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Distal Biceps Brachii Repair

Results in Dominant and Nondominant Extremities

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Nine patients with distal biceps tendon ruptures that had been repaired anatomically with a double-incision technique were evaluated. All patients were men, whose average age was 46 years old (range, 31–66 years). Three patients injured their dominant extremity and 6 their nondominant extremity. This represents the largest series of operatively treated nondominant biceps ruptures with quantitative followup in the literature. All patients responded to a questionnaire, and had clinical, radiographic, and isokinetic testing. The average followup was 30 months (range, 12–57 months). Patients were pleased uniformly with their operative results, and all would have had surgery given the option again. Strength testing results of the dominant extremities revealed full return of forearm supination strength and elbow flexion strength. Endurance data also revealed full return when compared with controls. In nondominant extremities, a 14% supination strength deficit from expected values (corrected for dominance) and a 14% flexion strength deficit (also corrected) were observed in the 6 patients. A radioulnar synostosis that required resection developed in 1 patient. Anatomic repair of distal biceps tendon rupture gives consistently good results. Dominant extremities can achieve normal function, whereas nondominant extremities may require aggressive therapy to achieve maximal strength.

Avulsion of the distal biceps brachii tendon at the elbow is an uncommon injury. In 1934, Gilcreest[9] reported on biceps tendon ruptures and found that proximal biceps (long head) ruptures represented 96%, short head 1%, and distal biceps 3%. The tendon typically is avulsed from the tendoosseous junction and only rarely have partial avulsions been reported. The injury typically occurs in men between the fourth and sixth decades of life; the average age at rupture is 50 years old (range, 21–70 years).[1,3–7,10,12] No case of a distal biceps rupture in a woman has been reported. Distal biceps tendon ruptures have been reported in association with anabolic steroid use.[17]

Virtually all patients report a single traumatic event. The most common mechanisms of injury are lifting a heavy weight with the elbow at 90° flexion, or an eccentric load placed on a flexed elbow.[12] Preexisting degenerative changes may predispose the tendon to rupture, but rarely have patients sought attention for this condition before rupture. Severe pain is the initial symptom, and deformity is seen. This intense pain subsides in a few hours, but a dull ache may be present for weeks. Antecubital swelling and weakness to supination are common findings.

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Patients with this injury may be treated nonoperatively or with surgical repair. Patients managed conservatively should expect diminished strength and endurance in flexion, especially supination.[12,13] The contours of the arm never return to normal because the distal biceps will scar to the brachialis muscle.[16]

Operative repair is indicated in the high demand athlete, body builders, people who require strong supination for their vocation, and those who deem their deformity unacceptable. An anatomic repair by attaching the tendon to the tuberosity has yielded good results in small series.[1,3,4,6,7,11,12,13,15] The Boyd and Anderson[4] technique of 2 incisions has decreased the complication rate. The purpose of this study was to determine the outcome of surgically repaired distal biceps ruptures, identify any functional disability, and quantify side-to-side strength differences.

MATERIALS AND METHODS

Nine patients had operative repairs of avulsed distal biceps tendons at the authors' institution from 1989 to 1993. All patients were available for followup. The average followup for the operative group was 30 months (range, 12–57 months). Data for the group are listed in Table 1.

All patients were men, whose average age was 46 years old (range, 31–66 years). Three patients were training for competitive weight lifting when the injury occurred. Six injuries were in the nondominant and 3 in the dominant extremity. The history is often consistent with violent pulling against a fixed forearm position, with a subsequent pop, pain, and later swelling and ecchymosis. The avulsed tendon may be palpable in the distal arm and the lacertus fibrosus rupture is a variable finding, possibly representing a continuum of injury. Seven of 9 ruptures occurred during an eccentric contraction of a flexed elbow. The cause of injury was volunteered by the patient in 7 cases. The injury caused immediate pain

TABLE 1. Historical Data of Patients With Distal Biceps Rupture

Case	Age	Side/ Dominant	Interval to Surgery (days)	Worker's Compensation	Followup (months)	Vocation	Mechanism of Injury
1	32	L/ND	13	No	17	Police officer	Weightlifting Eccentric Curl 90 pounds
2	43	L/D	20	No	20	Mechanic	Lifting 50-pound fence
3	31	L/ND	40*	Yes	21	Billboard artist	Lifting 50-pounds at work
4	58	L/ND	6	Yes	16	Police officer	Fell down stairs
5	66	R/D	18	No	57	Professor	Lifting 75-pound dishwasher
6	53	L/ND	348	No	25	Accountant	Lifting 75-pound dresser
7	49	L/ND	8	No	42	Engineer	Pulling stuck fence
8	53	L/D	4	No	57	Pharmacist	Grabbed drifting boat
9	53	L/ND	24	No	12	Laborer	Lifting wood

D = dominant; ND = nondominant; L = left; R = right.
*Revision surgery required because of synostosis.

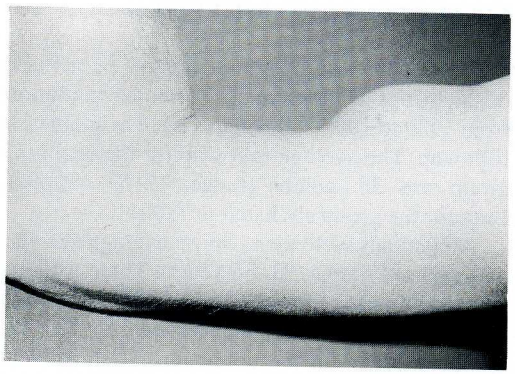

Fig 1. (Case 8) Elbow deformity with proximal migration of biceps muscle (flexed elbow with shoulder on the right).

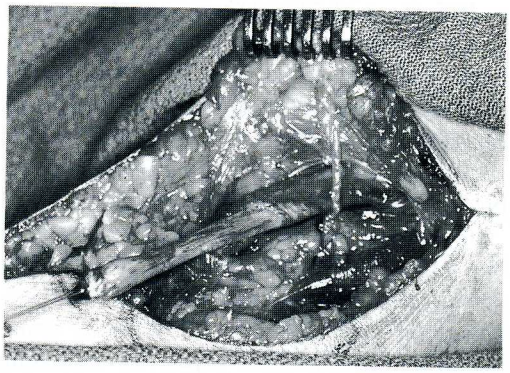

Fig 2. Photograph of avulsed biceps tendon with anterior exposure.

in the flexion crease of the elbow and a sensation of a window shade rolling up or an accordion-like feeling in the arm (Fig 1). Five patients had surgical treatment within 13 days of injury. One patient had surgery at 6 weeks, and another approximately 1 year after injury.

All patients returned for evaluation, completing a symptom and activity questionnaire, undergoing physical examination and isokinetic muscle testing, and having radiographs taken. The questionnaire determined prior and present activity levels, pain, and satisfaction with surgery. Patients were tested for range of motion, flexion and extension, and pronation and supination using a goniometer. Lateral radiographs in supination were taken to assess for potential heterotopic ossification. All patients were evaluated by isokinetic muscle testing using the Cybex II Isokinetic Dynamometer (Lumex, Inc, Bay Shore, NY).

Operative Technique

The biceps tendon was reinserted into the radial tuberosity using the double-incision technique as described by Boyd and Anderson[4] and others.[8,12] With the patient in the supine position and the elbow extended, the forearm was supinated on an arm board. An oblique curvilinear incision was made beginning medial and proximal to the elbow crease and extended distally and laterally if necessary. The lateral antebrachial cutaneous nerve was protected to avoid cutaneous sensory loss. The avulsed end of the biceps tendon was often adherent to the anterior brachialis fascia (Fig 2). The debrided end of the tendon was secured using 2 nonabsorbable Number 1 sutures using a modified Kessler or Bunnell stitch.

With a curved clamp, the tunnel between the radius and ulna was located. The clamp was pushed through this tunnel and, with the elbow flexed and pronated, the clamp was palpated over the dorsum of the proximal forearm. An incision was made directly over the clamp, and the extensor muscles were elevated with the forearm pronated. The radial tuberosity was palpated and exposed. A burr was used to create then enlarge a small trough in the cancellous bone to accept the repaired tendon. A suture passer was used to retrieve the tendons from the flexor crease. The tendon was passed from anterior to posterior by following the soft tissue tunnel. Nonabsorbable sutures were brought through drill holes and tied with the elbow flexed at 90° and the forearm supinated, making sure that the tendon was well seated in the trough (Fig 3).

The forearm was held in supination with the elbow at 90° for 2 weeks. Active range of motion was begun, followed by a progressive resistance exercise strengthening program that was started 4 to 6 weeks after surgery.

Isokinetic Muscle Testing

A comprehensive evaluation and attempt to test flexion and supination strength and endurance was performed. A Cybex II Isokinetic Dynamometer and its software were used for analysis. Strength and endurance data were collected for pronation and supination and flexion and ex-