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B2B: A technical note and case report on long head of biceps tendon autograft for chronic distal biceps tendon reconstruction

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Early primary anatomical repair after distal biceps tendon (DBT) rupture is indicated in active patients to restore loss in forearm supination and elbow flexion strength.[5] Occasionally, DBT ruptures are not initially recognized or there is a delay in clinical presentation.

Chronicity of a DBT tear has been linked to worsening atrophy, shortening, retraction, and fibrosis of the biceps muscle, making primary anatomical repair challenging.[4] In symptomatic patients, different allografts have been used to reconstruct the DBT with good reported clinical outcomes.[1,2,7,9] Autograft utilization potentially reduces surgical costs and host rejection; however, it is associated with morbidity at the donor site. Here we present a surgical technique for using the proximal long head of biceps autograft to augment a chronic DBT rupture.

Materials and methods

Surgical technique

Preparation

After general anesthetic and interscalene block, the patient is positioned in the beach chair position, with the arm in a pneumatic arm holder (Spider 2, Smith and Nephew, Watford, UK). Routine arthroscopy of the glenohumeral joint is performed. The long head of biceps tendon (LHBT) is released from its insertion on the glenoid (Fig. 1).

Graft harvest and proximal tenodesis

An open biceps subpectoral tenodesis is performed to attain a graft length of 7 to 9 cm. Distalization of the docking site of the tenodesis by 3 centimeters below the pectoralis major insertion allows for an additional 3 cm of excursion of the biceps muscle belly. The subpectoral tenodesis of the long head musculotendinous proximal end is performed as an onlay technique with 2 all suture anchors (Juggerknot 2.9 mm, Zimmer Biomet, Warsaw, IN, USA).

Distal tendon preparation

The limb is released from the pneumatic holder and placed on the arm table. A transverse incision proximal to the cubital fossa is made. While dissecting, the retracted DBT is retrieved proximal to the elbow (in extension). The stump is prepared and the LHBT autograft is attached in a side-to-side configuration with a 3-cm area of overlap; using a nonresorbable suture (Maxbraid Zimmer Biomet, Warsaw, IN, USA) in a whipstitch fashion. The distal part of the LHBT allograft is then attached to a looped fixation device with a button using a whipstitch (ToggleLoc with Ziploop Technology, Zimmer Biomet, Warsaw, IN, USA).

Ramsay Health Care QLD Human Research Ethics Committee (RHC QLD HREC) approved this study (Protocol 19/07).

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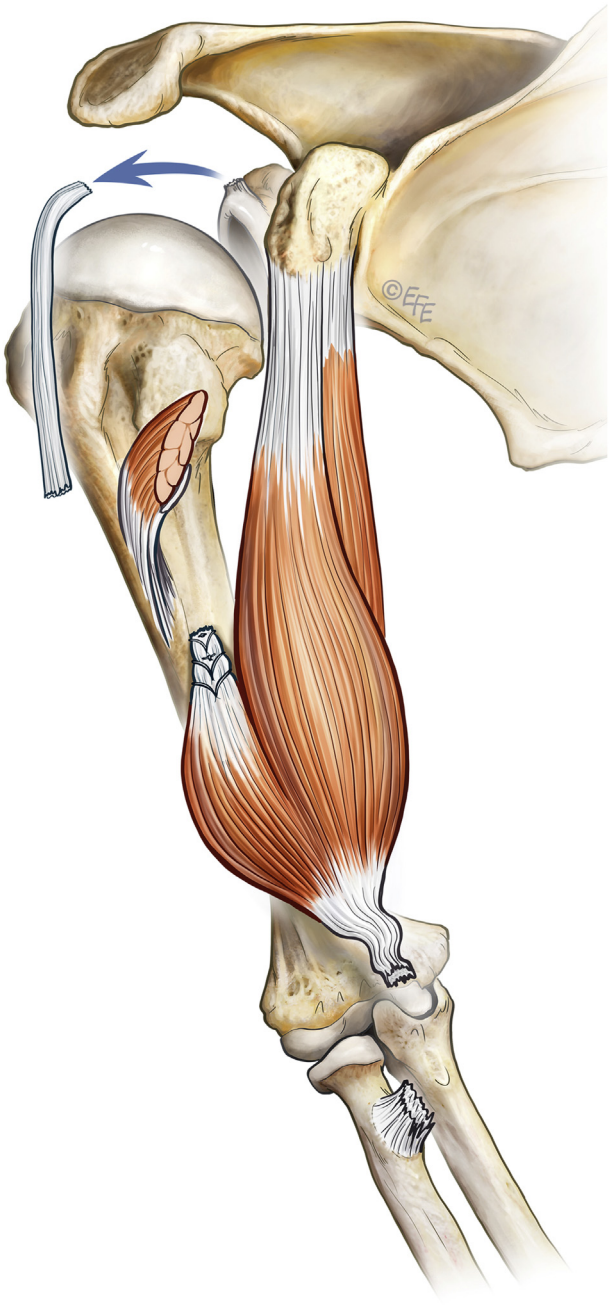

Figure 1 Artistic impression of harvesting the graft (of a right shoulder). The long head of biceps tendon is harvested and a subpectoral tenodesis (the pectoralis major muscle is reflected and transected in the image for clarity) is performed.

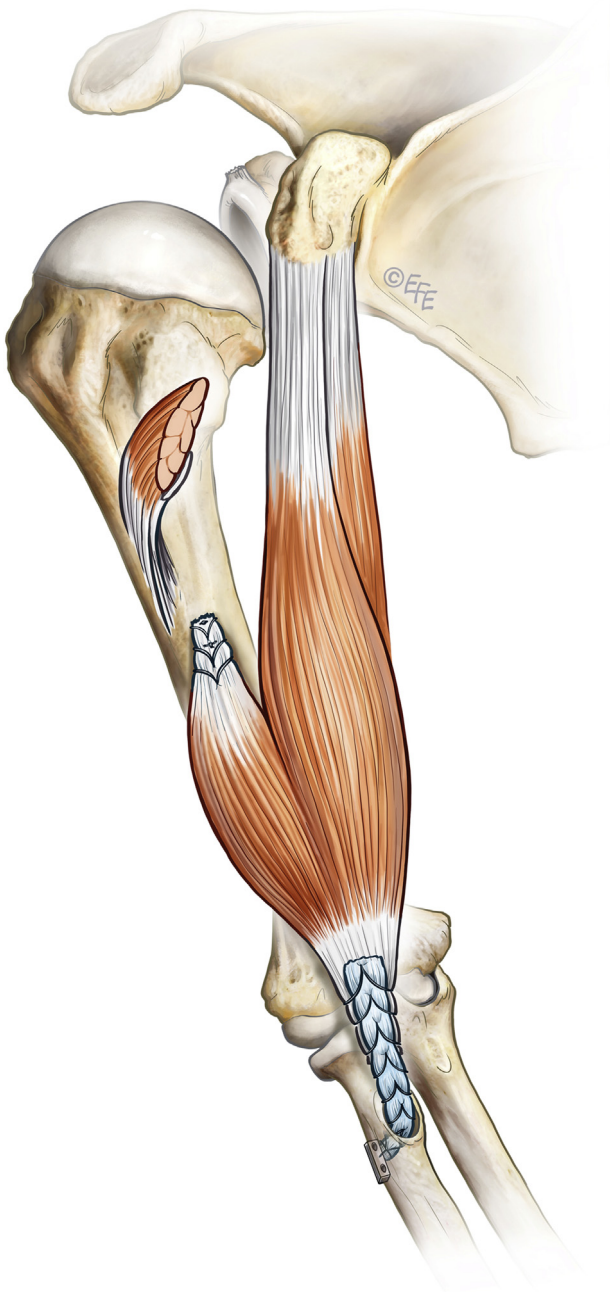

Figure 2 Artistic impression of graft incorporation (of a right shoulder). The long head of biceps tendon graft is used as an autograft for distal biceps tendon repair after a subpectoral tenodesis (the pectoralis major muscle is reflected and transected in the image for clarity).

Proximal radius preparation

An additional transverse incision 5 centimeters from the cubital crease is made in accordance with Henry's approach to gain exposure over the proximal radius.[3] The biceps tuberosity should be identified with the arm in maximum supination. A 2.9-mm guide pin is placed through the biceps tuberosity through both cortices. Next, the docking site is prepared by drilling the ventral radial tuberosity using a 7-mm drill guide. The unicortical tunnel edges are smoothened using a burr.

Docking the graft

The button is passed through the dorsal cortex and flipped and the looped fixation device is tightened by pulling alternately on the free limbs, while guiding the distal part of the graft into the transosseous tunnel. This results in a stable dock (Fig. 2). Care is taken to achieve full pronation and supination at 15 degrees of elbow flexion. The wounds are closed in layers and dressings applied.

Postoperative protocol

Postoperatively, the arm is positioned with the elbow in a dorsal blocking elbow splint at 90 degrees flexion for 6 weeks with passive ROM allowed as tolerated. Guided rehabilitation is commenced after 6 weeks with weaning of the brace and a progressive resisted

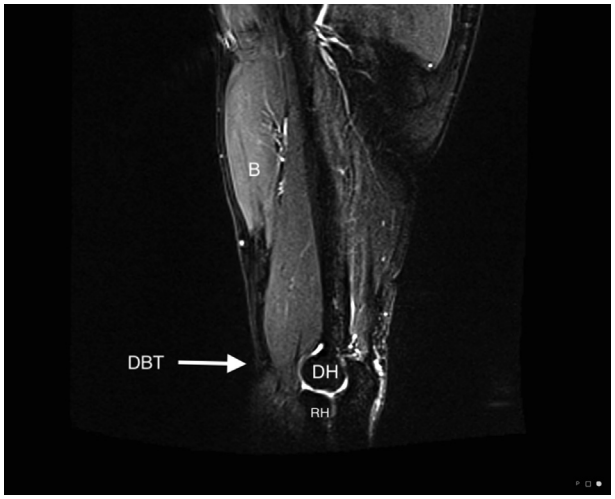

Figure 3 Preoperative MRI (T2 weighted, sagittal view) showing distal biceps tendon rupture and retraction. *B*, biceps muscle; *DBT*, retracted distal biceps tendon; *DH*, distal humerus; *RH*, radial head.

exercise program is instituted, allowing passive stretching as required. After 12 weeks, full activity as tolerated is permitted with return to sports.

Results

Case report

A 60-year-old, right-hand-dominant men sustained an injury to his left shoulder and elbow while pulling himself underneath a truck, 9 months before presentation. He had ongoing pain in both joints but was able to work on light duties. He complained of a painful shoulder with loss of power in his elbow and forearm. He was a smoker.

On clinical examination, he had restricted forward elevation and pain in the shoulder consistent with a rotator cuff tear. The DBT could not be palpated (hook test negative), and there was loss of strength of forearm supination. MRI scan of the upper extremity demonstrated a DBT rupture with retraction of approximately 7.5 cm (Fig. 3) and a partial rupture of the anterior supraspinatus tendon, with LHBT lying within bicipital groove. Informed consent was obtained from the patient and a rotator cuff repair with proximal biceps autograft for augmentation of chronic distal biceps rupture as per the technique described was performed (Fig. 4). The study was conducted in accordance with the principles of the Declaration of Helsinki (64th WMA General Assembly, Brazil, October 2013) and in accordance with the National Health and Medical Research Council Act 1992.

At six months follow-up, the patient reported no pain and gained good function. Pronation (Fig. 5) and supination (Fig. 6) were both 85 degrees with a pronation strength comparable with the nonoperated side (6.2 kg vs. 6.1 kg), and supination strength of 8.6 kg compared with 6.8 of the nonoperated side. He had elbow flexion of 140 degrees (Fig. 7), extension of 0 degrees (Fig. 8) with a flexion force of 11.6 kg compared with 10.0 kg on contralateral nonoperated side. The QuickDASH score (a self-reported questionnaire on physical function and symptoms in the upper limb) at 3 months follow-up was 18.2 points which improved to 2.3 points at 6 months postoperative (0 no complaints, 100 most severe disability). The Mayo Elbow Performance Score (a self-reported questionnaire on limitations of the elbow during activities of daily) at 3 months follow-up was 85 points, which improved to 100

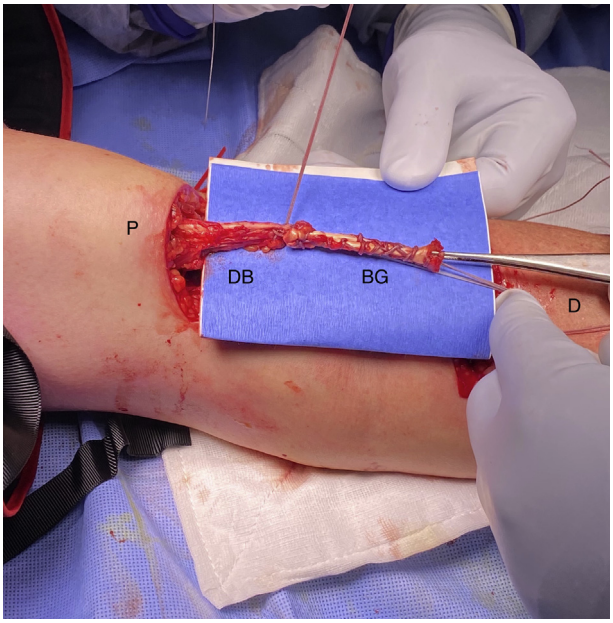

Figure 4 Intraoperative tendon-graft construct showing sufficient length. *DB*, distal biceps; *BG*, biceps graft; *P*, proximal side; *D*, distal side.

Figure 5 Six months postoperative function of the elbow in full pronation (left is the affected side).

Figure 6 Six months postoperative function of the elbow in full supination (left is the affected side).

Figure 7 Six months postoperative function of the elbow in full flexion.

Figure 8 Six months postoperative function of the elbow in full extension.

points at 6 months postoperative living (0 poor function, 100 excellent function). The postoperative MRI scan at 6 months showed an intact and incorporated graft (Fig. 9).

Discussion

Nonoperative management of DBT ruptures can lead to a significant elbow functional deficit, with up to 30% and 40% loss of flexion and forearm supination strength, respectively.[6] Delayed

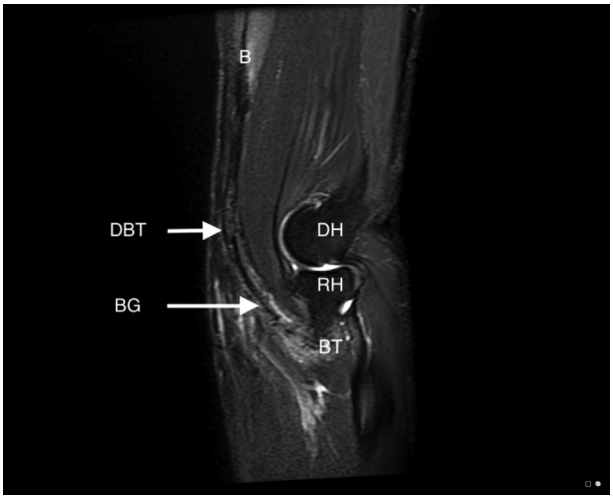

Figure 9 Postoperative MRI (T2 weighted, sagittal view) showing a continuous and incorporated graft to the radius without any scar tissue. *B*, biceps muscle; *DBT*, distal biceps tendon; *BG*, biceps graft; *DH*, distal humerus; *RH*, radial head; *BT*, biceps tuberosity.

direct repair of the DBT is reported to have good clinical results.[1,8] However, with increasing proximal retraction, reconstruction of the DBT with autograft or allograft is generally required to provide adequate length for fixation to the radial tuberosity.

Despite small patient numbers, several studies have reported good clinical outcomes after autograft[1,9] or allograft[2,7] reconstruction techniques with satisfactory restoration of strength and range of motion. Phadnis et al[7] reported on 21 patients who underwent delayed DBT reconstruction using Achilles tendon allograft with a mean follow-up of 25 months. Functional outcomes improved significantly, and all patients returned to preinjury activity level. Frank et al[1] compared 19 patients undergoing semitendinosus autograft reconstruction with 16 patients that underwent delayed direct repair. They reported equal improvements in strength and range of movement with no differences in complication rate. They concluded that when direct repair was not feasible, reconstruction with autograft provided predictably good outcomes.

Using allograft over autograft saves graft harvest time and avoids donor-site morbidity; however, use of allograft tissue poses allograft associated failures and additional financial costs. Allografts pose a longer graft integration time in addition to a higher graft stretch and failure rate than autografts. Furthermore, a potential risk of disease transmission remains when using allograft.[8]

The most commonly used autograft for DBT repair is semitendinosis.[1,9] Although this technique has potential donor-site morbidities such as pain, paresthesias, or hematoma. We identified no reports using LHBT autograft for distal biceps reconstruction and there are several advantages of using LHBT. Shoulder arthroscopy easily allows inspection and tenotomy of the LHBT. A mini-open incision to perform a subpectoral biceps tenodesis allows adequate length of autograft to be harvested with minimal additional donor-site morbidity. Furthermore, performing a subpectoral biceps tenodesis allows mobilization of the muscle belly and additional increased excursion distally of the retracted distal biceps tendon for reconstruction. The LHBT provides sufficient length and diameter to reconstruct the DBT. A potential limitation of using the LHBT is degenerative changes making the graft unsuitable, which can be assessed on MRI preoperatively and an alternative graft may be utilized.

Conclusions

This case report presents a technique to use a free autograft from the proximal long head of biceps tendon in treatment of a chronic distal biceps tendon rupture, where primary fixation was not feasible. Distalization of the biceps long head muscle belly by long head tenotomy and resultant autograft for distal reconstruction has surgical advantages showing excellent results at short-term follow-up with good strength and a full range of motion. This technique can be an addition to existing grafting options in the treatment of distal biceps tendon ruptures, especially where shoulder arthroscopy to manage concomitant shoulder pathology, such as a rotator cuff tear, is also required.

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Conflicts of interest

The authors, their immediate families, and any research foundations with which they are affiliated have not received any financial payments or other benefits from any commercial entity related to the subject of this article.

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Patient consent

Obtained.

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