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Factors associated with adverse events after distal biceps tendon repair or reconstruction

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Background: Factors associated with adverse events after distal biceps tendon repair or reconstruction are incompletely understood. This study examined factors associated with adverse events, prevalence of adverse events, and rate of second surgeries after distal biceps repair or reconstruction.
Methods: Between January 2002 and March 2015, 373 adult patients who underwent repair or reconstruction of the distal biceps tendon at 1 of 3 area hospitals were analyzed to determine factors associated with adverse events after surgical repair or reconstruction of the distal biceps tendon.
Results: Of 373 distal biceps tendon repairs or reconstructions, 82 (22%) had an adverse event; 5.3% were major adverse events. In multivariable analysis, a single-incision anterior approach and obesity were associated with a higher rate of adverse events. Fifteen patients (18% of patients with an adverse event and 4% of all patients) had a second surgery after distal biceps tendon surgery.
Conclusion: Patients should be counseled that 1 in 5 patients will have a minor complication and 1 in 20 patients will have a major complication after surgery on the distal biceps tendon. The most common adverse event is lateral antebrachial cutaneous neurapraxia.
Level of evidence: Level IV; Case Series; Treatment Study

Keywords: Distal biceps; tendinopathy; rupture; surgical repair; reconstruction; second surgery; adverse events

Untreated distal biceps tendon rupture results in an average loss of 30% to 40% of supination strength and reduced endurance.[9,16,17] Surgical reattachment of the ruptured tendon will improve strength, although not completely in some cases.[2,6,11] Typically, repair restores supination strength to about 80% to 90% of normal.[10,12]

Between 10% and 40% of patients have been reported to experience adverse events after surgical repair or reconstruction of the distal biceps tendon.[1,4,7,14,18] Cain et al reported a 36% complication rate in 198 consecutive patients after distal biceps tendon repair or reconstruction with a bone tunnel, suture anchor, or cortical button.[5] Major complications, such as posterior interosseous nerve palsy, heterotopic

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ossification, and rerupture, occurred in 9% of patients.[5] Minor complications, including superficial infection, wound separation, and lateral antebrachial cutaneous neuropathy, were more common.[5]

Factors associated with adverse events after surgery for the distal biceps tendon are incompletely understood. We used a database of patients treated at 3 hospitals to study the primary null hypothesis that there are no specific factors associated with adverse events after surgical repair or reconstruction of the distal biceps tendon. In addition, we addressed the following secondary study questions: (1) What is the prevalence of adverse events after surgical repair or reconstruction of the distal biceps tendon? and (2) What is the rate of a second surgery for an adverse event?

Materials and methods

Study design, setting, and participants

We reviewed 409 patients who underwent surgery to address rupture or tendinopathy of the distal biceps tendon between January 2002 and March 2015 at 3 regional hospitals. Two of these hospitals are level 1 trauma centers and 1 hospital is a community hospital tied to a level 1 trauma center. We identified patients using *Current Procedural Terminology* (CPT) codes for distal biceps tendon rupture (codes: 24340, 24341, 24342).

A multi-institutional Research Patient Data Registry was used to collect data of patients who underwent surgical repair or reconstruction of the distal biceps tendon. The Research Patient Data Registry is a centralized clinical data registry that comprises diagnostic codes (*International Classification of Diseases, Ninth Revision* [ICD-9] codes), CPT codes, demographic information (eg, sex, date of birth, and race), radiology and operative reports, and visit notes.

Thirty-six patients were excluded: 19 did not have adequate documentation; 10 had prior surgical repair of the biceps tendon in another hospital; 6 patients had biceps injury related to a traumatic wound; and 1 patient had débridement of the distal biceps tendon without repair. This resulted in a final cohort of 373 patients.

Outcome measures

We tracked adverse events (eg, rerupture, nerve injury, infection, heterotopic ossification) after surgical repair or reconstruction of the distal biceps tendon as described in the medical record. We considered symptomatic heterotopic ossification, rerupture, deep infection, and motor nerve dysfunction as major adverse events. We considered suture abscesses and radial forearm numbness minor adverse events. Forearm numbness was not subcategorized into injury of specific nerves because of ambiguous visit notes and often unreliable discrimination between different sensory nerves. It is likely that most of these are injuries to the lateral antebrachial cutaneous or—much less likely—the radial sensory nerve.

Explanatory variables

The following patient characteristics were obtained: age, sex, obesity, and smoking. In addition, we collected the following surgery-related factors: hospital, experience of the surgeon after board examination, rupture or tendinopathy, acute or chronic rupture, surgical technique (bone tunnel, suture anchor, cortical button, and tenodesis screw), surgical approach (anterior using 1 incision, anterior using 2 incisions, posterior using 1 incision, or anteroposterior [combined] using 2 incisions), use of graft, and time from injury to surgery. Obesity and smoking were retrieved using ICD-9 codes. All other variables were obtained through chart review. We included only the first distal biceps tendon repair or reconstruction in cases of bilateral tendon rupture.

Table I Adverse events after distal biceps tendon surgery (n = 373)

Adverse event	No. (%)
Radial side forearm numbness	53 (15)
Superficial infection/suture abscess	9 (2.4)
Heterotopic ossification	8 (2.1)
Posterior interosseous nerve palsy	4 (1.1)
Rerupture	6 (1.6)
Median nerve palsy	2 (0.54)
Total	82 (22)

The mean age in this cohort was 48 years (range, 20-74 years), and it included 5 women (1.3%). Of 373 patients who underwent surgical repair or reconstruction of the distal biceps tendon, 82 (22%) had a recorded adverse event (Table I). Fifty-nine patients had nerve injury after surgical repair or reconstruction of the distal biceps tendon (16%). Six patients had a motor palsy, including 4 posterior interosseous nerve palsies and 2 median nerve palsies. All of the nerve palsies recovered within an average of 4.7 months (range, 3-7.5 months). Eight patients developed heterotopic ossification restricting motion; 4 patients were treated using the combined approach, 3 using an anterior approach, and 1 from a posterior approach. Follow-up was available an average of 34 weeks after surgery (range, 1-349 weeks). Fifty-one patients (14%) had <2 months' evaluation in the medical record. We assumed that those patients had no major adverse events.

Statistical analysis

Data were described using frequencies and percentages for dichotomous and nominal variables, mean and confidence interval for normally distributed continuous data, and median and interquartile range for non-normally distributed continuous data.

In bivariate analysis, the association of adverse events with patient characteristics and surgery-related factors was assessed with a Student *t*-test for continuous independent variables (age), a Wilcoxon rank sum test for non-normally distributed explanatory variables (surgeon's experience and time until surgery) and ordinal categorical explanatory variables (surgical approach, surgical technique, and hospital), and a Fisher exact test for dichotomous explanatory variables (sex, alcohol abuse, smoking, obesity, acute or chronic, rupture or tendinopathy, use of graft, and incision).

Factors with $P < .10$ in bivariate analysis were entered into a multivariable logistic regression analysis to assess if possible factors were independently associated with adverse events after surgical repair of the distal biceps tendon. All analyses were performed with Stata 13 (StataCorp LP, College Station, TX, USA); a 2-tailed P value of $< .05$ was considered significant.