Outcomes of Modified 2-incision Technique With Use of Indomethicin in Treatment of Distal Biceps Tendon Rupture

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Abstract

Multiple surgical techniques for distal biceps tendon ruptures exist. Heterotopic ossification is an associated complication of the 2-incision technique. The purpose of this study was to review the results of distal biceps tendon repairs via the modified 2-incision technique using indomethacin chemoprophylaxis. A retrospective review of 34 2-incision repairs of the distal biceps tendon was performed. All patients received 6 weeks of indomethacin treatment postoperatively to prophylax against heterotopic ossification. Outcome measures included disabilities of the arm, shoulder, and hand (DASH) scoring, incidence of heterotopic ossification, and forearm range of motion. Of the 34 elbows, 2 had minor complications that resolved within 6 weeks of presentation. The average DASH score at final follow-up was 3.8. No cases of heterotopic ossification, nerve palsies, reruptures, or radioulnar synostoses were observed. At final follow-up, no significant difference was noted in range of motion between the injured and uninjured extremity in all planes. The Morrey modification of the 2-incision technique can be safe and provide full functional recovery in patients with ruptured distal biceps tendons when performed in conjunction with indomethacin prophylaxis.

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Dr. Anakwenze and Dr. Abboud and Messrs. Kancherla and Warrender have no relevant financial relationships to disclose.

This study was approved by the University of Pennsylvania Institutional Review Board.

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doi: 10.3928/01477447-20110922-10
A vulsion of the distal biceps tendon insertion from the radial tuberosity is rare, representing 3% of all biceps brachii ruptures. Tendon impingement, degenerative changes, and decreased vascularity may all play a role in distal biceps failure; however, the pathophysiology essentially remains uncertain. The mechanism of injury tends to be an eccentric weight placed on the arm while the elbow is in an actively flexed position.

On evaluation, ecchymosis in the antecubital fossa is usually reported, along with tenderness over the radial tuberosity and weakness in elbow flexion and forearm supination. Magnetic resonance imaging (MRI) is useful when physical examination and patient history are inconclusive because it can provide valuable information regarding the integrity of the distal biceps brachii tendon. Most literature recommends a surgical reattachment of the tendon to its anatomical position on the radial tuberosity if the patient wishes to regain full strength, endurance, and range of motion (ROM) in elbow flexion and forearm supination. Investigators also reported that early surgery decreases the risk of complication.

Some concern about radioulnar synostoses and heterotopic ossification with the 2-incision repair exists. Use of suture anchors, bioabsorbable interference screws, or an EndoButton (Smith & Nephew, Memphis, Tennessee) through a single anterior approach is an alternative to the 2-incision technique that may limit the risk of synostoses and heterotopic ossification. However, other surgical complications, such as radial nerve injury, resulting from these single anterior approaches have been reported.

The purposes of this study were to evaluate patients who underwent distal biceps repair with the Morrey modified 2-incision technique with indomethacin chemoprophylaxis and document the number of cases complicated by heterotopic ossification, compare the ROM at final follow-up with the uninjured contralateral side, and evaluate patients’ functional outcomes using the disability of the arm, shoulder, and hand (DASH) outcome analysis.

**MATERIALS AND METHODS**

After institutional board review and approval, a retrospective review was performed to identify cases of distal biceps rupture repairs performed from 2003 to 2010. Study inclusion criteria included presence of MRI-confirmed acute distal biceps rupture undergoing surgical repair. Patients were excluded if they had <6 months of follow-up or did not complete a full course of indomethacin prophylaxis. The senior author (J.A.A.) performed all of the surgeries and used the Morrey modification of the 2-incision technique (Figures 1, 2) using #2 FiberWire suture (Arthrex, Naples, Florida). At final clinical
follow-up, functional status and ROM was documented in comparison to the contralateral or uninjured extremity. All ROM measurements were recorded using a goniometer by the same independent evaluator (the senior author’s research assistant). Postoperative radiographs were taken at 6 months to confirm the presence or absence of heterotopic ossification. All patients received 75 mg of sustained-release indomethacin 1 time daily for 6 weeks starting on the day of surgery to prophylax against heterotopic ossification. This dosing regimen is similar to that reported for heterotopic ossification prophylaxis following hip surgery. Rehabilitation protocol included splint immobilization for 1 week followed by progressive passive ROM exercises for 5 weeks to regain full elbow ROM. From weeks 6 through 10, active ROM began. At 10 weeks, progressive strengthening was initiated, with a goal of lifting 20 pounds independently with the affected arm by 5 months.

For the purpose of this study, DASH scores were obtained for all patients. The DASH instrument is a 30-question self-reported questionnaire that assesses patients with upper extremity dysfunction; the maximum score is 100, and lower scores correspond with higher function.

Average DASH scores were recorded as median scores with interquartile ranges. Range of motion in all planes was compared using a 2-tailed paired sample t test comparing the injured extremity with the uninjured extremity in the same patient. Heterotopic ossification was evaluated on final follow-up radiographs as either present or absent.

Surgical Technique

A transverse incision overlying the antebrachial region of the elbow was made, and subcutaneous flaps were elevated. The lateral antebrachial cutaneous nerve (LACN) was identified and protected. The distal stump of the biceps was identified, and the tendon was debrided back to a healthy tendon edge. The #2 FiberWire suture was weaved through the tendon in a Krackow fashion 2 times. The tendon was passed medial to the LACN nerve. The interval between the radial tuberosity and the ulna was identified. A hemostat was passed through the interval. This was done using the Morrey modification of the 2-incision technique.

On the dorsal aspect of the forearm, an incision approximately 4 cm in length was made overlying the extensor compartment and supinator muscle. The fascia was incised, the supinator was bluntly dissected, and the posterior interosseous nerve was protected by maximally pronating the forearm. The radial tuberosity was identified, and a 2-mm high-speed bur was used to create a trough approximately 1 cm × 4 mm in the radial tuberosity to allow for placement of the tendon stump.

A drill bit was used to make 3 holes approximately 5 mm apart and 8 mm from the cortical edge of the tuberosity. The sutures were passed through the drill holes in the radial tuberosity. The antebrachial fossa was checked to ensure that the biceps had appropriate tension on it and that the lateral antebrachial cutaneous nerve was lateral to the biceps tendon. The sutures were then tied, anatomically reapproximating the tendon into the radial tuberosity.

RESULTS

A total of 46 patients were identified. Of these, 12 patients had <6 months of follow-up and were excluded. Therefore, the authors studied the results of 34 patients undergoing 34 distal biceps tendon repairs. Results are summarized in the Table. All patients in the study were men, and their mean age was 46 years (range, 28-65 years). The dominant arm was involved in 24 of 34 (71%) patients. The average follow-up was 22 months (range, 6-102 months; SD, 21 months). The mean time between the initial injury and surgery was 29 days (range, 3-180 days; SD, 43 days).

When compared with the uninjured arm, no significant differences were noted in terms of postoperative elbow ROM. Three patients noted losses of 5°, 10°, and 15° of flexion, respectively, and 1 patient noted a 5° loss of pronation (Table). All patients returned to preinjury levels of activity or employment at 6 months (95% confidence interval, 5.4, 6.7 months). One patient was not available for DASH scoring. The remaining 33 patients had a postoperative mean DASH score of 3.8.

One of the 34 patients had a minor complication and developed dysesthesia into the radial aspect of his forearm, which resolved within 6 weeks. This was likely secondary to a transient traction injury to the lateral antebrachial cutaneous nerve. No heterotopic ossifications, nerve palsies, reruptures, or radioulnar synostoses were clinically or radiographically observed. All patients gave verbal confirmation of compliance with indomethacin regimen and duration. No patients reported any gastrointestinal discomfort, bleeding, or hypertensive side effects secondary to its use.

DISCUSSION

Approximately 3% of all biceps ruptures occur in the distal biceps. This injury is most common in active male laborers and is usually caused by applying an eccentric weight to a flexed elbow. Surgical repair is advocated to prevent loss of elbow supination and flexion, particularly in the dominant extremity. Although no clear consensus as to the best technique for repair of distal biceps rupture exists, there is concern about the development of heterotopic ossification following the 2-incision technique. To the authors’ knowledge, reports of specific outcome measures following treatment with chemoprophylaxis do not exist.

This study had several limitations. It was a retrospective study and had all of the limitations associated with a retrospective study. Although this study was larger than most, it had a relatively small number of patients. Because the authors could only include 34 patients, they only...
had enough power to detect large differences (SD, 0.8), with a type I error rate of 0.05 and a power of 0.8. In addition, no control group was available in this study to allow for a comparison of heterotopic ossification rates with and without che-
moprophylaxis. Therefore, it is possible that the low incidence of heterotopic ossification may be due to surgical technique, length of immobilization, or the type of rehabilitation, not indomethacin.

The authors used a goniometer to measure isolated elbow ROM with the shoulder static. Dynamic radiographic series used for measurement may be the most accurate means of recording joint ROM. However, goniometric measurements have proven to have adequate correlation and are frequently used to report ROM as an outcome. However, some inherent measurement errors with its use exist. The authors did not specifically test arm strength following repair because the restoration of flexion and supination strengths following repair has been well established and, therefore, is not one of the objectives of this study. Instead, the authors chose to focus on the rate of complications, heterotopic ossification formation, and resultant ROM.

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Medical management plays a small role in treating heterotopic ossification once it has formed. Indomethacin, a conventional cyclooxygenase inhibiting nonsteroidal anti-inflammatory drug, can be used in its prevention in high-risk patients and can minimize the risk of recurrence following surgical excision. The etiology of heterotopic ossification is poorly understood, but it may involve mesenchymal stem cells that are pluripotent progenitor cells with the ability to generate bone through osteoblastic activity. Basic science animal data exist that document a reduction in heterotopic ossification with the use of cyclooxygenase inhibitors. By using osteoblast differential assay, Kellinsalmi et al. found a significant decrease in osteoblast differentiation among mesenchymal stem cells under a controlled osteoblastic differential pathway when treated with indomethacin compared with the untreated controlled specimens. Although this may suggest a theoretical decrease in heterotopic ossification formation, insufficient in vitro basic science studies exist to specifically document this.

Basic science and animal studies implicated that indomethacin was associated with decreased tendon-to-bone repair pull-out strength, stiffness, and impaired fracture healing. Additional complications include bleeding and gastrointestinal discomfort. Based on clinical evaluation, the authors did not note any failures of tendon-to-bone healing and, therefore, did not obtain MRI or ultrasound imaging because it was not indicated and they had no funding to do it routinely.

At final follow-up, no significant differences between the injured and uninjured extremities existed in terms of ROM. This was consistent in all planes of motion. In a recent systematic review, Chavan et al. reported a higher but statistically insignificant rate of heterotopic ossification following 2-incision (6%) compared with single-incision (3%) distal biceps repair. They noted this loss of motion to be more common following 2-incision techniques. However, their study did not use any form of heterotopic ossification prophylaxis. In the current study, the use of indomethacin may have helped to account for the postoperative recovery of near full ROM in the majority of the patient population.

In terms of DASH scoring, the authors’ outcomes are favorable to those reported in the literature. Freeman et al. reported nonoperative and operative treatment of distal biceps repair. They performed a systematic review of individualized distal biceps repairs outcomes as a historical control. They aggregated individualized data from studies (40 patients) and obtained a median DASH score of 37. The authors noted a median DASH score of 2.3 and a mean score of 3.8 among their patients.

The Morrey modification of the 2-incision technique can be safe and provide full functional recovery in patients with ruptured distal biceps tendons. Patients in this study had lower complication rate compared with previous studies. We theorized that the addition of indomethacin prophylaxis may play a role in this finding. In the future, a larger randomized prospective study would be helpful in further assessing the role of indomethacin.

**REFERENCES**


