Case Report

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Reconstruction of chronic long head of biceps tendon tears with gracilis allograft: report of two cases

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We present two cases of symptomatic chronic long head of the biceps tendon (LHBT) ruptures treated with reconstruction of the tendon with an allograft due to native tendon shortening in one case and complete native tendon loss in the other. A gracilis allograft was Pulver-Taft weaved through the biceps muscle belly to reconstruct the LHBT and provide sufficient working length to perform a subpectoral tenodesis. In cases of chronic, symptomatic LHBT rupture with a shortened or absent tendon, a gracilis allograft can be used to reconstruct the biceps tendon and to perform a subpectoral tenodesis, providing symptom relief and reversing a Popeye muscle.

Keywords: Proximal biceps reconstruction; Long head biceps reconstruction; Allograft biceps reconstruction; Biceps tendon deficiency; Subpectoral tenodesis

Long head of the biceps tendon (LHBT) ruptures are commonly seen in patients over the age of 50 years [1]. The anatomy of the tendon predisposes it to rupture as it courses through the bicipital groove prior to making a near 90° turn toward its attachment on the supraglenoid tubercle of the scapula and superior glenoid labrum [2]. Long head of biceps tendon tears are described as either partial- or full-thickness and often occur at the hypovascular zone between 1.2 and 3.0 cm from the origin of the tendon [3]. Risk factors for rupture include recurrent tendinitis, a history of rotator cuff pathology, a contralateral biceps tendon rupture, age, and inflammatory arthritides [4]. In most patients, these ruptures are asymptomatic or mildly symptomatic and may be managed nonoperatively with rest, ice, activity modification, nonsteroidal anti-inflammatory drugs, physical therapy, and corticosteroid injections into the bicipital sheath [3,5]. However, some patients may develop a cosmetically unappealing Popeye deformity, muscle belly cramping, pain, muscular fatigue, and loss of supination strength, as seen in the biceps tenotomy literature [2,5-7]. In patients with symptoms refractory to nonoperative management, surgical intervention may be required. Ideally, these tears should be identified early and surgically treated so that the muscle-tendon unit can be retensioned and tenodesed. However, in patients who present with chronic ruptures, the tendon may be retracted, shortened, or altogether absent [6]. When faced with this dilemma, our management approach has been to leave the biceps in situ, and the patients' symptoms have continued. Another option is to reconstruct the long head of biceps tendon and then perform a tenodesis. However, to date, there are no reports describing this procedure. Several techniques for distal biceps tendon reconstruction with an allograft have been described [8-10]; however, this is the first report of long head of biceps tendon reconstruction and tenodesis to our knowledge.

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CASE REPORTS

The Institutional Review Board (IRB) of Southern California Kaiser Permanente does not require IRB approval for case reports on 6 or less patients. Informed consent was obtained from the patients for publication of this case report and the accompanying images.

Case 1

A 50-year-old right-hand-dominant male school bus driver presented with right shoulder but mostly arm pain, as well as cramping of the biceps muscle for more than 1 year after lifting a heavy barbeque. Conservative management efforts, including activity modification, nonsteroidal anti-inflammatory medications, and physical therapy, had failed to alleviate his pain. The pain and cramping were affecting his ability to operate the school bus. On physical examination, he had a Popeye muscle deformity (Fig. 1) and tenderness over the biceps muscle belly. Plain radiographs were unremarkable. Magnetic resonance imaging demonstrated a partial-thickness, articular-sided tear of the subscapularis tendon with moderate hypertrophic tendinopathy of the subscapularis tendon and non-visualization of the proximal biceps tendon, compatible with a biceps tendon rupture (Fig. 2). He underwent LHBT reconstruction as described below. At the 1-year follow-up, he had maintained the contour of the biceps muscle and had no pain or cramping. He had a Single Assessment Numeric Evaluation (SANE) score of 100 at his follow-up and was very satisfied with the outcome of the procedure.

Fig. 1. Popeye muscle deformity of the right biceps.

Surgical technique

The patient was positioned in a reclining beach chair position. The inferior border of the pectoralis was marked in line with the anterior axillary wall (Fig. 3). An incision was carried distally from that line over the anterior compartment. The anterior compartment was entered and the muscle belly of the LHB was identified (Fig. 4). The muscle belly was carefully freed from surrounding tissue to be able to mobilize it. Care was taken to identify and protect the neurovascular bundle entering the biceps muscle posteriorly (Fig. 5). A 240-mm gracilis allograft tendon (LifeNet Health) was weaved through the biceps muscle belly in a Pulver-Taft fashion (Fig. 6). The allograft tendon end was then sutured with #2 FiberWire (Arthrex) in a Krakow fashion (Fig. 6B). A cannulated spade tip guide pin (diameter of 3.2 mm) was then placed bicortically into the humerus. The sutured tendon diameter was 4.5 mm. Therefore, a 5.5-mm ream was used over the guide pin to create a socket without violating the back wall.

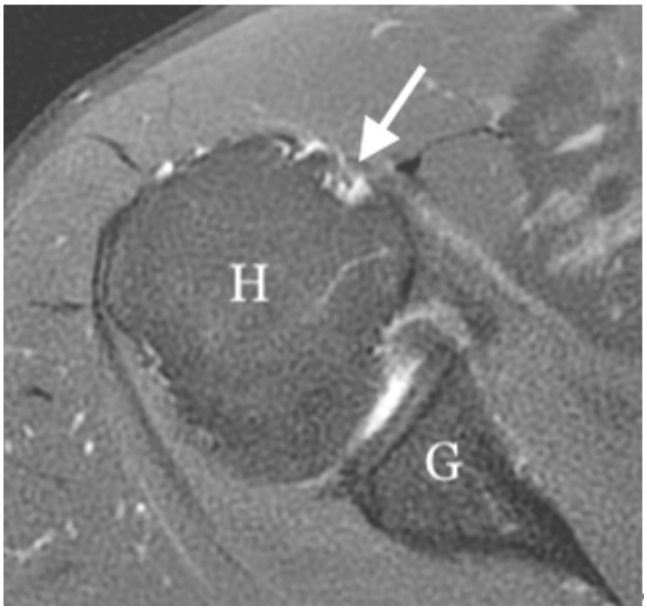

Fig. 2. Axial T2 magnetic resonance imaging demonstrating the absence of the biceps tendon from the bicipital groove (arrow). H: humeral head, G: glenoid.

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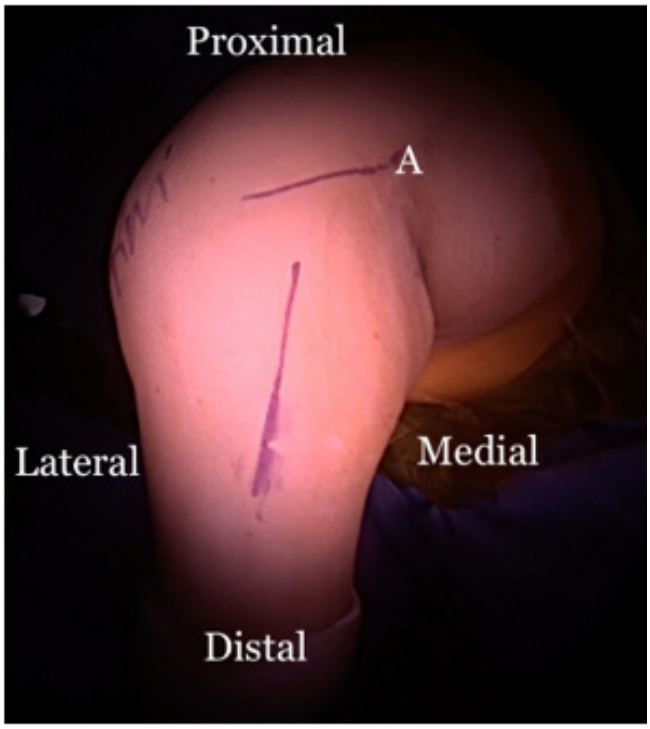

Fig. 3. Anterior view of the right shoulder demonstrating the line of the anterior axillary wall (A) and the incision over the anterior compartment (the entire marking was not used).

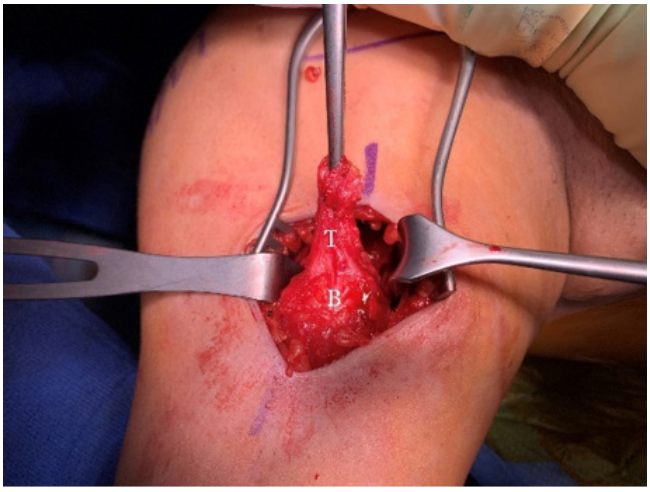

Fig. 4. The biceps (B) muscle belly was dissected free and mobilized and a shortened biceps tendon (T) is demonstrated.

#2 FiberWire sutures were then passed through a BicepsButton (Arthrex), which was advanced through the tunnel and the guide pin hole in the back cortex. The button was disengaged from the insertor and flipped onto the back cortex. The sutures were then pulled in a tension slide fashion, and the allograft tendon was advanced into the socket. A knot pusher was used to tie knots and

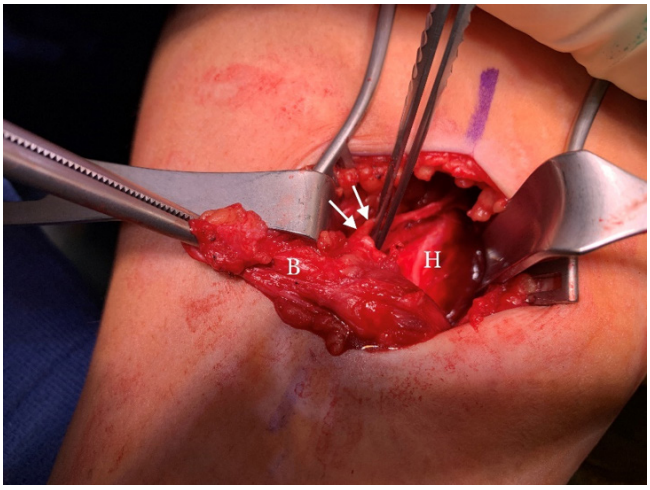

Fig. 5. The biceps (B) muscle was retracted, demonstrating the neurovascular structures (arrows) entering the muscle belly posteriorly. H: humerus.

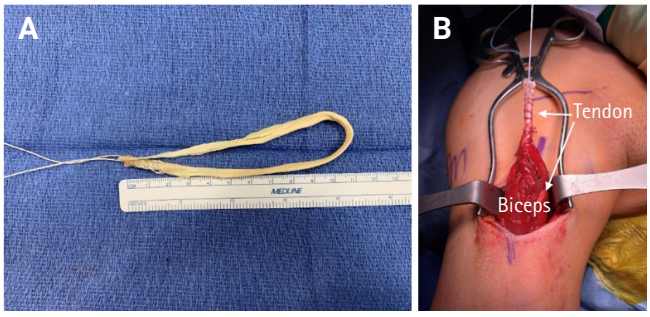

Fig. 6. (A) Gracilis tendon allograft (LifeNet Health), 240 mm in length, was sutured on one end with #2 FiberWire (Arthrex) in a Krakow fashion. (B) The gracilis tendon allograft was Pulver-Taft weaved (arrow) through the biceps muscle belly.

advance them to the bottom of the tunnel. A 4.75-mm BioComposite SwiveLock anchor (Arthrex) was also placed into the tunnel for aperture fixation of the tendon graft.

Postoperative care

The patient was placed in a padded sling for 2 weeks. Pendulum exercises were initiated at that time, as were active and active assist range of motion exercises. The patient was instructed not to lift more than 5 pounds on the operative arm for 6 weeks and not to reach behind with that arm to avoid placing tension on the graft and repair site. Resistance exercises were initiated at 6 weeks and gradually transitioned to strengthening with weights at 3 months. Full recovery was expected by 6 months.

Case 2

A 53-year-old right-hand dominant male court reporter present-

ed with right shoulder and arm pain and stiffness for greater than 1 year that started after lifting heavy weights at home. His symptoms of biceps pain and cramping were refractory to conservative treatment. On physical examination, he had full symmetric range of motion of the shoulder but had a Popeye deformity with tenderness along the biceps muscle. Plain radiographs were unremarkable. The proximal biceps tendon was not visualized on magnetic resonance imaging, and there was tendinopathy of the supraspinatus, infraspinatus, and subscapularis without evidence of a tear. He underwent the identical technique described for the first patient. At his 1-year follow-up, he was extremely satisfied with the procedure and had no pain or cramping. The normal contour of the biceps was restored and maintained. His SANE score was 100, and he had resumed all activities.

DISCUSSION

Long head of biceps tendon (LHBT) ruptures are seen mostly in men in their 50s and are most commonly treated non-surgically [1]. Most patients are treated successfully nonoperatively [3,5]. However, a case series by Kelly et al. [11] analyzing functional outcomes following arthroscopic biceps tenotomy found a statistically significant difference in number of biceps curls to fatigue in the older age group versus the younger age group when comparing the tenotomized arm with the contralateral arm. Discomfort symptoms were reported at a greater rate in age groups outside of the older age group, which was statistically significant compared to the other age groups. Sturzenegger et al. [12] demonstrated that the strength of elbow flexion was diminished by 16%, that of supination of the forearm by 11%, and that of shoulder abduction by 16% following rupture of the LHBT. These findings indicate that some patients continue to have persistent biceps-related complications, such as cosmetic deformity, cramping, pain, and weakness [2,5-7,13] and elect to undergo surgical intervention. When surgery is performed early enough after the injury, sufficient tendon remains to allow for tenodesis. However, chronic ruptures are much more challenging to treat due to tendon shortening and retraction [6]. Reconstruction of the LHBT aims to mitigate these functional deficits particularly in younger, more active individuals and those with a largely manual labor occupation as it pulls the muscle-tendon unit back to length, alleviating cramping and pain.

This article describes a novel surgical technique using a gracilis tendon allograft that is Pulver-Taft weaved through the muscle belly of the long head of the biceps to allow subsequent subpectoral tenodesis. Indications include chronic proximal biceps tendon ruptures where primary repair and tenodesis cannot be performed, elbow supination strength and endurance deficits, and failed nonoperative management. Contraindications include active infection and immunosuppression. The main advantages of this technique are that use of an allograft avoids donor-site morbidity and the Pulver-Taft method allows integration of the graft into the native muscle belly. We believe that using the Pulver-Taft technique for implantation provides improved pull-out strength of the graft compared to the onlay technique, although this has not been demonstrated in any studies to date. Disadvantages include the cost of the allograft, fixation implant costs, risk of disease transmission from the allograft, risk of injury to the musculocutaneous nerve when dissecting around the proximal humerus, and an approximate 6-month recovery time. Further clinical research is needed, but this technique allowed reconstruction of symptomatic chronic LHBT ruptures with good functional and clinical outcomes.

NOTES

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Author contributions
Conceptualization: RM. Data curation: RM, AV. Investigation: RM. Methodology: RM. Supervision: RM. Writing – original draft: RM, AV. Writing – review & editing: RM, AV.

Conflict of interest
None.

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