Technical Note

Teres Major and Latissimus Dorsi Repair With Biceps Tenodesis Utilizing Cortical Suspensory Fixation Buttons

Victor Hoang, D.O., Taylor Anthony, B.S., Joseph Meter, D.O., M.Sc., Ajit Amesur, D.O., Arnold Alqueza, M.D., and Bassem T. Elhassan, M.D.

Abstract: Teres major (TM) and latissimus dorsi (LD) ruptures are relatively rare in the general population and have primarily been observed in overhead throwing athletes. Although the gold standard of care has traditionally been nonoperative, surgical repair of TM and LD tendon ruptures has become increasingly prevalent in high-level athletes who fail to return to play. Literature is scarce regarding operative repair of these tendon ruptures. Therefore, our goal is to present a potential technique for open repair to surgeons who may be faced with this unique orthopedic injury. Our technique details an open TM and LD repair, in addition to biceps tenodesis, using cortical suspensory fixation buttons with a combined anterior and posterior approach.

Introduction

Teres major (TM) and latissimus dorsi (LD) ruptures are relatively rare in the general population and have been reported primarily in overhead throwing athletes.[1] The most common mechanism of injury occurs in professional baseball players because of a shift from eccentric to concentric contraction of both TM and LD muscles during the pitching cycle. Forceful resisted shoulder adduction and flexion are other previously reported mechanisms.[2] Potential accompanying physical exams findings for this injury include adduction or internal rotation weakness, weakness, or pain reproducible with resisted internal rotation, decreased fullness of the posterior axillary fold, and swelling with or without ecchymosis at the axilla. Magnetic resonance imaging with a distally expanded view, which captures both TM and LD is routinely used to confirm rupture.[1,3-4] Nonoperative treatment has been considered the gold standard for most, but high-level athletes who fail to return to play have led to increased frequency of surgical repair of these tendon injuries.[1,5] Because of the scarcity of literature regarding surgical repair of TM and LD ruptures, we have endeavored to present a reproducible systematic technique that may guide orthopaedic surgeons faced with this unique injury. Therefore, we present a technique detailing the repair of TM and LD tendon ruptures, with an accompanying biceps tenodesis through deltopectoral and posterior axillary approaches with the use of cortical suspensory fixation buttons.

From the Brigham and Women's Hospital/Harvard Medical School, Boston, Massachusetts, U.S.A. (V.H.), Touro University Nevada College of Osteopathic Medicine, Henderson, Nevada, U.S.A. (T.A.); Valley Hospital Medical Center, Las Vegas, Nevada, U.S.A. (J.M.); Valley Hospital Medical Center, Las Vegas, Nevada, U.S.A. (A. Amesur); Brigham and Women's Hospital, Boston Massachusetts, U.S.A. (A. Alqueza); and Massachusetts General Hospital, Boston, Massachusetts, U.S.A. (B.T.E.)

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Address correspondence to Victor Hoang, D.O., Brigham and Women's Hospital/Harvard Medical School, 75 Francis St., Boston, MA, 02115, U.S.A. E-mail: Hoangorthopedics@gmail.com

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Surgical Technique (With Video Illustration)

Indications

This technique is indicated for treating traumatic acute to subacute ruptures of the TM and/or the LD in highly active patients or elite athletes. Although this procedure can be performed on less active or sedentary patients, surgeons should strongly consider patient compliance and the ability to recover postoperatively in deciding to proceed with surgery. Magnetic resonance imaging of the left shoulder commonly demonstrates a complete rupture of the TM tendon with a complete or partial LD tendon tear at its insertion on the humerus

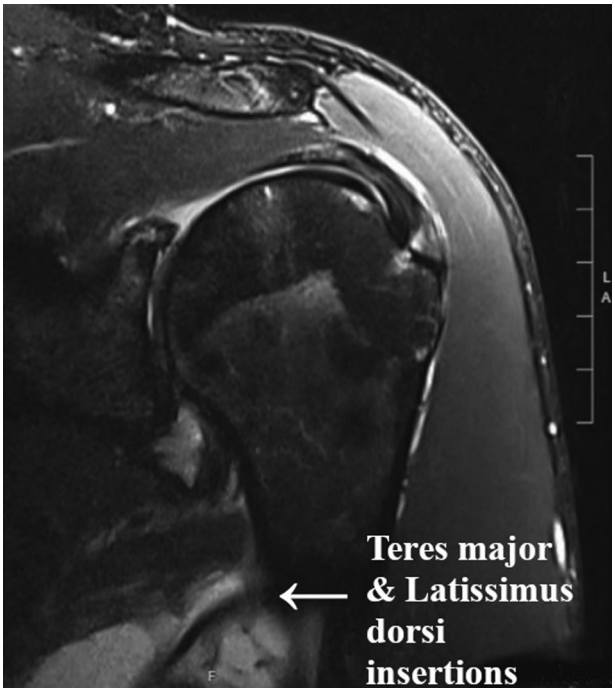

Fig 1. Preoperative T2 coronal view of the left shoulder demonstrating a complete rupture of the teres major tendon with a partial latissimus dorsi tendon tear at its insertion on the humerus with intramuscular edema and hematoma.

with intramuscular edema and hematoma formation (Fig 1).

Materials

This technique uses the following items: Stryker power drill, electrical burr, electrocautery, four cortical suspensory fixation buttons with drill bit, #2 SutureTape (Arthrex, Naples, FL) suture scissors, and needle driver.

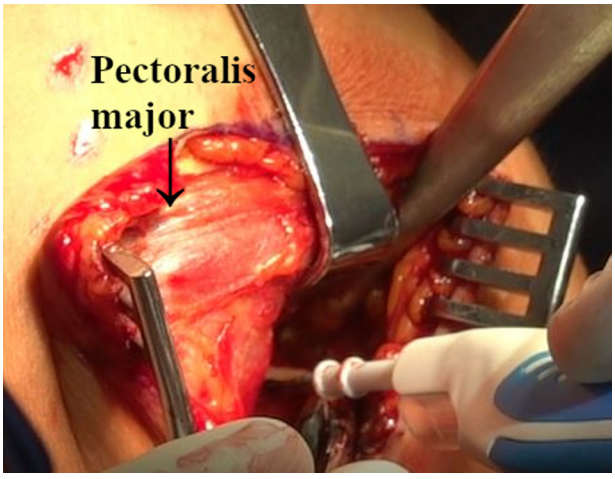

Fig 2. Intraoperative image of the left shoulder from an anterior viewpoint with the patient in the beach chair position. The pectoralis major is retracted anteriorly during a deltopectoral approach to gain access to the teres major and latissimus dorsi tendons.

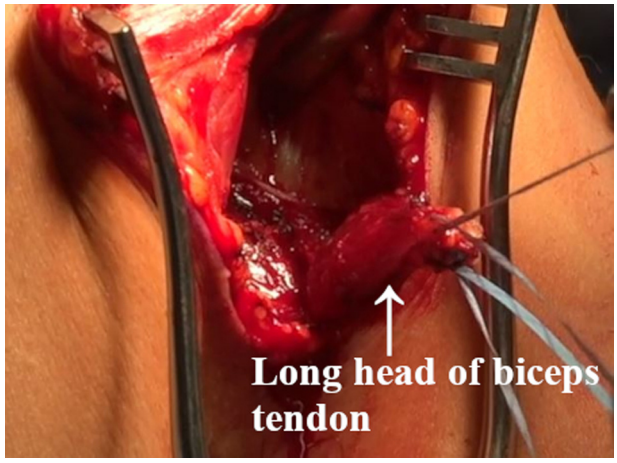

Fig 3. Intraoperative image of the left shoulder from an anterior viewpoint with the patient in the beach chair position. A Krackow stitch is placed into the tenotomized long head of the biceps tendon prior to tenodesis.

Patient Positioning

The patient is placed in a beach chair position with bony prominences padded. The operative upper extremity is prepped and draped in usual sterile fashion. Care should be taken to obtain sufficient exposure when draping in the case of making a second incision at the posterior axilla.

Deltopectoral Approach

A standard incision for an anterior deltopectoral approach to the shoulder is created and extended ~6 cm from the axillary fold. Skin flaps are raised. The underlying muscular anatomy is identified. The pectoralis major is identified and pulled anterior, exposing the TM and LD tendons (Fig 2). The long head of the biceps tendon (LHBT) is identified and tenotomized

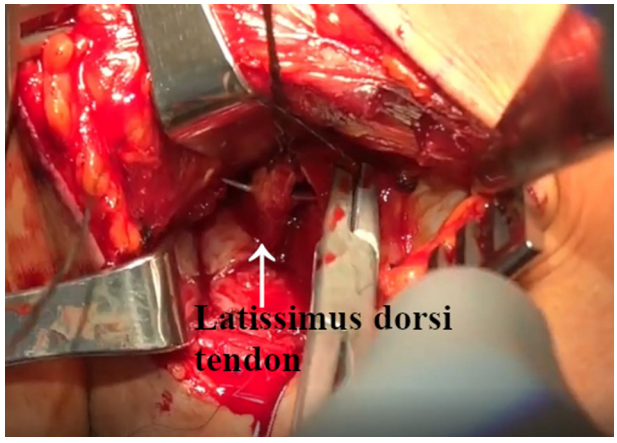

Fig 4. Intraoperative image of the left shoulder from an anterior viewpoint with the patient in the beach chair position. After identification of the latissimus dorsi tendon, a Krackow stitch is placed into the distal musculotendinous portion for later repair.

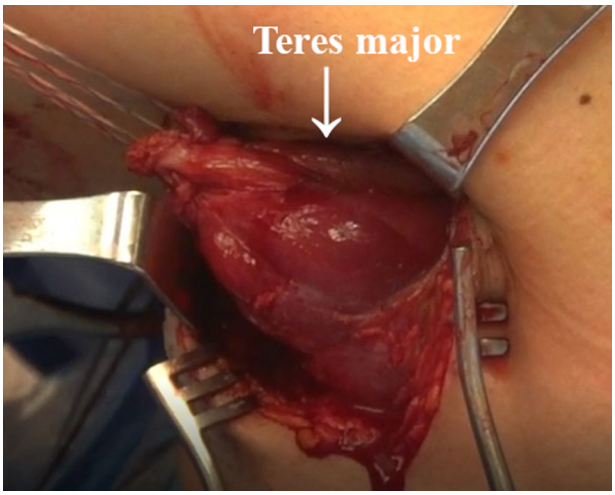

Fig 5. Intraoperative image of the left shoulder from a posterolateral viewpoint with the patient in the beach chair position. Two Krackow stitches are placed into the distal aspect of the teres major prior to passing the tendon anteriorly.

using a Krackow stitch with #2 SutureTape for later tenodesis (Fig 3). The LD tendon is then identified and inspected for pathology. A Krackow stitch is placed through the LD tendon distally for later repair (Fig 4). The TM tendon is then inspected, which in this case, demonstrated a complete rupture with extensive fraying and posterior retraction.

Posterior Axillary Approach

Next, to facilitate mobilization of the retracted TM, attention is turned to the posterior aspect of the shoulder. An incision is created at the level of the posterior axillary fold and extended distally for 5 cm.

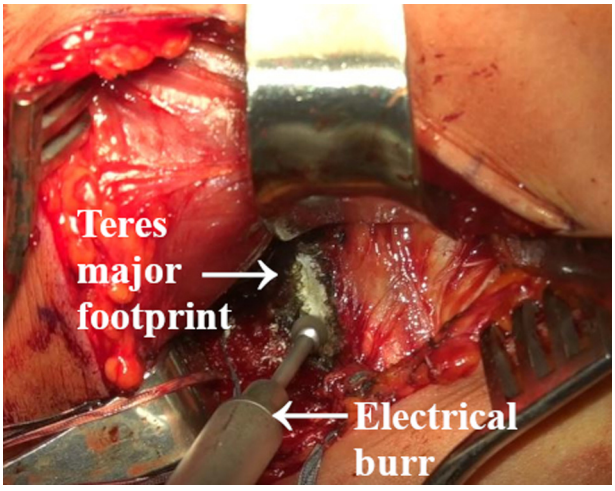

Fig 6. Intraoperative image of the left shoulder from an anterior viewpoint with the patient in the beach chair position. An electrical burr is used to create a trough at the teres major footprint of the humerus prior to drilling for reattachment with cortical suspensory fixation buttons.

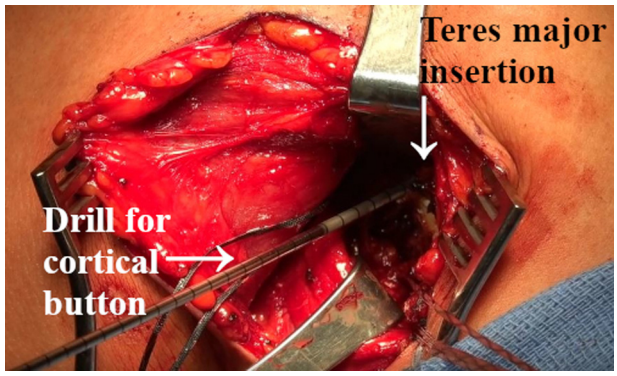

Fig 7. Intraoperative image of the left shoulder from an anterior viewpoint with the patient in the beach chair position. Two tunnels are drilled at the teres major footprint of the humerus, and two cortical suspensory fixation buttons are used to achieve reattachment of the teres major tendon.

Again, skin flaps are raised, and the underlying musculature is inspected. The TM tendon is identified, and an interval is created between the TM and the LD. The TM is dissected free and inspected again, confirming complete rupture. The tendon is sutured with two Krackow stitches into the tendon distally again using #2 SutureTape, and the muscle is dissected free circumferentially to improve mobility and excursion of the fibers. This prepares the tendon for anterior passage (Fig 5).

Tendon Passage and Fixation

The tendon is then passed from posterior to anterior using the attached SutureTape. Care is taken to ensure there is enough remaining length for reattachment at the humeral footprint for both LD and TM tendons. The sites for planned reattachments are debrided of remaining nonviable tissue, and these sites are marked for reattachment. A trough is created at the TM footprint with an electric burr (Fig 6). Two tunnels are

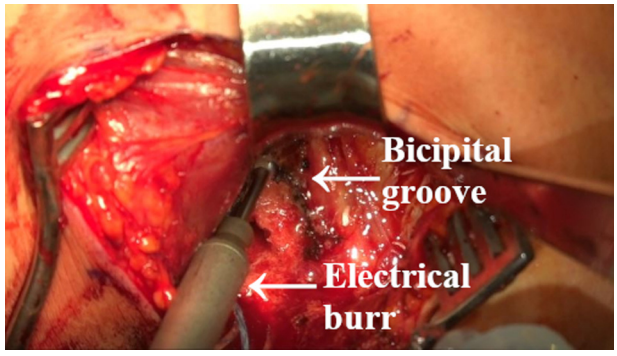

Fig 8. Intraoperative image of the left shoulder from an anterior viewpoint with the patient in the beach chair position. A 5-mm hole is created with an electric burr at the level of the bicipital groove prior to tenodesis of the long head of the biceps tendon with a cortical suspensory fixation button.

Table 1. Pearls and Pitfalls

Step	Pearl	Pitfall
Deltopectoral approach	Sutures should be placed in tendons to prevent further retraction.	Failure to do so may increase operative time, result in further unnecessary anatomic injury from additional dissection, and potentially lead to incorrect repair.
Posterior axillary approach	Surgeon should be prepared to open posteriorly because of the possibility of tendon retraction.	Failure to consider this preoperatively may preclude adequate exposure and result in inability to complete the repair.
Tendon mobilization	Adequate excursion should be assessed prior to repair.	If not assessed, tendon may be overtensioned and potentially risk rerupture or limit motion.
Biceps tenodesis	Special consideration should be given in cases of inflamed biceps tendons, which is common with this injury.	Failure to intervene may result in persistent postoperative pain and limited function, potentially affecting rehabilitation progress.
Immobilization	Patient should be immobilized in internal rotation in the initial perioperative period to protect the repair and facilitate tendon healing.	Rerupture may occur if immobilization is not addressed.

drilled, and two cortical suspensory fixation buttons are used to fixate the TM to the humerus, thereby restoring the native anatomy (Fig 7). The LD tendon is then repaired in a similar fashion using a single cortical suspensory fixation button. The construct is assessed with gentle traction, and stable repair is confirmed.

Biceps Tenodesis

Attention is turned to the LHBT, and a 5-mm hole is created with an electric burr at the level of the bicipital groove, just deep to the pectoralis major (Fig 8). The posterior humeral cortex is drilled for the cortical suspensory fixation button by passing the drill through the previously created burr hole at the anterior cortex. The suture holding the LHBT is then passed through the cortical suspensory fixation button creating marionette sutures. The cortical suspensory fixation button is then passed through the posterior cortex to rest in an extramedullary location. The marionette sutures are then tugged on to flip the button, which facilitates tendon intussusception into the humeral canal. A secure fit is ensured and the suture is tied to complete the tenodesis.

Wound Closure

The wound is thoroughly irrigated, and vancomycin is placed in the wounds. The wounds are then closed in a layered, subcuticular fashion, and a sterile dressing is applied. An arm sling is applied before the patient is awakened to maintain the shoulder in a position of internal rotation.

Postoperative Management

Postoperative recovery is broken down into 4 phases. The patient is fully immobilized with the shoulder in a position of internal rotation for 8 weeks. No shoulder motion is allowed. Early active elbow and finger range of motion is permitted. In phase 2, active assisted range of motion and aqua therapy are started. No strengthening or stretching is permitted. External rotation to neutral is allowed, but no further. Scapular stabilization exercises and core and hip strengthening are also performed. In phase 3, progressive stretching and strengthening are initiated. Increased mobilization of the shoulder in all directions is permitted. Scapular stabilization exercises and core hip strengthening are continued, as well as aqua therapy. In phase 4, the patient is permitted to progress to full activity and full strengthening as tolerated.

Discussion

TM and LD ruptures are rare injuries that primarily occur in professional baseball pitchers. Nonoperative treatment has historically been recommended for these injuries, but recent literature has been beginning to challenge this notion. Erickson et al. reports a similar return-to-sport rate in pitchers treated nonoperatively and operatively, although their nonoperative cohort had a decline in pitching performance metrics post-injury.[1] In a previous study, these authors recommended a 3- to 6-month nonoperative treatment period followed by operative repair if they cannot return to their previous level of play.[6] Although the majority of these repairs have been performed acutely to minimize the amount of tendon retraction and

Table 2. Advantages and Disadvantages

Advantages	• Potentially stronger construct due to cortical suspensory fixation buttons that may reduce risk of rerupture • Use of two incisions may aid in gaining exposure in cases with extensive tendon retraction. • Ability to assess radiographically intact fixation postoperatively because of cortical suspensory fixation buttons
Disadvantages	• Technically demanding procedure • Increased operative time due to two separate approaches • Cortical suspensory fixation button utilization presents theoretical risk of foreign body reaction.

scarring, there are reports of chronic LD repairs with excellent outcomes. Postoperative strength assessments in previously reported cases have demonstrated strength deficits in extension, adduction, and internal rotation, but the clinical significance was deemed uncertain because of these patients denying subjective weakness.[3] Because there are only a few reported reruptures in pitchers, additional studies with larger sample sizes are needed to determine a conclusive rerupture rate.

Because of the rarity of TM and LD ruptures, our goal of demonstrating this technique is to provide orthopaedic surgeons a step-by-step surgical technique if they are unfamiliar with this unique injury and the patient meets appropriate indications for operative intervention (Video 1). There have been excellent outcomes reported with the deltopectoral and additional posterior axillary approach in cases with significant tendon retraction.[2] Adequate exposure may not be achieved through a single anterior approach, and the surgeon should consider using a posterior axillary incision preoperatively (Table 1). Despite the approach utilized, the surgeon should be cautious of both the radial and axillary nerves to reduce the risk of iatrogenic injury. Although tendon fixation is commonly achieved with the use of suture anchors, we believe that the use of cortical suspensory fixation buttons may provide a stronger construct and reduce the risk of rerupture (Table 2).[2] Alrabaa and Ahmad describe the use of suture buttons for a LD tendon repair in a professional pitcher. There are no comparative biomechanical studies for fixation in LD and TM repair, but suture buttons have displayed superior strength in distal biceps.[7] Disadvantages to this technique include the technically demanding nature of this procedure, increased operative time due to two incisions, and the potential for foreign body reaction from the use of cortical suspensory fixation buttons. Although extremely rare, there is a report of a pitcher who sustained a spiral humeral shaft fracture originating from the inferior-most unicortical button drill hole 12 months postoperatively following a TM and LD repair.[8] Ultimately, further studies with-long term outcomes are needed to quantify whether surgical repair of these uncommon injuries is beneficial in high-level athletes compared to nonoperative management.

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