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Anatomic direct repair of chronic distal biceps brachii tendon rupture without interposition graft

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Background: Rupture of the biceps brachii insertion is relatively uncommon and may present late. Chronic ruptures pose a management dilemma, with higher reported complication rates when surgery is delayed, whilst conservatively treated injuries may do badly in active patients.

Materials and methods: Six consecutive male patients with delayed presentation of biceps rupture were treated operatively using a limited standard anterior approach, a secondary proximal ''retrieval'' incision, and EndoButton fixation. This modification of the well-described EndoButton technique for distal biceps reconstruction allows passage of the shortened tendon in maximal elbow flexion and a rehabilitation program without immobilization. The mean interval to repair was 79 days (range, 35-116 days). The mean age at presentation was 47.5 years. The injury mechanisms were unexpected loads on a flexed supinated forearm.

Results: Patients were assessed at a mean of 20.2 months. Range of motion was restored to 94% in flexion and 95% in prosupination compared with the uninjured limb. Supination endurance was reduced by 9 repetitions/min compared with the contralateral side (mean, 83.4 repetitions/min). Mayo Elbow Performance Scores were universally 100 and the mean Disabilities of Arm, Shoulder and Hand score was 4. Patient satisfaction was high, with visual analog scores of 92 to 100. No major complications occurred, and all repairs were intact at the final follow-up.

Conclusions: Our outcomes are comparable to acute repair, with restoration of range of motion and function and few complications.

Level of evidence: Level IV, Case Series, Treatment Study.

Keywords: Biceps brachii; biceps rupture; biceps repair; chronic repair biceps; delayed biceps repair; Endobutton

Injury of the distal bicep brachii tendon is relatively uncommon, comprising 3% of bicep ruptures (96% long head, 1% short head). The mechanism of injury is of unexpected eccentric loading of a flexed, supinated arm, usually in middle-aged men. The pathophysiology is poorly understood; however, degenerate tendinopathy, local attrition, mechanical impingement, and use of anabolic steroids have all been implicated.[2,11,18,21]

Although the clinical findings tend to be classic, the infrequency of the injury and the good range of active elbow flexion that is evident on examination may result in

Formal Ethical Committee approval was not required. Patient consent for medical photography was provided.

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delayed presentation and diagnosis. Historically, conservative management has been suggested for acute distal ruptures. However, with biomechanical confirmation of the loss of flexion and supination strength of 25% to 30% and 25% to 40%, respectively, and with a reduction in supination endurance of 86% secondary to neglected injury, most authors would now advocate acute anatomic repair rather than nonanatomic repair, most commonly to the brachialis tendon.[4,23] With resultant loss of supination strength after tendon transfer to the brachialis reported at 50%,[17] the emergence of new techniques has allowed direct repair to become the preferred treatment for patients wishing to achieve full return of strength and function.[18]

Chronic ruptures may be difficult to treat, with increased complication rates, whereas conservative treatment may lead to an unsatisfactory outcome in active patients.[4,5] Tendon retraction, scarred fascial planes, and muscle atrophy complicate any potential surgical repair.

Although there is no agreed-on interval defining delayed presentation, use of grafts has been advocated for the treatment of chronic ruptures to regain tendon length and avoid flexion contracture.[16] Harvesting an autograft may cause donor site morbidity, and using an allograft carries a risk of infection and significant cost. We therefore modified the EndoButton (Smith & Nephew, Andover, MA, USA) technique, as described by Bain et al,[3] and treated patients presenting >28 days after injury by performing the repair directly to the radial tuberosity without using an interposition graft. The postoperative protocol involved immediate mobilization without plaster or bracing. We present the results of 6 consecutive patients treated with this technique.

Methods and materials

Patients presenting to our hospital between July 2007 and November 2009 with distal biceps rupture were assessed and operated on by a single surgeon (N.S).

Six consecutive men, who were an average age of 47.2 years, underwent repair of chronic distal biceps tendon rupture, of which 5 returned for follow-up. Patient details are presented in Table I. We defined delayed repair as repair occurring beyond 28 days because there is no agreed-on interval currently in the literature. All patients completed postoperative questionnaires. The common mechanism of injury was an excessive or unexpected load on a flexed, supinated arm. Three patients injured their dominant arm.

The mean time to repair was 79 days after injury. Follow-up with clinical assessment and outcome questionnaire occurred at an average of 20.2 months (range, 12-28 months).

Operative technique

All patients were positioned supine with the extremity prepared and draped, without a tourniquet, on an arm table. A 5-cm longitudinal incision was made distal to the elbow crease. A Henry's approach was made to the proximal radius to expose the radial tubercle in full supination, and a bicortical drill hole was then carefully made with 4.5-mm drill. A burr was used to shape the entry drill hole to take the width of the tendon end and smooth the edges.

A second transverse 4-cm incision was made over the retracted stump of the tendon, usually palpable under the skin, about 5-cm proximal to the elbow crease. The tendon stump was usually found to be initially shortened to between 2 and 3 cm, the end folded over on itself, and encased in scar tissue. The musculotendinous junction was identified, followed by careful dissection of the entire scar off the longitudinal fibers of the tendon. This usually allowed recovery of a further 1 to 2 cm of the tendon. In every case, sufficient tendon was mobilized to allow 2 running Krackow locking sutures with No. 2 FiberWire (Arthex, Naples, FL, USA) to be inserted at 1-cm intervals to attach the distal tendon to the EndoButton.

Subsequent blunt mobilization was done with the finger to release the muscle belly from the deep fascia and underlying brachialis, and this gave further length. Care must be taken to avoid damage to the lateral cutaneous nerve of the forearm that is adherent to the deep surface of the biceps. The EndoButton and tendon end were then tunnelled subfascially under the elbow crease along the original path of the biceps to the radial tuberosity. No attempt was made to identify or repair the lacertus fibrosis or to excise the residual scar along the tract of the tendon. The outer holes of the button were then threaded with No. 1 Vicryl (Ethicon, Somerville, NJ, USA) and No.2 Ethibond (Ethicon).

In all cases, despite mobilization of the proximal tendon, the EndoButton could only be passed through the radius in significant elbow flexion, from 80° to 110°. Passage of the EndoButton in such flexion through only a volar incision was impossible. Therefore, the Vicryl and Ethibond were threaded to a standard silver probe to act as a suture leader and passed through the predrilled hole in the radius to exit through the mobile wad and then to exit the skin dorsally through a small incision over the probe as it reached the skin. The passage of the blunt end of the small probe is unlikely to cause injury to the posterior interosseous nerve.

The EndoButton was then advanced through bone with the ''lead'' Vicryl loop and ''flipped'', using the Ethibond ''following'' suture, once through both cortices. Once the EndoButton was passed, the elbow was allowed to extend on the arm table to its maximum without any applied force, and the resulting ''flexion contracture'' was recorded with a goniometer as the intraoperative maximal extension.

Postoperative protocol

The patient is placed in a simple broad arm polysling (Molnlycke Healthcare, Dunstable, Bedfordshire, UK) postoperatively for comfort at 90° of elbow flexion. Active range of movement is commenced at day 1 postoperatively. The patient is advised to do no resisted flexion exercises beyond 1 kg for 6 weeks. Active and passive extension is allowed as able, with the patient encouraged to use gravity-assisted extension of the elbow during the first 3 weeks. The sling is only worn for comfort. Physiotherapy to work on extension is commenced at 4 weeks. At 6 weeks, a return to normal activities is encouraged, although no specific biceps strengthening is allowed for 8 weeks.