

Reconstruction of a Chronic Distal Biceps Tendon Rupture 4 Years After Initial Injury

L. Pearce McCarty, III, MD, Joshua M. Alpert, MD, and Charles Bush-Joseph, MD

ABSTRACT

Rupture of the distal biceps insertion can produce, on average, a 40% loss of supination strength, a 47% loss of supination endurance, and a 21% to 30% loss of flexion strength at the elbow. In acute biceps tendon ruptures in which a patient will not tolerate resulting functional deficits, anatomical reinsertion of the biceps tendon into the radial tuberosity is usually recommended.

The various surgical techniques that have been described for anatomical repair of distal biceps rupture include passage of the tendon stump through a transosseous tunnel and use of suture anchors, interference screws, and EndoButtons (Smith & Nephew, Andover, Mass). Reported results for these techniques have mostly been excellent with respect to restoration of functionality.

Chronic cases, however, may involve retraction of the native tendon and extensive scar formation, which preclude anatomical repair. In these situations, one of several described reconstructive techniques, including use of semi-

tendinosus autograft and Achilles tendon allograft, may be needed to reestablish acceptable function. Delayed (≤ 18 months) reconstruction of chronic ruptures, using allograft soft-tissue constructs, has been described in the literature.

We present the case of a chronic distal biceps rupture reconstructed 4 years after initial injury using a single-incision technique with free semitendinosus autograft and EndoButton fixation.

fore, some of these injuries go undiagnosed for an extended period.⁵⁻⁷

For acute rupture cases in which the patient will not tolerate resulting functional deficits, anatomical reinsertion of the biceps tendon into the radial tuberosity is recommended. The various surgical techniques that have been described for anatomical repair of distal biceps rupture include passage of the tendon stump through a transosseous tunnel and use of suture anchors, interference screws, and EndoButtons

“[For chronic cases,] the use of semitendinosus autograft or Achilles tendon allograft...may be needed to reestablish acceptable function.”

Rupture of the distal biceps brachii tendon is a relatively uncommon injury; it occurs approximately 1.2 times per 100,000 patients per year and represents only 3% of tendinous avulsions involving this muscle.^{1,2} Typically observed in the fourth or fifth decade in life, distal biceps rupture occurs almost exclusively in men, usually involves the dominant extremity, is thought to occur more commonly in smokers, and usually follows a violent, eccentric contraction.²⁻⁵ Loss of the distal biceps insertion can produce a 40% loss of supination strength, a 47% loss of supination endurance, and a 21% to 30% loss of flexion strength at the elbow when compared with the uninjured extremity.^{4,5} Nevertheless, some patients initially tolerate rupture of the distal biceps, and, there-

(Smith & Nephew, Andover, Mass).^{5,8-12} Reported results for these techniques have been excellent with respect to restoration of functionality.

Chronic cases, however, may involve retraction of the native tendon and extensive scar formation, which preclude anatomical repair. In these situations, one of several described reconstructive techniques, including the use of semitendinosus autograft or Achilles tendon allograft, may be needed to reestablish acceptable function.^{6,7,13} Delayed (≤ 18 months) reconstruction of chronic ruptures, using allograft soft-tissue constructs, has been described in the literature.¹³

We present a case of chronic distal biceps rupture with delayed reconstruction 4 years after initial injury using a single-incision technique with semitendinosus autograft and EndoButton fixation.

Dr. McCarty is with Sports and Orthopaedic Specialists, Minneapolis, Minnesota.

Dr. Alpert is with Midwest Bone and Joint Institute, Chicago, Illinois. Dr. Bush-Joseph is Professor, Department of Orthopaedic Surgery, Rush University Medical Center, Chicago, Illinois.

Address correspondence to: Charles Bush-Joseph, MD, 1725 W Harrison St, Suite 1063, Chicago, IL 60614 (fax, 312-942-1517; e-mail, cbj@rushortho.com).

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Figure 1. Preoperative views of affected extremity show clinical findings consistent with distal biceps rupture.

CASE REPORT

A male right-hand-dominant former competitive weight lifter in his late 30s was referred for evaluation and treatment of bilateral distal biceps ruptures of 4 years’ duration. The injuries had occurred during weight-lifting activities. Although the diagnosis had been made in the acute setting, the patient had deferred surgical treatment and then been lost to follow-up. On being evaluated at our institution, he complained primarily about his right arm and mentioned persistent antecubital pain with activities of daily living, a feeling of subjective weakness, and marked lack of endurance in both supination and flexion.

Physical examination revealed bilateral arm “Popeye” deformities (right more than left) with a palpable mass representing the chronically retracted muscle belly of the biceps brachii 12 cm proximal to the elbow flexion crease (Figure 1). Manual motor testing revealed 4/5 motor strength in flexion and supination, but, other than that, motor strength was normal throughout the right upper extremity. A

magnetic resonance imaging study of the right elbow showed absence of a distal biceps tendon and proximal retraction of the biceps brachii muscle belly consistent with clinical observation.

Given his symptoms, clinical and radiographic findings, and desire to improve on these findings, the patient decided to proceed with distal biceps reconstruction. As he wanted to avoid use of cadaveric tissue, a semitendinosus autograft was selected for the procedure.

The authors have obtained the patient’s informed, written consent to publish his case report.

Surgical Technique

The patient was positioned supine with the right elbow extended on a hand table. The left lower extremity was selected for semitendinosus harvest for 2 reasons: (1) The anterior cruciate ligament on the right knee had been ruptured, and the patient was anticipating reconstruction using 4-strand hamstring autograft, and (2) surgical time could be shortened by having a second surgical team harvest the semitendinosus while exposure

for distal biceps reconstruction was being carried out. A sterile tourniquet was used on the right upper extremity. A tourniquet was placed, but it was not inflated during semitendinosus harvest.

For reconstruction of the distal biceps, an S-shaped incision was made over the anterior aspect of the elbow. Superficial dissection revealed what appeared to be a thickened lacertus fibrosus with a thin neotendinous structure scarred to the medial aspect of the brachialis (Figure 2). The lateral antebrachial cutaneous nerve was dissected carefully from a mass of scar tissue adjacent to this neotendinous structure, which itself was then followed proximally to the retracted muscle belly of the biceps brachii. Meticulous dissection was then performed around the biceps brachii to gain the maximum degree of excursion.

A whip stitch was placed in each free end of the graft using No. 2 non-absorbable suture. A double-loop of No. 5 Fiberwire (Arthrex, Naples, Fla) was used to secure the construct to a free EndoButton with 5 mm of “flip distance” (Figure 3). This distance

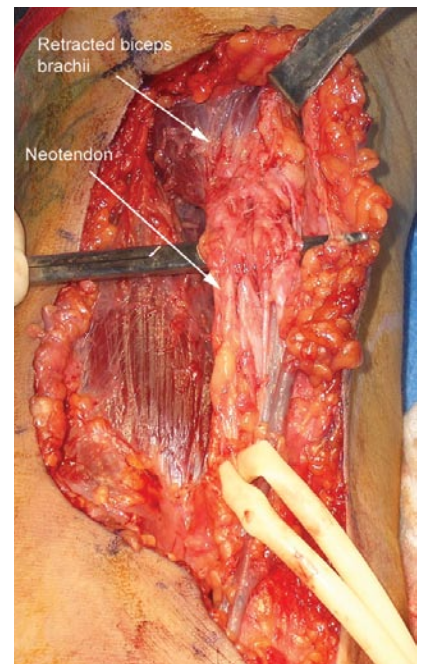


Figure 2. A thin, nonfunctional neotendinous structure extending from the muscle belly of the biceps brachii to the lacertus fibrosus was found scarred down to the medial aspect of the brachialis.

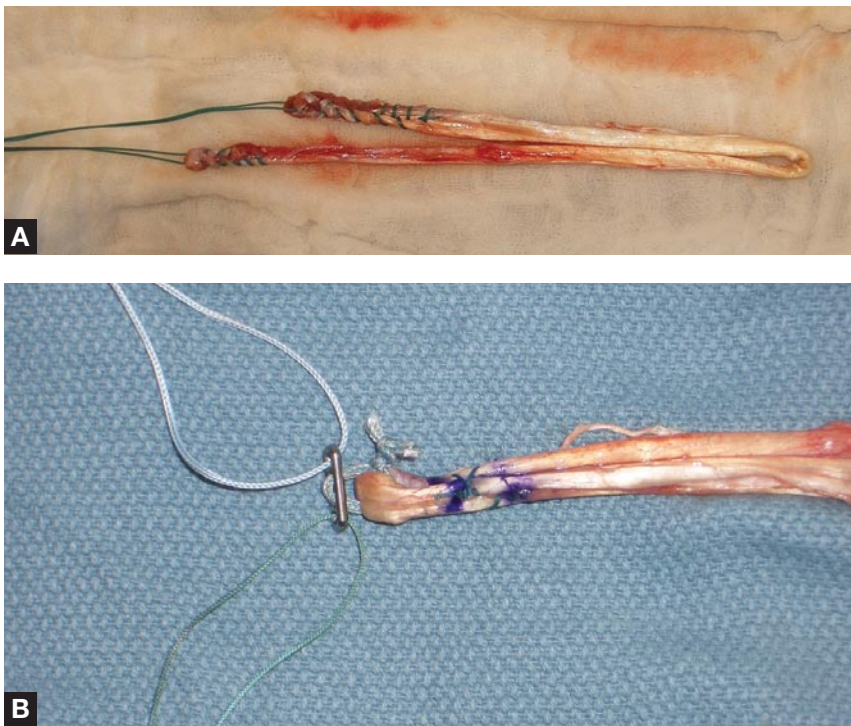


Figure 3. A double-loop semitendinosus autograft was prepared for EndoButton (Smith & Nephew, Andover, Mass) fixation.

was intentionally left shorter than the recommended distance based on past experience with compliance inherent in such soft-tissue constructs, need to maximize bone–tendon contact within a relatively short bony tunnel, and desire to minimize piston motion of the tendon construct within the recipient bone tunnel.

The forearm was maintained in maximal supination to protect the posterior interosseous nerve and to help deliver the tuberosity into the field. A 2.7-mm suture-passing, drill-tip guide pin was then drilled into the center of the bicipital tuberosity until the opposite cortex was securely engaged. Then a 6-mm cannulated acorn reamer was used as far as, but without violating, the opposite cortex. A cannulated EndoButton drill was then used to penetrate the opposite cortex. The suture-passing guide pin was retrieved through a stab incision in the dorsal forearm skin to deliver the “flip sutures” for the EndoButton. The semitendinosus autograft construct was then pulled into the prepared osseous tunnel, and the EndoButton was flipped against the opposite radial cortex. Fluoroscopy was used

to confirm correct placement of the EndoButton.

The free ends of the semitendinosus graft were woven through the biceps brachii neotendon stump and secured using No. 2 nonabsorbable suture. Tension was set with the elbow in 60° of flexion and in maximal supination (Figure 4).

A suction drain was then inserted, and the surgical incision was closed in layers. A soft, bulky, lightly compressive dressing was placed, and the elbow was splinted in 90° of flexion and approximately 45° of supination. The suction drain was removed on postoperative day 1, and the dressing was changed and the sutures removed on postoperative day 10. At that time, the patient was switched to a hinged elbow brace with an extension block set at 60° of flexion. Range of motion (ROM) was advanced an additional 10° each week in a supervised physical therapy program that permitted only active-assisted motion. Motion against resistance was begun 3 months after surgery, and return to unrestricted activity was permitted at 6 months.

At 1 year, the patient was subjectively satisfied with the outcome of the

operation, indicated he would choose to have the same operation again, and requested that it be performed on the left elbow. Active ROM was 3° to 145° of flexion, 78° of supination, and 80° of pronation. Elbow flexion strength and supination strength were graded 5/5 by manual motor testing.

DISCUSSION

Rupture of the distal tendon of the biceps brachii has been recognized as producing clinically significant deficits in elbow flexion strength, forearm supination strength, and forearm supination endurance.^{4,5} Most authors now recommend surgical repair of distal biceps avulsion for patients who will not tolerate these deficits in strength and endurance.^{4,5,8,10,14,15} Although nonanatomical repair techniques have been shown to provide adequate restoration of elbow flexion strength, they fail to restore supination strength or endurance.¹⁶ Anatomical repair of the distal biceps tendon to the radial tuberosity, however, permits restoration of both flexion and supination deficits.^{5,10,16}

Multiple techniques have been described for repair of acute distal biceps injuries.^{5,8-12,14,15,17,18} Morrey and colleagues⁵ reported restoration of normal flexion and supination strength 1 year after anatomical reinsertion into the radial tuberosity using a 2-incision, muscle-splitting technique with transosseous fixation. McKee

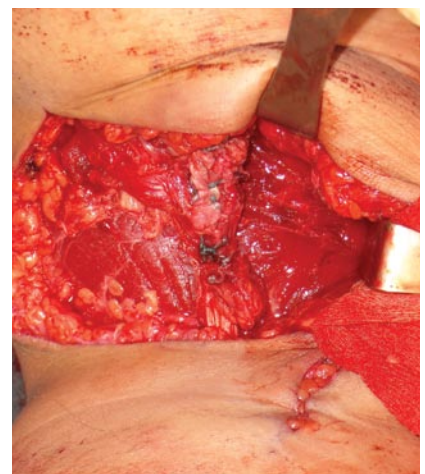


Figure 4. In the completed reconstruction, the semitendinosus autograft is woven through the remnant of the distal biceps tendon.

and colleagues¹⁴ reviewed the outcomes of 53 repairs using an anterior single-incision technique with suture anchor fixation and found 96% restoration of flexion strength and 93% restoration of supination strength at a minimum follow-up of 14 months. The authors also noted significantly higher DASH (Disabilities of the Arm, Shoulder, and Hand) scores for cases repaired less than 12 months after injury than for cases repaired more than 12 months after injury.

Bain and colleagues⁸ were the first to report using an EndoButton to repair distal biceps rupture. All 12 patients in their series (mean follow-up, 18.7 months) regained grade 5 strength, 5° to 146° mean flexion,

formed on 1 patient, revealed a 33% to 90% increase from normal supination strength. Sanchez-Sotelo and colleagues¹³ reviewed their experience using Achilles tendon allograft for reconstruction of chronic distal biceps rupture in 4 patients. Patients underwent reconstruction between 3.6 and 18 months after injury. At a mean follow-up of 2.8 years, mean flexion in the operative limb was 135°, and mean supination was 84°, with strength “comparable” with that of the normal extremity in 2 patients and “slightly less” than that of the normal extremity in the other 2 patients. Hang and colleagues⁷ reported on a single chronic distal biceps rupture reconstructed

“Despite the long time between injury and surgery (4 years), this reconstructive technique provided...significant restoration of flexion and supination strength...”

81° supination, and 80° pronation. Return to light activity was permitted 3 weeks after surgery. Greenberg and colleagues¹⁰ reported on a series of 14 acute distal biceps ruptures, also treated with EndoButton fixation, and followed for a mean of 20 months after surgery. Objective biomechanical strength testing revealed 97% restoration of elbow flexion strength and 82% restoration of supination strength. Mean flexion arc was 141°, and mean supination was 74°.

The literature includes few reports of delayed repair or reconstruction of chronic distal biceps ruptures.^{6,7,13,19} Hallam and Bain⁶ reported on a series of 9 patients treated with hamstring autograft reconstruction and EndoButton fixation between 2.5 and 6.5 months after rupture. Mean postoperative flexion arc was 3° to 147°, and mean supination was 75°. Biomechanical strength testing, per-

with autogenous semitendinosus tendon and a 2-incision technique with transosseous suture fixation. At 1-year follow-up, ROM was full. Biomechanical testing revealed that elbow flexion strength was 87% of normal and supination strength was 86% of normal.

We have described a chronic distal biceps rupture repaired with autogenous semitendinosus graft and EndoButton fixation. Despite the long time between injury and surgery (4 years), this reconstructive technique provided excellent symptom relief, significant restoration of flexion and supination strength, and subjective patient satisfaction with the outcome.

AUTHORS’ DISCLOSURE STATEMENT

The authors report no actual or potential conflict of interest in relation to this article.

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