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ORIGINAL ARTICLE

The prevalence of rotator cuff pathology in the setting of acute proximal biceps tendon rupture

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Background: The prevalence and severity of concomitant rotator cuff pathology in the setting of proximal biceps tendon ruptures are poorly understood. Concomitant rotator cuff disease may have important implications in the prognosis and natural history of this shoulder condition. Therefore, an observational cohort of patients with an acute rupture of the long head of the biceps tendon (LHBT) was evaluated to determine the prevalence and severity of concomitant rotator cuff disease.

Methods: Thirty consecutive patients diagnosed with acute proximal biceps tendon rupture were prospectively enrolled. Magnetic resonance imaging of the affected shoulder was obtained in 27 patients and reviewed by a fellowship-trained orthopedic surgeon.

Results: The cohort consisted of 20 men (74%) and 7 women (26%) (mean age, 61.0 years [range, 42-78 years]). The dominant side was involved in 20 injuries (74%), and a low-energy trauma mechanism of injury was involved in 23 (85%). Of the patients, 11 (41%) reported a history of antecedent shoulder pain. Magnetic resonance imaging assessment revealed that 93% of patients had evidence of rotator cuff disease, including 13 full-thickness tears. Of the full-thickness tears, 3 were small, 6 medium, 2 large, and 2 massive. Pathology of the subscapularis tendon was identified in 7 patients (26%).

Conclusion: In this cohort, we found LHBT rupture to be highly correlated with the presence of rotator cuff disease, with the majority of patients presenting with full-thickness tears of the supraspinatus. These findings may have important implications in the treatment and prognosis of patients who present with acute LHBT ruptures.

Level of evidence: Level III; Cross-Sectional Design; Epidemiology Study

Keywords: Rotator cuff pathology; acute proximal biceps tendon; shoulder; shoulder injuries; magnetic resonance imaging; observational study

Lesions of the long head of the biceps tendon (LHBT) can be a common cause of the painful shoulder. It is well established that secondary tenosynovitis can develop in association with impingement syndrome or rotator cuff disease.[1,2,7,12,16-20] Pathology can develop from overuse activity causing primary tendinopathy, as well as from the inherent bony anatomy of

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the intertubercular sulcus, leading to instability.[13,18] LHBT lesions also can be found in the setting of both isolated subscapularis and complete rotator cuff tears.[5,9,10] Traumatic rupture of the LHBT is a shoulder injury that can often be treated conservatively. Isolated ruptures have a reported incidence ranging from 5% to 25% but are more commonly found in association with other shoulder conditions such as superior labral anterior-posterior lesions.[4]

It is unknown whether concomitant rotator cuff pathology exists in the setting of an acute LHBT rupture in the absence of high-energy trauma. The purpose of this study was to determine the condition of the rotator cuff in patients who present with an acute proximal biceps tendon rupture. Our hypothesis was that the majority of patients who present with an acute rupture of the LHBT would have concomitant rotator cuff disease.

Methods

We prospectively collected data on 30 consecutive patients between September 2015 and February 2017. Patients of any age diagnosed with an acute proximal biceps tendon rupture who presented to the clinic within 8 weeks of injury were included. All patients underwent a routine physical examination and shoulder radiography as part of their initial assessment. Further evaluation included a magnetic resonance imaging (MRI) study of the affected shoulder, which was subsequently reviewed by either a sports or shoulder and elbow fellowship–trained orthopedic surgeon. Patients unable to undergo MRI because of contraindications and patients with a history of shoulder surgery were excluded. An independent research assistant recorded demographic data and patient-reported outcome scores.

The primary outcome variable was defined as the presence or absence of a rotator cuff tear. Partial- versus full-thickness tearing was recorded. The size of the tear was measured based on sagittal MRI and classified as small (<1 cm), medium (1-3 cm), large (3-5 cm), or massive (>5 cm) as defined by Cofield.[6] MRI findings of muscle edema and tendon kinking, described by Loew et al[14] as characteristic of traumatic injury, were recorded. Fatty atrophy was measured on sagittal T1-weighted sequences according to Fuchs et al[8] and correlated with the original staging system of Goutallier et al[11] and was defined as follows: grade 0, normal muscle; grade 1, muscle with some fatty streaks; grade 2, less fat than muscle; grade 3, same amount of fat as muscle; and grade 4, more fat than muscle. Tendon retraction was measured on coronal MRI and classified based on the location of the proximal tendon stump in reference to the bony insertion (stage I), the level of the humeral head (stage II), and the level of the glenoid (stage III) as described by Patte.[21] The presence or absence of subscapularis tendon pathology was also documented. Secondary outcome variables included shoulder range of motion and the visual analog scale (VAS) pain score, Simple Shoulder Test (SST) score, and American Shoulder and Elbow Surgeons (ASES) shoulder score.

All data underwent descriptive statistical analysis using the SAS Enterprise Guide (version 6.1; SAS Institute, Cary, NC, USA). Two groups were defined based on the presence of partial- versus full-thickness rotator cuff tearing for comparative analysis. A Wilcoxon 2-sample test was used for continuous variables. For categorical variables, a χ^2 or Fisher exact test was used.

Results

The demographic data are summarized in Table I. MRI evaluation was available for 27 of 30 patients in the cohort (Table II). There were 20 male and 7 female patients with an average age of 61 years (range, 42-78 years). The average body mass index was 29.2. A history of antecedent shoulder pain was reported by 11 patients (41%). Of the patients, 23 (85%) sustained a low-energy traumatic injury to the affected shoulder, with 20 injuries (74%) involving the dominant side.

Rotator cuff disease was present in 25 patients (93%). Of these patients, 13 (52%) sustained full-thickness tears and 12 (48%) presented with partial-thickness tears of the supraspinatus. The majority of full-thickness tears were medium in size (Fig. 1, *A*), whereas 3 (23%) were small, 2 (15%) were large, and 2 (15%) were massive.

The majority of full-thickness tears (54%) retracted to the level of the articular surface of the humeral head (stage II). Of the patients with full-thickness tears, 10 (77%) had some

Table I Patient demographic data

	Data
No. of shoulders	27
Male	20 (74%)
Female	7 (26%)
Mean patient age, yr	61.0
Mean BMI	29.2
Antecedent shoulder pain	11 (41%)
Traumatic injury	23 (85%)
Low energy	23 of 23 (100%)
Dominant shoulder	20 (74%)

BMI, body mass index.

Table II MRI characteristics of full-thickness rotator cuff tears (n = 13)

	Data
Traumatic (Loew et al[14])	
Muscle edema, tendon kinking	4 (31%)
Size (Cofield[6])	
Small, <1 cm	3 (23%)
Medium, 1-3 cm	6 (46%)
Large, 3-5 cm	2 (15%)
Massive, >5 cm	2 (15%)
Retraction (Patte[21])	
Stage I, bony insertion	4 (31%)
Stage II, humeral head	7 (54%)
Stage III, glenoid	2 (15%)
Atrophy (Fuchs et al[8])	
Stage 0, normal	3 (23%)
Stage 1, fatty streaks	5 (38%)
Stage 2, muscle greater than fat	2 (15%)
Stage 3, muscle equal to fat	3 (23%)
Stage 4, fat greater than muscle	0

MRI, magnetic resonance imaging.