

Distal biceps brachii tendon avulsion

A simplified method of operative repair

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ABSTRACT

Rupture of the distal insertion of the biceps brachii may lead to severe functional impairment of the upper extremity on the basis of resultant weakness of elbow flexion and supination. When the diagnosis of a post-traumatic distal biceps tendon avulsion is made, a simple method of reattachment is possible and functionally warranted.

Rupture of the distal insertion of the biceps brachialis is an infrequent injury, representing only 3% of all biceps tendon ruptures.^{2,6,8,9,12} The biceps tendon usually avulses from the bone and periosteum of the radial tuberosity following rapid resisted flexion of the elbow.^{2,7,8,13,14,16,17} Attritional changes of the tendon have been implicated.⁵ The traumatic etiology of sudden distal tendon rupture, however, is much more common.

Nonoperative management of these lesions has been described and proponents indicate that the subsequent mechanical dysfunction is insignificant and that the required surgical exposure entails a high morbidity.⁴ Recent reports, however, have advocated surgical repair of distal biceps ruptures in order to improve rotational strength and motion of the forearm.^{1,15}

Various surgical approaches to correct this lesion have been described in the literature, dating back to the first report of a surgical repair by Acquaviva in 1898.^{5,9,13} In 1961, Boyd and Anderson³ described a two-incision technique for approaching this lesion. They felt that a second dorsal incision was necessary to limit the volar surgical dissection required near the radial nerve as it passes through the supinator muscle.^{2,6,8,11,14,17} Most subsequent reports and

recent editions of standard operative texts have recommended this two-incision technique.^{1,2,12,15}

An anterior exposure through a single incision, as described by Henry, has been used at our institution during the last 15 years for the surgical management of this lesion. This technique has previously been reported in the literature.⁸⁻¹⁰ This approach has provided an excellent surgical exposure without undue risk to nearby neurovascular structures.

MATERIALS AND METHODS

Eight patients with the clinical diagnosis of biceps tendon rupture (distal) have been treated at our institution during the past 12 years. All patients were male, and ranged in age from 22 to 56 years (average, 31 years). The dominant extremity was involved in 50% of cases, and no patient experienced "prodromal" symptoms of pain or weakness prior to the traumatic event. The mechanism of injury was lifting or pulling a heavy weight in all cases. Three of the eight patients were involved in recreational weight lifting activities. Seven patients underwent operative repair an average of 8 days (range, 1 to 26 days) following the injury.

CASE REPORT

A 22-year-old white male was performing upper extremity curling exercises with 80 pounds of weight. His friend added resistance to the bar during the elbow flexion jerking maneuvers. A tearing sensation in the right antecubital fossa was felt by the patient as he fell from the bar. Painful limited flexion-extension of the elbow and pronation-supination of the forearm was immediately appreciated. A palpable defect in the volar arm muscle mass was also noted. Within hours, ecchymosis developed along the proximal medial aspect of the volar forearm. The patient was evaluated at our institution on the day of injury.

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At the time of his initial evaluation, he had normal passive motion of all joints of his upper extremity. Active motion of the elbow was 30/45 and active rotation of his forearm was 45° pronation and 10° supination. Flexion of the elbow and supination of the forearm were significantly weaker than the normal contralateral side. No neurovascular deficits were present. Ecchymosis was present near the insertion of the lacertus fibrosis. The biceps tendon was not palpable and the biceps muscle was proximally displaced (Fig. 1). Elbow radiographs were normal. After informed consent was obtained, the patient underwent a repair of his biceps tendon insertion on the following day.

OPERATIVE TECHNIQUE

An extended anterior Henry approach was used. The radial nerve was identified in the interval between the brachialis and brachioradialis muscles; it was followed distally to its bifurcation, and protected throughout the course of the procedure. The brachial artery and its branches were identified and carefully protected. If necessary, branches from the radial recurrent artery can be ligated to facilitate exposure. The ruptured end of the tendon was cleared of soft tissue debris. Following full supination of the forearm, the radial tuberosity was located and cleared of overlying bursal tissue. The periosteum at this site is frequently avulsed with the tendon. A drill bit or burr of sufficient size was used to establish a portal into the medullary cavity of the radial tuberosity. With curettes and rongeurs, the channel was enlarged to accommodate the distal portion of the tendon.

A large, nonabsorbable suture was secured to the avulsed distal tendon using the Bunnell technique. Both ends of the suture were then threaded into a Keith needle which was then passed through the cavitated radial tuberosity, through the opposite cortex, through the anconeus muscle, and exited out through the skin on the extensor surface of the proximal forearm. With the elbow in 90° of flexion and fully supinated, the suture was pulled tight, drawing the tendon, under



Figure 1. Forearm ecchymosis is evident as well as clinical appearance of distal biceps tendon rupture.

direct vision, into the portal in the radial tuberosity. The suture was then tied over dental rolls or a felt pad (Fig. 2).

In order to minimize pressure necrosis on the skin, while securing the tendon in place, additional local sutures may be used to provide added fixation of the tendon to adjacent periosteum. The lacertus fibrosis can either be excised or used as reinforcing material for the tendon substance. After deflation of the tourniquet, hemostasis was achieved. The wound was closed and a long arm cast fashioned with the forearm in full supination. The button and suture can be removed after 4 to 6 weeks. After 6 to 8 weeks, the cast was removed and active motion program begun. Resisted exercise was initiated 3 months following the repair.

RESULTS

During the past 15 years, seven patients have undergone repair of their distal biceps rupture using this single-incision technique. There have been no difficulties with wound infection or re-rupture of the tendon. The average period of followup was 5.5 months (range, 3 to 10 months).

Postoperative range of motion has varied depending on the patient's age and activity level. Our youngest patient (22 years) regained full elbow motion, including rotation, while a 56-year-old prisoner lacked 30° of full extension and the final 45° of pronation. The transient nature of our patient population precluded obtaining follow-up Cybex data. At the time of the last clinic visit, six of the seven operative patients were subjectively pleased with the strength, motion, and cosmetic appearance of their limbs. Postoperatively, one patient developed heterotopic bone along the course of the brachialis muscle, but was not functionally restricted.

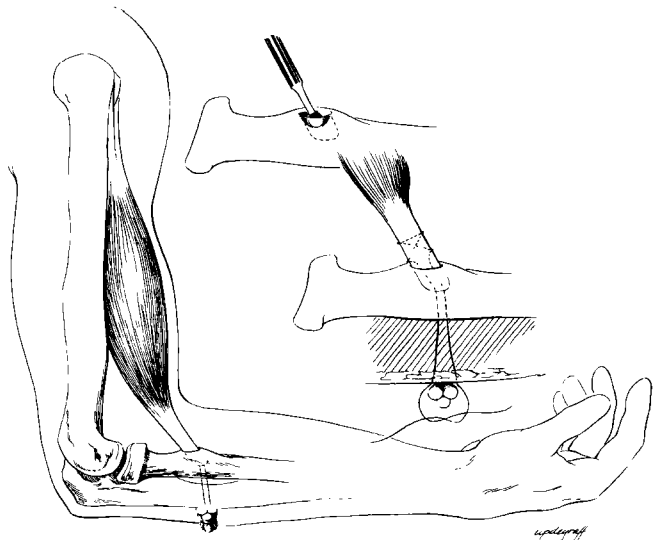


Figure 2. High speed burr is used to create a channel through the radial tuberosity and into the medullary canal. With the elbow flexed to 90° and the forearm in full supination, the tendon is introduced under direct vision into the channel. Pull-out suture is exited through the dorsal aspect of the forearm and secured over dental rolls.

DISCUSSION

The biceps brachii tendon functions as an important elbow flexor and is the principle forearm supinator.^{1,15} Although some authors have suggested that little functional deficit occurs as a result of distal biceps tendon rupture,⁴ recent studies have clearly documented significant impairment in patients treated nonoperatively following distal tendon rupture.^{1,9,14,15,19} Baker and Bierwagen¹ demonstrated reductions in supination strength of 40% and supination endurance of 79% in conservatively treated patients as compared to those who had operative repair. Surgical repair of these lesions is thus advocated not only on cosmetic grounds but also to minimize this upper extremity weakness and functional impairment.^{1,9,14,15,19}

When confronted with a rupture of the distal tendon, the reattachment of the tendon to its original point of insertion would appear to be physiologically appropriate.^{2,6,9,13,15,16,20} The single-incision anterior surgical approach provides a generous exposure and facilitates reattachment of the tendon to its anatomical position.⁸⁻¹⁰

The treatment of this injury must be individualized for each patient. Management considerations should include postinjury motion and strength potential. The technique presented in this paper constitutes another method by which surgical repair can be accomplished. We believe that this single-incision anterior approach with anatomical reinsertion of the avulsed biceps tendon warrants a place in the armamentarium of the orthopaedic surgeon.

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