

Primary Repair of Traumatic Distal Biceps Ruptures in a Military Population: Clinical Outcomes of Single- Versus 2-Incision Technique

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Purpose: To determine the success of distal biceps repair in a high-demand military population and to comparatively evaluate the perioperative risk profile, functional results, and adverse patient outcomes of a single- versus 2-incision technique within this high-risk group. **Methods:** Between 2007-2013, all military service members undergoing primary surgical repair for distal biceps rupture through the Military Health System were isolated. Patients with allograft tendon reconstruction, revision procedures, nonmilitary status, and/or follow-up of less than 24 month were excluded. Demographic data (age, limb dominance) and surgical variables (time to surgery, surgical technique) were extracted, and rates of perioperative complications, rerupture, reoperation, revision, and inability to return to preinjury function were recorded. Logistic regression analysis was performed to evaluate for prognostic risk factors, whereas the Fisher exact test was used for comparative analysis. **Results:** A total of 290 patients met the inclusion criteria, including 44 (15.2%) with a delayed presentation; all patients were men, with an average age of 38.9 years (range, 20-61 years). A single-incision technique was performed in 75.4% (n = 214) versus a 2-incision technique in 24.6% (n = 70), and a cortical button was the predominant fixation construct (73.4%). Reruptures occurred in 7 patients (2.4%), and 3 individuals (1.0%) had significant elbow dysfunction postoperatively. When we compared the overall complication rates, the 2-incision technique (7.1%, n = 5) was not significantly different from the single-incision repair (16.4%, n = 35; $P = .0732$). Tobacco use was significantly associated with risk of rerupture (odds ratio, 4.86; $P = .0423$) or combined surgical and clinical failures (odds ratio, 5.64; $P = .0091$), whereas age, limb dominance, time to surgery, fixation construct, and surgical technique were not statistically significant ($P > .05$). **Conclusions:** Among active patients, a single—volar incision technique and a 2-incision technique showed similar complication profiles. Rerupture and persistent elbow dysfunction were uncommon, but adverse outcomes were significantly more likely among patients who used tobacco. Anatomic distal biceps repair is a safe surgical procedure with excellent clinical outcomes and a 96.6% rate of return to preoperative military function without restrictions. **Level of Evidence:** Level III, retrospective comparative study.

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Distal biceps tendon ruptures are uncommon among aging athletes, with a reported incidence between 2% and 10% in selected groups and an incidence of 1.2 to 5.4 per 100,000 within the general population.^{1,2} With distal biceps injury, forearm supination and, to a lesser extent, elbow flexion strength and endurance can be compromised by over 40%,³⁻⁶ and significant pain can result due to persistent traction on the lacertus fibrosus or residual tendon. Consequently, direct primary repair of distal biceps rupture remains the hallmark for treatment, particularly with more acute injuries. However, there is no consensus currently on the optimal method for surgical management.⁷ Several proponents have separately recommended a single- or dual-incision approach and several different fixation constructs, but rates of perioperative complications and rerupture vary widely

according to specific surgical technique and patient demographic characteristics.⁷

The purposes of this study were to determine the success of distal biceps repair in a high-demand military population and to comparatively evaluate the perioperative risk profile, functional results, and adverse patient outcomes of a single- versus 2-incision technique within this high-risk group. The null hypothesis was that there would be no significant difference in the rates of perioperative complications between these surgical approaches. We hypothesized that active-duty military service members would show a high rate (>90%) of return to previous level of occupational function after primary distal biceps repair.

Methods

After approval from the institutional review board, a retrospective comparative study of all US military service members with consecutive primary anatomic surgical repair (Current Procedural Terminology code 24,342) of confirmed distal biceps tendon rupture (*International Classification of Diseases, Ninth Revision* code 727.61, 727.62, 727.69, 840.8, 841.8, and/or 905.8) between October 1, 2007, and February 1, 2014, was conducted using the Military Health System Management Analysis and Reporting Tool. The exclusion criteria were as follows: biceps tendon ruptures requiring allograft tendon reconstruction, revision procedures, nonmilitary beneficiary status, insufficient clinical follow-up (i.e., <24 months), and/or inadequate clinical documentation to ascertain selected clinical and surgical variables.

By use of the military outpatient and inpatient electronic medical record systems (AHLTA [Armed Forces Health Longitudinal Technology Application] and Essentris system; CliniComp), line-by-line analysis of all orthopaedic surgery, physical and/or occupational therapy, and primary care documentation was performed for all identified patients. Demographic data and patient-based variables, including age, gender, branch of military service, laterality, hand dominance, tobacco use, and specific military treatment facility, were extracted. In addition, injury characteristics and surgical variables, such as time interval between injury and surgery, specific surgical technique (single incision vs 2 incisions), and method of fixation (suture anchor, cortical button, bone bridge, and/or interference screw), were identified. For this study, subacute or chronic injuries were defined as distal biceps ruptures undergoing surgical management at greater than 4 weeks after index injury.⁸

Clinical and functional outcomes were recorded, and the primary outcome measure in this study was the rate of adverse patient outcomes, including perioperative complications and inability to return to full preoperative upper extremity function. Perioperative complications

were classified accordingly as neurovascular, infectious, fracture related, heterotopic ossification (HO), and partial or complete rerupture after primary repair as indicated by the operative surgeon. Postoperative rehabilitation regimens varied depending on treating physician and were nonstandardized. Postoperative upper extremity limitations affecting specific aspects of military performance were extrapolated from the electronic medical record and/or Physical Profile system (DA Form 3349) or electronic tracking system (eProfile electronic profiling system, version 3.18; Medical Operation Data System, Falls Church, VA), whereas more significant, rate-limiting cases of elbow dysfunction warranting medical discharge were identified from the Defense Manpower Data Center or US Army Physical Disability Agency. The cumulative failure rate was defined as the presence of postoperative rerupture (i.e., surgical failure) or inability to return to full preoperative military function (i.e., clinical failure).

Statistical Analysis

Means with standard deviations were calculated for continuous variables, whereas frequencies with associated percentages were used for categorical variables. To discern significant differences between single- and 2-incision surgical techniques, perioperative complication rates were compared by the Fisher exact *t* test. In addition, logistic regression analysis was used to evaluate the association between potential risk factors and the outcomes of interest, including clinical, surgical, and cumulative failure (i.e., surgical or clinical failure). Relative risk was quantified through odds ratios (ORs) with 95% confidence intervals (CIs), and *P* < .05 was deemed statistically significant.

Results

Demographic Characteristics

After review of 393 patients, a total of 290 patients with primary distal biceps repair at 66 separate medical treatment facilities were isolated at a mean of 3.2 years' follow-up (range, 2.0-10.0 years) (Table 1). Patients with triceps tendon (*n* = 37), proximal biceps tendon (*n* = 5), pectoralis major (*n* = 2), and/or proximal wrist extensor ruptures (*n* = 1) were excluded because of miscoding, and 34 patients with distal biceps reconstruction were also omitted. An additional 34 patients (8.7%) had inadequate documentation or follow-up. The average patient age was 38.9 years (standard deviation, 7.3 years; range, 20-61 years), and 81.7% of patients were aged between 30 and 49 years. The patient series was exclusively male patients and predominantly comprised Army service members (45.9%). Tobacco use was identified in 22.5% of patients. Right hand dominance was identified in 69% of patients, but left-sided injuries were common (53.4%).

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