Biceps tenodesis for long head of the biceps after auto-rupture or failed surgical tenotomy: results in an active population

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Background: Long head of the biceps (LHB) deformity after surgical tenotomy or auto-rupture may result from attrition or injury. The purpose of this study was to describe the surgical outcomes of biceps tenodesis after failed surgical tenotomy or auto-rupture of the LHB tendon in a population of active patients.

Methods: During a 5-year period, 11 patients with a mean age of 43.3 years (range, 33-56 years) presented with symptoms of biceps cramping with activity (100%), deformity (100%), or pain (36%) at a mean of 8 months (range, 0.5-22 months) from a tenotomy (6 of 11) or an auto-rupture (5 of 11). All patients underwent a mini-open subpectoral biceps tenodesis with interference screw fixation. Patients were independently evaluated by patient-reported outcome measures (Single Assessment Numeric Evaluation [SANE] and Western Ontario Rotator Cuff Index [WORC]) and a biceps position examination.

Results: Of the 11 patients, 10 (91%) completed the study requirements at a mean of 2.6 years (range, 1.6-4.2 years). A total of 9 of the 10 patients (90%) returned to full activity. The mean preoperative SANE score was 61.1 (standard deviation [SD], 8.8), and the mean preoperative WORC score was 53.2 (SD, 9.2), which improved postoperatively to a SANE score of 84.2 (SD, 7.1) and a WORC score of 86 (SD, 8.2). There were no differences in LHB muscle position relative to the antecubital fossa (3.17 cm preoperatively to 3.25 cm postoperatively; \( P = .35 \)). Deformity was resolved in all patients; 9 of 10 patients reported full resolution of cramping, and pain was resolved in 8 of 10.

Conclusions: LHB tenodesis after auto-rupture or surgical tenotomy improved symptoms and allowed predictable return to activity and patient satisfaction. Additional work is necessary to determine the optimal treatment of primary biceps lesions.

Level of evidence: Level IV, Case Series, Treatment Study.

Keywords: SLAP; biceps tenotomy; long head of biceps; tenodesis; tenotomy; superior labrum; Popeye deformity
Long head of the biceps (LHB) deformity, cramping, and generalized pain are complications that may result from surgical LHB tenotomy or attrition (auto-rupture).\textsuperscript{7,12} Recent clinical series reported a 45% prevalence of cosmetic deformity (Popeye deformity; Fig. 1) and 8% cramping arm pain after arthroscopic surgical tenotomy of the LHB tendon.\textsuperscript{7} Currently, there is insufficient evidence providing treatment recommendations for management of these symptoms.\textsuperscript{3,6,13,15} A subpectoral biceps tenodesis is a surgical alternative to tenotomy that minimizes these complications but at the perceived expense of additional surgical morbidity. However, this additional morbidity associated with tenodesis has recently been quantified as minimal.\textsuperscript{11}

The surgical conversion of a biceps tenotomy to a tenodesis has been described\textsuperscript{1,5}; however, the expected results and outcomes are not well understood. The purpose of this study was to describe the surgical outcomes of a subpectoral biceps tenodesis after failed surgical tenotomy or auto-rupture of the tendon in a population of active patients. The null hypothesis is that there will be no change in patient-reported outcomes, biceps contour, and persistence of symptoms.

Methods

Study design

After Institutional Review Board approval was obtained, between 2006 and 2011, patients were enrolled in a longitudinal prospective cohort study at a tertiary care center under the care of 2 sports/shoulder fellowship–trained surgeons. Inclusion criteria were patients 18 to 50 years old with both a history and physical examination findings of LHB tendon rupture presenting after failure of nonoperative care (range, 0.5-22 months). All had cramping with upper extremity biceps activities and deformity of the LHB. Exclusion criteria were defined as the presence of any other concomitant pathologic process, including full-thickness rotator cuff tear, symptomatic acromioclavicular joint arthritis, labral tear, and previous biceps tenodesis at any site within the groove. In addition, patients were also excluded if they underwent any additional repairs at the time of surgery, including rotator cuff, labrum repair outside of the superior labral anterior-posterior region, and distal clavicle procedures.

Outcomes

Patients were evaluated preoperatively and postoperatively with a comprehensive history evaluating cosmetic concerns, pain level, extent of cramping, and the Single Assessment Numeric Evaluation (SANE)\textsuperscript{2} and Western Ontario Rotator Cuff Index (WORC)\textsuperscript{8} outcome scores. An independent physical examination was performed by unblinded independent examiners. A biceps position examination measures the distance of the biceps apex relative to the center skinfold of the antecubital fossa with the biceps firing and the arm abducted and externally rotated (90/90 position), compared with the unaffected contralateral arm.\textsuperscript{3} Examiners were

Figure 1  Popeye deformity (arrow) in a patient who had a long head of biceps (LHB) tenotomy after pectoralis major repair (arrowhead) that manifested with pain, cramping, and weakness. He underwent a mini-open subpectoral tenodesis that resolved his symptoms.
All patients underwent the identical printed rehabilitation protocol with supervised physical therapy. Patients remained in a sling for a total of 3 weeks with scapular mobility and gentle passive but full range of motion. Scapular exercises were started by 1 week, and rotator cuff and biceps strengthening was instituted between 4 and 6 weeks postoperatively. No active biceps exercise of more than 10 pounds of lifting was allowed until 6 weeks postoperatively. At 3 months, patients were allowed to return to light sports (nonthrowing or nonlifting) and began a work-specific strengthening regimen, with resumption of full activities between 3 and 6 months.

Statistical analysis

Reporting of data used descriptive statistics reported as mean ± standard deviation. A 2 × 2 contingency table with a 2-tailed Fisher exact probability test assessed statistical significance between patients’ subjective complaints. Paired Student t test was performed between surgical outcome and biceps position assessments. Statistical analysis was completed with SPSS software for Windows (version 8.0; SPSS, Chicago, IL, USA). An α value of .05 was set as significant.

Results

A total of 10 of 11 patients (91%) completed the study requirements at a mean of 2.6 years (range, 1.6-4.2 years). The 1 patient excluded from the study was lost to follow-up at 3 months. All patients were male, with a mean age of 43.3 years (range, 33.9-56.3 years). Etiology was an auto-rupture for 55% (6 of 11) and failed surgical tenotomy for 45% (5 of 11). Preoperatively, patients presented with symptoms of biceps cramping with activity (100%), cosmetic deformity (100%), or pain (4 of 11; 36%) at a mean of 8 months (range, 0.5-22 months).

After biceps tenodesis, the cosmetic deformity was resolved in all patients (10 of 10; 100%) (P < .0001), and only 1 of 10 patients (10%) complained of persistent cramping with activity (P < .0001). Pain was resolved in 8 of 10 (80%) (P = .63); 9 of 10 patients (90%) returned to full activity. The mean preoperative SANE score was 61.1 (standard deviation [SD], 8.8), and the mean preoperative WORC score was 53.2 (SD, 9.2), which improved postoperatively to a SANE score of 84.2 (SD, 7.1) and a WORC score of 86 (SD, 8.2) (P < .001) (Table I). There were no differences bilaterally in LHB muscle position relative to the antecubital fossa (3.17 preoperative vs 3.25 postoperative; P = .35). There were no complications, including no musculocutaneous nerve issues or wound problems. At final follow-up, there was no cosmetic deformity in any patient.

Discussion

The principal findings of this study demonstrate that subpectoral biceps tenodesis after failed surgical tenotomy or auto-rupture of the LHB tendon in a population of active patients provides predictable resolution of biceps deformity and improvement in cramping and fatigue symptoms. There is currently a paucity of literature to guide treatment decisions of failed surgical tenotomy or auto-rupture. In our cohort, after biceps tenodesis, nearly all patients were able to return to their desired activity levels and achieved primarily good to excellent surgical outcomes on the basis of SANE and WORC scores.

Whereas excellent outcomes have been reported for both primary tenodesis and tenotomy for primary LHB disease, one treatment has not been clearly identified as superior, given the heterogeneity in techniques combined with lack of power and randomization in the current literature. Moreover, there is a paucity of current literature regarding surgical management of bicipital symptoms or cosmetic deformity after LHB tenotomy or auto-rupture.

Conversion of a biceps tenotomy to tenodesis has been described but there is little in the literature revealing the outcomes of this procedure. In a comparable study, Gregory et al reported results of 21 patients who underwent revision open subpectoral biceps tenodesis that included patients who had failed tenotomy (1 of 21) or ruptured biceps after tenodesis (7 of 21). Patients had significant improvement in pain relief and functional outcomes at a mean follow-up of 33.4 months, although the majority of patients (17 of 21) also underwent concomitant procedures.

Table I  Patient-reported outcomes with SANE and WORC

<table>
<thead>
<tr>
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<th>Pre-revision mean</th>
<th>Post-revision mean</th>
<th>P value</th>
<th>Mean improvement</th>
</tr>
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<tbody>
<tr>
<td>SANE</td>
<td>61.1 (8.8)</td>
<td>84.2 (7.1)</td>
<td>.001</td>
<td>37.8%</td>
</tr>
<tr>
<td>WORC</td>
<td>53.2 (9.2)</td>
<td>86.0 (8.2)</td>
<td>.001</td>
<td>61.7%</td>
</tr>
</tbody>
</table>

PRO, patient-reported outcome; SANE, Single Assessment Numeric Evaluation; WORC, Western Ontario Rotator Cuff Index. Data are presented as a mean percentage of normal with standard deviation in parentheses.
for management of other glenohumeral disease at the time of surgery. All but 1 patient was satisfied postoperatively. Tangari et al recently reported on a series of 5 professional wrestlers with acute rupture of the LHB tendon treated with a mini-open tenodesis with suture anchor.14 At an average follow-up of 7.6 years, patients achieved excellent results on the basis of the Constant score and Mayo Elbow Performance Score, with no significant difference in forearm flexion strength noted. Finally, Ng et al performed a retrospective review of 11 patients undergoing biceps tenodesis for symptomatic chronic LHB rupture at a mean interval of 25 months between injury and surgery.10 In their series, the authors reported difficulty in obtaining enough tendon length for interference screw fixation in 6 of 10 cases, which was not observed in our series, probably because of our shorter interval to surgery.

Persistent anterior humeral pain is a complication in some patients undergoing subpectoral tenodesis. Mazzocca et al found anterior humeral pain in 9 of 41 patients (22%), whereas Gregory et al reported 8 of 15 patients (53.3%) in their revision series.19 In our study, 2 of 10 patients (20%) had persistent pain, consistent with prior observations.

In our experience, identification of the biceps tendon is predictable although more distal in the bicipital groove. The tendon is usually shortened 2 or 3 cm, depending on prior intervention or level of auto-rupture. Residual tenosynovitis and adhesions should be evaluated and treated at the time of surgery.

In our study population, only patients with isolated LHB tendon disease were included, and therefore clinical improvement can be appropriately attributed to the subpectoral tenodesis procedure without confounding variables from concomitant glenohumeral disease. In addition, our study design and data collection were prospective with excellent postoperative follow-up (91%). Furthermore, this study had both subjective assessment of cosmetic improvement and objective measurement of biceps position.

Study limitations include the small cohort, which limits generalizability. However, there are few reports in the literature of this condition and subsequent treatment. In addition, the study design was a case series without a control group for direct comparison. There is also potential selection bias, given that those patients returning to the clinic were dissatisfied after their initial failed tenotomy treatment, as well as potential performance bias as this procedure was performed by a single surgeon. Furthermore, postoperative outcome measures did not include direct objective strength measurements.

Conclusion

LHB tenodesis for biceps auto-rupture or failed surgical tenotomy improved symptoms and allowed a predictable return to activity and patient satisfaction in young, active patients who complained of persistent deformity and cramping; 100% of patients had resolution of their cosmetic deformity, and patients achieved good to excellent surgical outcomes on the basis of SANE and WORC scores. Our results affirm that biceps tenodesis provides significant clinical improvement in this population of challenging patients.

References


Disclaimer

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