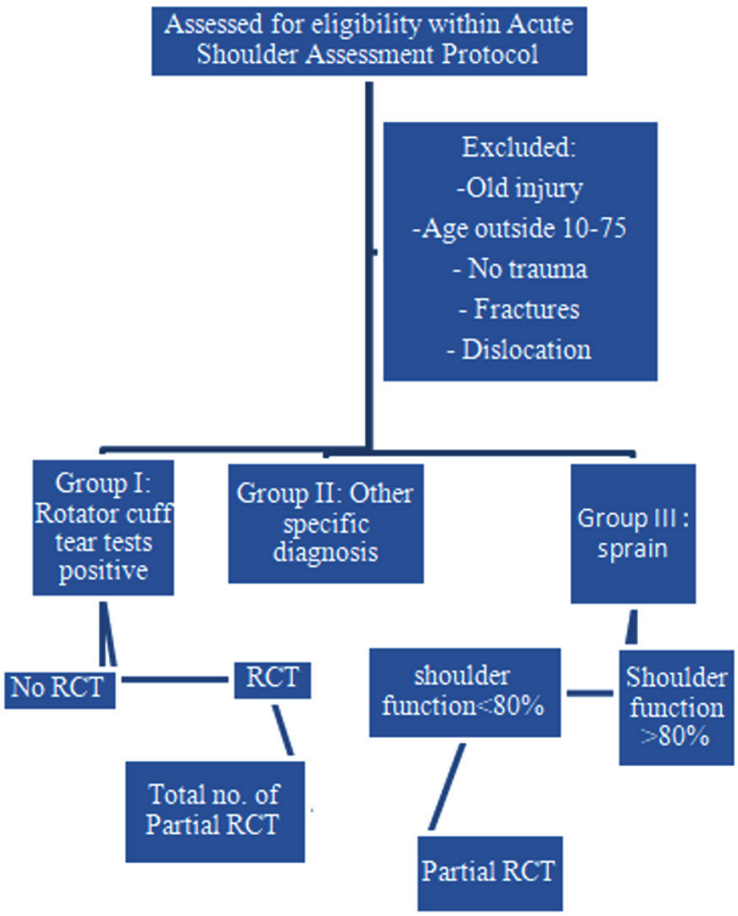

Fig. 1: The study protocol

From June 2019 through June 2021, 171 consecutive patients with trauma to the shoulder, with acute onset of shoulder pain and with limitations in active abduction, were enrolled from the Outpatient Unit of Department of Orthopaedics, Apollo Institute of Medical Sciences and Research, Chittoor, Andrapradesh, India after an initial physical examination and normal conventional radiographs. Only patients aged 18–75 years were included. Hill-Sachs impression fractures or bony Bankart lesions following acute dislocation of shoulder were excluded. Patients with severe comorbidity, previous shoulder surgery, glenohumeral osteoarthritis, or rheumatoid arthritis were also excluded. The patients underwent physical examination within 10 days of the initial clinical assessment. We defined acute rotator cuff tears as tears that occurred after direct or indirect trauma to the shoulder with sudden onset of symptoms in patients without ongoing shoulder disability. The study variables included age, sex, hand dominance, activity and mechanism of injury, previous shoulder discomfort, presence of ecchymosis, deformity or hypotrophy, and passive and active range of motion measured by use of a standard goniometer with the patient sitting. Several physical diagnostic rotator cuff tests were performed. The patients were divided into 3 groups according to their clinical presentation (Fig. 1). Group I comprised patients with positive rotator cuff tests and suspected RCT (RCT group). MRI was performed within 2 weeks in this group. Group II included 120 patients with other specific shoulder pathologies to explain their pain and disability, including AC joint sprain, calcifying tendinitis, adhesive capsulitis, brachial plexus traction, and shoulder instability. Group III included 51 patients with subtle reduction of active range of motion due to suspected partial tearing of the rotator cuff or a bursal bleeding. These patients were followed up with telephone interview 3 months after trauma. A clinical examination by a shoulder surgeon was undertaken if the patient rated his or her shoulder function to be less than 80% of their pre-injury level. MRI was performed if rotator cuff tear could not be ruled out at the physical examination. Patients who rated their function to be ≥ 80% were assumed not to have an FTRCT but were encouraged to return to be re-evaluated if there was not full recovery.

CLASSIFICATION OF ROTATOR CUFF TEAR

PTRCTs can be classified by location (articular, bursal, and intratendinous), the tendons involved (supraspinatus, infraspinatus, teres minor, and subscapularis), and the size of the tear (represented as percentage of the tendon thickness torn). The Ellman classification defines tears based on location (articular, bursal, and intratendinous) and the percentage of the tendon thickness torn (Table 1).[5]

Table 1: Classification of partial thickness rotator cuff tears (PTRCTs): articular, bursal, and intratendinous locations.

Grade	Size of Tear (Percentage of Tendon Thickness)
I	<3mm (<25%)
II	3-6mm (25-50%)
III	>6mm (>50%)

While widely accepted, this classification system does not take into account a number of factors including: an analysis of tissue quality, the area of tearing (i.e., not just thickness but anterior to posterior and medial to lateral), or the etiology of the tear itself. Furthermore, there is relatively poor interobserver reliability[6] of this classification system when using imaging modalities (e.g., MRI) or even dedicated arthroscopic videos.[7] Despite this, the Ellman classification system continues to be the most popular classification system quoted, likely due to its history of utilization and that no alternative classification system has gained universal acceptance.

DIAGNOSIS

Clinical examination

A thorough examination begins with an assessment of the cervical spine for range of motion, palpable tenderness or muscle spasm, and for provocative tests, such as the Sperlingmaneuver, to rule out a compressive neuropathy that may lead to radicular symptoms referred to the shoulder region. The shoulder girdle should be inspected for signs of muscle atrophy or scapulothoracic asymmetry with active shoulder motion. Range of shoulder motion (both active and passive) and grading of muscle strength in the planes of elevation, extension, abduction, adduction, internal rotation, and external rotation with contralateral comparisons are also performed. The results of impingement tests, such as the Neer and Hawkins tests, with or without subacromial local anaesthetic injection, are often positive in the presence of partial thickness rotator cuff tears, although occasionally these test results are negative, especially in the high level, well conditioned athlete. Loss of supraspinatus muscle strength with complete or near complete

resolution of pain after a subacromial injection suggests the presence of a full-thickness rotator cuff tear, whereas maintenance of strength in the absence of pain on supraspinatus testing suggests either rotator cuff inflammation or an articular surface or intratendinous partial thickness tear. Tests to evaluate unidirectional or multidirectional shoulder instability, such as the Jobe test, the sulcus sign, the relocation test, and the degree of anterior and posterior humeral translations are mandatory in the young throwing athlete who may possess both rotator cuff injury and shoulder instability because of internal impingement described earlier. The O'Brien test may help distinguish lesions of the long head of the biceps tendon from conditions involving the acromioclavicular joint, which often coexist with conditions involving the rotator cuff. A thorough neurovascular assessment of the upper extremity with an emphasis on distal muscle strength, sensation, and pulses completes the examination.

DIAGNOSTIC IMAGING

Although plain radiographs are rarely helpful in making the diagnosis of a partial thickness rotator cuff tear, they are an important component of evaluating the patient with shoulder pain. The identification of a greater tuberosity notch[8] though nonspecific, has been described as an indicator ofpartial-thickness articular surface tears in throwing athletes. The presence of a subchondral cyst in the greater tuberosity may also be seen in the presence of rotator cuff pathologic abnormalities. Conventional and positional radiographic arthrography[9,10] and subacromial bursography[11,12] historically have been used as the primary imaging modalities in the evaluation of the rotator cuff. However, the accuracy of arthrography and bursography has been a topic of debate in the literature. Although proponents touted accuracy rates of up to 83%[10] and 67%,[11] respectively, other studies have shown less favourable results, with reported accuracy rates as low as 15%[9] and 25%[10] respectively. As a result of these disparate data, arthrography and bursography have been replaced largely by ultrasonography and MRI.

The diagnosis of partial thickness rotator cuff tears is based on the presence of increased signal in the rotator cuff without discontinuity on T1-weighted images. This finding corresponds to increased signal noted on T2-weighted sequences with the identification of a focal defect on either the bursal or articular surfaces or within the tendon substance.[13,14] (Fig. 4).

All MRI scans were read by a senior radiologist with more than 10 years' experience of MRI shoulder examinations. A PTRCT was defined as a tendon without discontinuity or increased signal on T2-weighted sequences with the identification of a focal defect on either the bursal or articular surfaces or within the tendon substance.[13-15]

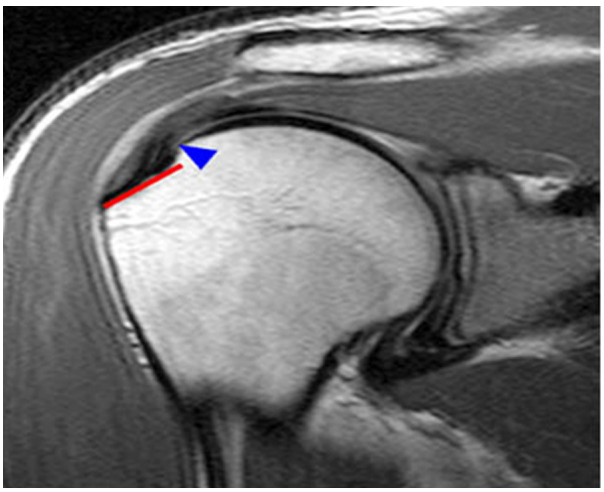

Fig. 2: Normal Supraspinatus tendon insertion

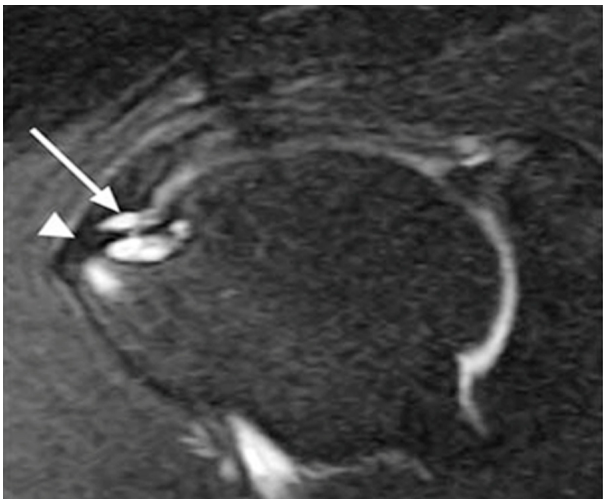

Fig. 3: Articular side PTRCT

Table 2: Diagnoses in group I who were suspected with acute rotator cuff tear (n = 110)

MRI diagnosis	N	Median Age (Range) in Years
Shoulder dislocation	5	33.4
PTRCT	75	37.2
Fracture of Proximal humerus	5	34.6
Calcific Tendinitis	10	52
FTRCT	15	55
Total	110	-

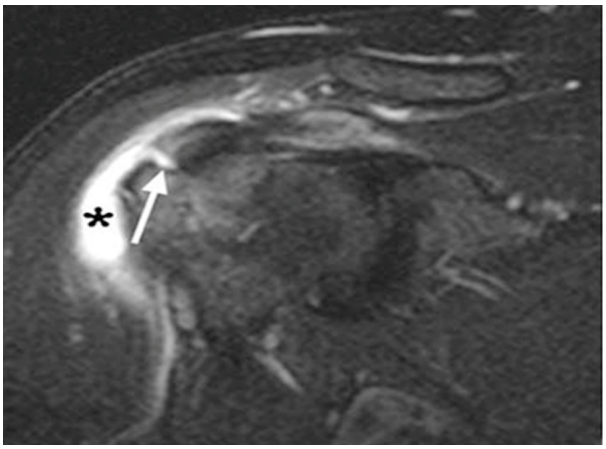

Fig. 4: Bursal side PTRCT

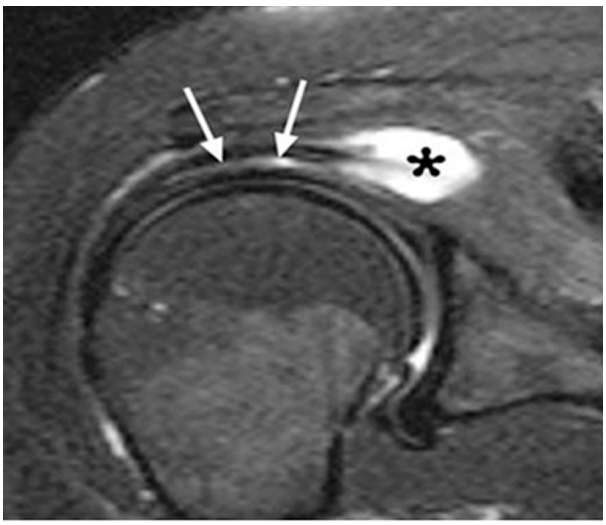

Fig. 5: Intratendinous PTRCT

Statistics

Data are presented as median (range) for continuous or ordinal data and as number (%) for categorical data. The annual incidence of FTRCT was calculated using the total number of FTRCTs divided by 2 (the 2 years duration of the study). The 95% confidence interval (CI) of percentages was calculated using the Diagnostic Test Evaluation Calculator of the free-access Interactive Statistical Pages website. CI of the annual incidence was calculated using a web-based CI calculator.

Table 3: Diagnosis in group II (other specific diagnoses) ***(n=45)***

Diagnosis	n	Median Age in Years (Range)
Acromioclavicular joint sprain	6	34.2
Calcific Tendinitis	10	52
Neck distortion	3	29
Initially missed fracture	1	33
Frozen shoulder	25	54.4
Total	45	-

RESULTS

The Orthopedician examined 473 patients (60% men) at a median time of 14 (10–40) days after trauma. 302 patients were excluded because they did not meet the inclusion criteria or declined to participate (Fig. 1). 173 participants made up the study group (65% men); median age was 51 (18–75) years. 110 participants with suspected RCT were diagnosed by MRI (n = 87) or ultrasound (n = 3, used because of claustrophobia). Patients with MRI verified FTRCT were recommended to have arthroscopic rotator cuff repair. The remaining 20 patients in group I had other lesions (Table 1). Group II (other specific diagnoses) comprised 45 patients (Table 2). Group III (sprain) comprised 16 patients. 8 of them rated their shoulder function to be greater than 80%, and they were assumed not to have RCT. 4 patients could not be reached by telephone, were contacted by mail, and were encouraged to return for an update clinical examination if they still felt shoulder discomfort. None of them returned during the first 16 months after enrollment in the study, and they were considered not to have RCT. 4 patients rated their shoulder function to be less than 80% and were examined by a shoulder surgeon. MRI was performed in all but 4 patients; 1 patients were diagnosed with FTRCT.

With respect to the aim of our study in evaluating the location of partial thickness rotator cuff tear it is found out that 75 patients had partial thickness rotator cuff tear of which 40 were articular 22 were bursal side at remaining 13 were intra tendinous.

The injury mechanism included fall from the same level (63%) followed by fall from a height (20%) and no fall (17%). 21% were sports related injuries, which were mainly caused by skiing. Of the 259 participants, 54% suffered from direct trauma to the shoulder, 30% from indirect trauma, 5% from combined trauma, and 11% were unknown. The same pattern was also seen in the FTRCT patients. 30 patients had direct trauma, 19 had indirect trauma, and 3 had combined trauma. The dominant side was affected in 40 of the 60 FTRCTs.

DISCUSSION

We found that incidence of partial thickness rotator cuff tear was 75 out of 171 shoulder injury patients examined and confirmed with MRI of affected shoulder in our hospital. A number of studies have been carried out since 1995[16-18] in order to compare US and MRI in detecting partial tears of the rotator cuff, with correlation to surgical findings. The results

of these studies are controversial and, although a consistent improvement in detection rates would have been expected, a number of authors remain reluctant toward US imaging. Data reported by **Farin *et al.***[17] and **Van Holbeeck *et al.***[19] yielded sensitivity and specificity values of up to 93% for US; however, a more recent article from **Martin Hervas *et al.***[16] found unacceptably low sensitivities of up to 13% for detection of partial tears with US, suggesting that the method was inadequate for reliable routine clinical practice. Our data found comparable accuracy for US and MRI in the detection of partial tears, with MRI having slightly superior rates regarding sensitivity. MR arthrography has been considered superior in detecting rotator cuff pathology, especially partial tears.[20,21] However, routine clinical practice has shown that performing MR arthrography on all patients with suspected rotator cuff pathology may result in a cumbersome procedure due to scheduling constraints and patient reluctance to undergo an invasive MR scan. Therefore, in the present study, we compared only MRI and US studies of the shoulder in patients with symptomatic impingement syndrome.

Partial-thickness articular surface rotator cuff tears (PTASRCTs) are at least twice as common as bursal-sided tears[22,23] and usually involve the supraspinatus tendon.[23,24] They have been described in the literature as an injury of the young athlete with a traumatic mechanism[25,26] and are thought to be due to internal impingement of the under surface of the supraspinatus against the glenoid within the athletic population.[27,28]

For the population as a whole, there is a debate about the etiology of partial thickness rotator cuff tears. The extrinsic theory relies on an abnormal acromion causing external abrasion and damage to the bursal side of the cuff.[29,30] The intrinsic theory hypothesises that degeneration occurs within the tendon. Histological tendon degeneration has been demonstrated more commonly on the articular side in cadaveric specimens[31] and this side of the rotator cuff is known to have a half the ultimate stress to failure compared to the bursal side.[32] Furthermore, histological changes to the under surface of the acromion have been associated with bursal sided tears but not seen in association with articular sided tears.[33] Clinical studies, however, have also shown that external impingement due to coracoacromial arch narrowing can lead to partial tears on the articular and bursal side of the rotator cuff.[34] Symptomatic partial tears have been demonstrated to progress to full-thickness tears both with non-operative treatment[35] and with surgical interventions.[36,37] Therefore, an understanding of their pathology is crucial. The aim of this study was to document the frequency and incidence of PTRCTs location (articular side, bursalside, tendinous) in patients with rotator cuff pathology, analyze the association with other abnormalities within the joint, and document the association with injury.

CONCLUSION

Thisstudydemonstrated that PTRCTs are common at articular side than bursal side in patients with shoulder injuries with trauma being the most common etiology for articular sided tears and and the average age group for articular side tear were 35yrs and the tears due to tendon degeneration were next in frequency and seen more in patients aged more than 35 yrs.

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