Proximal Long Head Biceps Rupture: A Predictor of Rotator Cuff Pathology

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Purpose: To investigate whether acute rupture of the proximal long head biceps is a harbinger of disease of the nearby supraspinatus and subscapularis tendons. **Methods:** A retrospective chart review from February 1, 2008, to August 31, 2016, was performed at our institution identifying patients who presented with an acute (<12-week) history of "Popeye" deformity of the distal biceps and a magnetic resonance imaging (MRI) of the affected shoulder. MRI images were then reviewed in duplicate to determine supraspinatus and subscapularis tendon tear incidence, size, chronicity, and depth. The association between rotator cuff status and acute long head biceps rupture as well as patient age, sex, smoking status, hand dominance, and history of diabetes mellitus or trauma was then evaluated. **Results:** A total of 116 patients were included in this study (mean age: 61.9 ± 10.9 years). A significant proportion (n = 99; incidence: 85%) were found to have some degree of supraspinatus or subscapularis tendon tearing on MRI ($P < .001$). These patients were also found to be significantly older compared with those with an intact rotator cuff (mean age 63.3 ± 10.7 vs 54.2 ± 9.2; $P = .001$). Full thickness rotator cuff tears were significantly more likely to involve the supraspinatus as opposed to the subscapularis (incidence: 44% and 21%; $P = .002$). **Conclusions:** Despite the expected association of rotator cuff disease with increasing patient age, the results of this study also affirm the hypothesis that inflammation in the rotator cuff interval signaled by rupture of the long head of biceps is a harbinger of rotator cuff disease. Clinicians should have a high index of suspicion regarding concomitant anterosuperior rotator cuff pathology in patients presenting with acute long head of biceps rupture. Early evaluation with advanced imaging should be strongly considered. **Level of Evidence:** Level IV, case series.

Pathology of the long head of biceps (LHB) and tears of the rotator cuff tendons have long been identified as frequent and closely related sources of anterior shoulder pain.[1,2] The LHB is encased by synovium, and as a result of gliding within the highly constrained intertubercular groove during humeral head abduction and rotation, it is prone to tenosynovitis.[3,4] Unchecked progressive tenosynovitis may lead to a degenerative cascade of tendinosis, delamination, prerupture, and eventual rupture.[3,5] Rupture of the LHB manifests clinically with a "Popeye" deformity of the distal biceps, a frequent presenting complaint among patients.

In the setting of LHB tendinosis, secondary inflammatory changes to interval structures lead to incompetence of the stabilizing biceps pulley formed by the superior glenohumeral and coracohumeral ligaments. The ensuing LHB instability is believed to cause damage to the neighboring supraspinatus (SS) and subscapularis (SSC) tendons. In a cohort of 120 patients who underwent LHB extra-articular tenosynovectomy after subacromial decompression for impingement, Murthi et al.[6] noted that 47% of patients had partial thickness tearing, whereas 23% had full thickness tears of their rotator cuff. Similarly, Habermeyer et al.[7] found that among patients being treated for anterosuperior impingement who also had an arthroscopically proven biceps pulley lesion, the SS or SSC was torn in 70.8% of patients. Most recently, Lafosse et al.[8] noted LHB tendon instability in 45% of patients who underwent arthroscopic rotator cuff repair.

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Table 1. Incidence of Rotator Cuff Tears According to Patient Age

Age	Number of Patients	Incidence of Supraspinatus or Subscapularis Tears		Incidence of Supraspinatus Tears		Incidence of Subscapularis Tears	
		Partial Thickness	Full Thickness	Partial Thickness	Full Thickness	Partial Thickness	Full Thickness
<50	n = 18	33% (n = 6)	22% (n = 4)	22% (n = 4)	17% (n = 3)	28% (n = 5)	11% (n = 2)
≥50 to <60	n = 31	45% (n = 14)	39% (n = 12)	32% (n = 10)	32% (n = 10)	36% (n = 11)	13% (n = 4)
≥60 to <70	n = 40	33% (n = 13)	53% (n = 21)	35% (n = 14)	45% (n = 18)	38% (n = 15)	23% (n = 9)
≥70	n = 27	22% (n = 6)	78% (n = 21)	30% (n = 8)	70% (n = 19)	56% (n = 15)	33% (n = 9)

Although these studies highlight the association of LHB with rotator cuff pathology, none provide information regarding the inverse relation—the status of the rotator cuff in the setting of end-stage LHB tendinosis signaled by LHB tendon rupture. The purpose of this study was to investigate whether acute rupture of the proximal long head biceps is a harbinger of disease of the nearby SS and SSC tendons. It was hypothesized that rupture of the LHB would be strongly associated with tearing of SS and SSC tendons.

Methods

After institutional review board approval, a retrospective chart review from February 1, 2008, to August 31, 2016, was performed at our institution identifying patients who presented with an acute (<12-week) history of "Popeye" deformity of the distal biceps. The institutional electronic medical record (EMR) was reviewed using search terms that were systematic combinations of popeye, deformity, long, proximal, stump, biceps, tendon, tear, rupture, lump, and bump. Search terms were chosen based on phrases commonly used in the EMR to describe LHB tendon ruptures by both patients and surgeons. Patients with distal biceps tendon ruptures and those with previous surgery on the same shoulder were excluded. All patients required a magnetic resonance imaging (MRI) of the affected shoulder within 3 months of rupture to be included in the study. Patient age, sex, smoking status, body mass index (BMI), history of diabetes mellitus, hand dominance, and injury date were recorded.

Patient MRI images (3-mm slice thickness, 1.5-T, GE Signa, GE Healthcare, Chicago, IL) were independently reviewed in duplicate by 2 board-certified orthopaedic surgeons and evaluated for tears of the SS and SSC to determine the location, chronicity, and incidence of rotator cuff disease. Tears were classified as being full or partial thickness in nature. Measurement of full thickness tears was performed using a digital image system (iSite, Philips Medical Systems, Best, the Netherlands—software accuracy = 0.1 mm and 0.1°). Full thickness tears were graded small, moderate, large, or massive as described by Cofield.[9] Partial thickness tears were classified as either articular or bursal sided. All full thickness tears were also classified as acute, chronic, or acute on chronic. For a tear to be deemed acute, residual footprint tissue needed to be present on the tuberosity with a wavy-like appearance of the affected tendon. Edema also had to be present on T2-weighted image sequences in the muscle belly of the affected tendon. These features were agreed upon to define acute tears after consultation with a committee of local fellowship-trained musculoskeletal radiologists. Tears lacking any of the above features were deemed chronic, whereas if some but not all of the above criteria were met, then tears were classified as acute on chronic. Combined tears of the SSC and SS in a single individual were treated as individual tears of each tendon in the data analysis. A subgroup analysis was also performed to stratify the incidence of rotator cuff disease by age.

An independent *t*-test was used to assess whether patient age and BMI were associated with rotator cuff pathology. A nonparametric χ-squared test was used to evaluate the association between rotator cuff status and acute LHB rupture as well as patient sex, smoking status, hand dominance, and history of diabetes mellitus or trauma.

To assess agreement between reviewers, Cohen's kappa coefficient with 95% confidence intervals was calculated. The guideline suggested by Landis and Koch[10] was applied for measures of agreement. An intraclass correlation coefficients of 0 to 0.2 represented slight agreement, 0.21 to 0.40 fair agreement, 0.41 to 0.60 moderate agreement, 0.61 to 0.80 substantial agreement, and any value above 0.80 almost perfect agreement. All statistical calculations were performed using SPSS 22.0 (International Business Machines, Armonk, NY, 2013), and statistical significance was set at $P \leq .5$.

Table 2. Full Thickness Rotator Cuff Tear Characteristics

Location and Overall Incidence	Tear Chronicity			Tear Size			
	Acute	Acute on Chronic	Chronic	Small	Moderate	Large	Massive
Supraspinatus 44.0% (n = 51)	14% (n = 7)	35% (n = 18)	51% (n = 26)	12% (n = 6)	37% (n = 19)	14.% (n = 7)	37% (n = 19)
Subscapularis 20.7% (n = 24)	8% (n = 2)	29% (n = 7)	63% (n = 15)	38% (n = 9)	13% (n = 3)	17.% (n = 4)	33% (n = 8)