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ORIGINAL ARTICLE

Major complications after distal biceps tendon repairs: retrospective cohort analysis of 970 cases

Samuel E. Ford, MD[a], Jason S. Andersen, MD[b], David M. Macknet, MD[a], Patrick M. Connor, MD[b], Bryan J. Loeffler, MD[c], R. Glenn Gaston, MD[c,*]

[a]*Department of Orthopaedic Surgery, Carolina Medical Center, Charlotte, NC, USA*
[b]*Shoulder and Elbow Center, Sports Medicine Center, OrthoCarolina, Charlotte, NC, USA*
[c]*OrthoCarolina Hand Center, Charlotte, NC, USA*

Background: The major complication and reoperation rates after distal biceps repair are poorly defined. The purpose of this large retrospective cohort study of distal biceps repairs performed by multiple surgeons within a large orthopedic group was to more clearly define the rates and risk factors of clinically impactful major complications and reoperations.

Methods: All distal biceps tendon repairs performed from January 2005 through April 2017 with a minimum 2-month follow-up were identified using Current Procedural Terminology code 24342. We included 970 patients. The primary outcome measure was the total major complication rate. Reoperations, minor complications, and risk factors were also tracked.

Results: Repairs were performed via a single anterior incision in 652 cases and a 2-incision exposure in 318 cases. A 7.5% major complication rate and 4.5% reoperation rate were observed overall. Major complications occurred at the following rates: proximal radioulnar synostosis, 1.0%; heterotopic ossification or loss of range of motion with reoperation, 0.9%; tendon rerupture, 1.6%; deep infection, 0.5%; posterior interosseous nerve palsy, 1.9%; and complex regional pain syndrome, 0.6%. The 2-incision exposure was identified as a significant risk factor for the development of proximal radioulnar synostosis when compared with single-incision repair techniques ($P = .0003$; odds ratio, 19), occurring in 2.8% of 2-incision exposure cases. Lateral antebrachial cutaneous nerve neuritis or numbness and radial sensory nerve neuritis or numbness were documented more frequently in the postoperative period among patients treated with a single-incision exposure ($P < .0001$ and $P = .034$, respectively).

Conclusions: Distal biceps repair is associated with a 7.5% major complication rate and 4.5% reoperation rate. The use of a 2-incision technique for repair increases the risk of radioulnar synostosis.

Level of evidence: Level III; Retrospective Cohort Design; Treatment Study

Keywords: Distal biceps; proximal radioulnar synostosis; complications; reoperation; rerupture; heterotopic ossification; single incision; two-incision exposure

Repair of distal biceps tendon tears carries a high risk because of the adjacent anatomy. Reported overall complication rates vary widely, ranging from 15%-36%.[1,2,9,10] The most common complication is sensory neuritis involving the lateral antebrachial cutaneous nerve (LABCN) or radial sensory

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*Reprint requests: R. Glenn Gaston, MD, OrthoCarolina Hand Center, 1915 Randolph Rd, Charlotte, NC 28207, USA.

E-mail address: glenn.gaston@orthocarolina.com (R.G. Gaston).

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nerve (RSN), occurring at a combined rate of 6%-32% depending on the series; these symptoms typically resolve with conservative observation.[2,4,8-11] The risk of major complications associated with distal biceps tendon repair is inadequately defined by the existing literature because of inadequate power. Prior to 2017, no series reporting complications after distal biceps tendon repair had over 200 patients.[2,9] Reported rerupture rates also vary widely, ranging from 1.5%-5.4% among small, single-institution series.[2,4,8,9,14,15]

On the basis of the existing literature, the risk factors for postoperative sensory neuritis, tendon rerupture, and the need for revision surgery are not well defined. Several series have correlated the use of a single incision with higher complication rates, while multiple other studies have contradicted these findings.[2,8,10,11,13,15] Close examination of studies by Grewal et al,[8] Cain et al,[2] and Shields et al[13] shows that higher reported total complication rates with a single incision can be largely attributed to sensory neuropathies.[6] The frequency of less common major complications, including posterior interosseous nerve (PIN) palsy, symptomatic heterotopic ossification (HO), and proximal radioulnar synostosis, is not well documented because of the small size of reported series.[1,2,4,5,7,9-11,15] The purpose of this large retrospective cohort study of distal biceps repairs performed by multiple surgeons within a large orthopedic group was to more clearly define the rates and risk factors of clinically impactful major complications and reoperations.

Materials and methods

A retrospective comparative treatment study was conducted. A query of patients surgically treated by multiple surgeons within a large independent orthopedic group (with >100 surgeons) for distal biceps tendon repair from January 2005 through April 2017 was generated using Current Procedural Terminology (CPT) code 24342 for repair of ruptured distal biceps or triceps tendons. Patients were excluded from the study if they had less than 2 months of follow-up unless a major complication or reoperation occurred, if their injury was open, or if they underwent a distal triceps tendon repair. Chronic tears that required reconstruction with graft augmentation, as well as revision surgical procedures, were included.

The primary outcome variable was the development of a major complication, which was defined as the occurrence of at least 1 of the following: distal biceps tendon rerupture,[2,4,8,9,14,15] deep infection requiring operative intervention, PIN palsy, proximal radioulnar synostosis, symptomatic (painful or range of motion [ROM]–limiting) HO, functional ROM loss treated with surgical intervention (without HO), vascular injury, complex regional pain syndrome (CRPS), or any other postoperative complication or sequela that required reoperation. The treating surgeon diagnosed distal biceps tendon rerupture clinically, often confirming rerupture with magnetic resonance imaging, but no uniform criteria were used to test patients for rerupture. Proximal radioulnar synostosis was defined by the absence of pronosupination on clinical examination in combination with radiographic evidence of bony bridging between the proximal radius and ulna on plain radiographs or computed tomography. This complication was defined as being distinctly separate from nonbridging symptomatic HO, which may be subcutaneously palpable, focally tender, or painful with ROM or may limit terminal supination, pronation, flexion, or extension. Functional loss of ROM with reoperation was separately defined as a limitation in ulnohumeral motion in the absence of HO on radiographs. Deep infection was defined by the clinical need for operative débridement for infection control. PIN palsy was defined as focal weakness in digital and/or wrist extension out of proportion with postoperative weakness related to pain.

Secondary outcome measures included specific rates of major complications and of clinically relevant minor complications, as well as reoperation rates. Minor complications were recorded and included LABCN and RSN paresthesia,[2,4,8-11] postoperative cubital tunnel syndrome, symptomatic (painful or ROM-limiting) HO without repeated operative intervention, and superficial infection not requiring reoperation. Reasons for reoperation were recorded as an additional secondary outcome measure. Sensory neuritis or numbness in the LABCN or RSN distribution was considered clinically meaningful (and included) if symptoms persisted beyond 2 postoperative months.

The following variables were tracked as potential confounding variables: patient age, history of tobacco use,[12] sex, time from injury to surgery, associated injuries (if any), use of postoperative HO prophylaxis,[3] and postoperative rehabilitation details. The use and duration of postoperative rigid immobilization in a nonremovable splint or cast were specifically noted. The subsequent use of a hinged elbow brace or removable rigid elbow orthosis and its duration were also noted. Particular attention was paid to the restriction of terminal extension while in a hinged elbow brace and the time of initiation of active elbow flexion.

Additional operative findings were tracked as potential predictive variables. Tendon ruptures were classified either as full-thickness tears of the tendon from the proximal radius or as partial tears if attenuated or degenerative strands of the biceps tendon remained in continuity with the radial tuberosity, given that mobilization and scarring of a retracted full-thickness tear may predispose patients to a more adverse complication profile. The number of incisions used for exposure of the repair or reconstruction site was tracked as single, meaning an isolated anterior incision, or 2 incisions, indicating the combined use of anterior and dorsal incisions over the proximal forearm. Additional proximal incisions needed for biceps tendon retrieval were not included in this distinction. Single anterior incisions were recorded as either transverse or longitudinal if a determination could be made based on the operative report. The type of fixation was also recorded, including suture or a cortical button in isolation, suture or a cortical button with the addition of an interference screw, interference screw fixation alone, fixation with suture anchor(s), or repair with sutures tied over bone tunnels. Revision repairs were documented, and the use of autograft or allograft tendon for reconstruction of a retracted distal biceps tendon was recorded. The fellowship training of the treating surgeon was categorized as general (no fellowship), sports medicine, shoulder and elbow, or hand surgery.

Postoperative rehabilitation was not standardized and followed the preference of the treating surgeon. The formal distal biceps repair protocol that some surgeons prescribed for postoperative rehabilitation centered on abstaining from active elbow flexion for the first 6 postoperative weeks. Under this protocol, passive, tension-free ROM was advanced under a physical therapist's supervision, often with a brace in place to limit terminal extension. In addition, passive forearm pronation and supination were only allowed with the elbow in a position of 90° of flexion. After 6 weeks of progressive passive