A New Technique for Repairing Pectoralis Major Muscle Injuries With Cortical Button Fixation

Erik A. Schnaser, MD, Curtis Noel, MD,* and Reuben Gobezie, MD†*

Abstract: Several techniques have been described for the treatment of pectoralis major tendon injuries. Surgical intervention has shown to yield superior clinical results in complete injuries. Without fixation, the patient may have poor functional and cosmetic results. We describe here a new technique for repairing complete ruptures of the pectoralis major tendon back to its insertion onto the humerus. To date, we have had promising results with this technique and believe it may have superior biomechanical properties over other methods of fixation.

Key Words: pectoralis major rupture, cortical button, unicortical, humerus

(*Tech Should Surg* 2010;11: 81–84)

Pectoralis major muscle injuries are relatively rare injuries and are commonly associated with strenuous athletic activity, particularly weight lifting. The most common pattern of injury is an avulsion of the tendonous insertion from the humerus[1] leading to functional and cosmetic deficiencies. In the setting of a complete tear, patients tend to have better clinical outcomes with surgical repair versus nonoperative management.[2–5]

Ruptures of the pectoralis major tendon are often caused by indirect injuries during their eccentric phase of contraction and patients often report hearing or feeling a "pop" or tearing sensation in the proximal arm or lateral chest wall.

Several surgical techniques exist to address an avulsion type injury including suturing through drill holes, periosteal sutures, cancellous screws and washers, and suture anchors.[6] There is a paucity of the literature regarding the biomechanical fixation of each of these different techniques with no clear benefit of one over the other. We present here a new technique using unicortical suture button fixation for the repair of an avulsed pectoralis major tendon.

TECHNIQUE

Diagnosis of a pectoralis major tendon rupture is most often identified after obtaining a good history and physical examination. Bruising in the area of the upper arm, near the axilla and/or into the chest wall, as well as, deformity of the pectoralis muscle belly and loss of the normal axillary contour confirm the diagnosis (Fig. 1). Radiographs are rarely helpful, unless a fragment of bone is avulsed with the tendon, and an magnetic resonance imaging verifies a complete rupture and insures that there is enough pectoralis tendon to repair.

After appropriate preoperative planning, the patient receives an interscalene regional block before general anesthesia. The beach-chair position is used with the operative arm placed in either an arm positioner or on a padded Mayo stand. Perioperative antibiotics are administered before skin incision, and the skin is prepped and draped in standard sterile fashion. An Ioband (3M, St Paul, MN) is then used to seal the drapes and axilla. The inferior aspect of the deltopectoral approach is used, making a small incision in the upper medial humerus near the axillary fold. Sharp dissection is completed through the subcutaneous fat layer and hemostasis achieved with electrocautery. Care is taken when entering the fascial layer and once through the fascia, blunt finger dissection medially toward the pectoralis muscle belly will reveal the retracted pectoralis tendon.

The tendon is sufficiently mobilized by bluntly freeing soft tissue adhesions on the superficial and deep borders of the tendon. The end of the ruptured tendon is gently cleared of loose, grossly nonviable tissue leaving as much tendon as possible for repair. Two number 2 Fiberwires (Arthrex, Naples, FL) are passed through the tendon in a modified Krackow fashion with a closed loop stitch. One Krackow stitch is placed on the superior aspect and one stitch on the inferior aspect of the tendon, dividing the tendon evenly. In our experience, 2 different whip-stitches have been sufficient to secure the

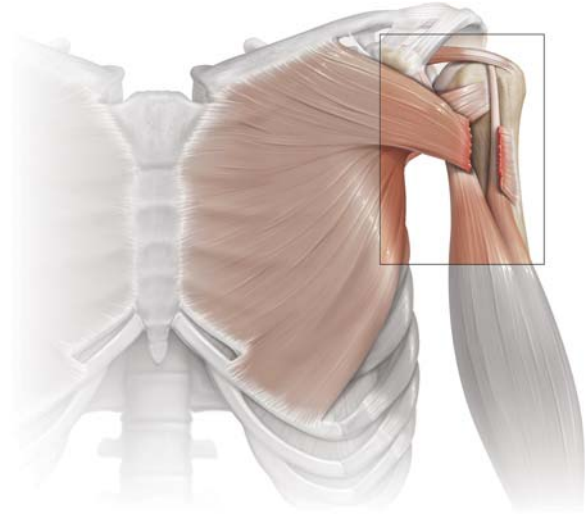

FIGURE 1. Rupture of the pectoralis major.

From the *Department of Orthopaedic Surgery, Case Western Reserve University School of Medicine, Cleveland, OH; and †Crystal Clinic, Akron, OH.
Reprints: Erik Schnaser, MD, University Hospitals/Case Medical Center (e-mail: schnaser22@me.com).

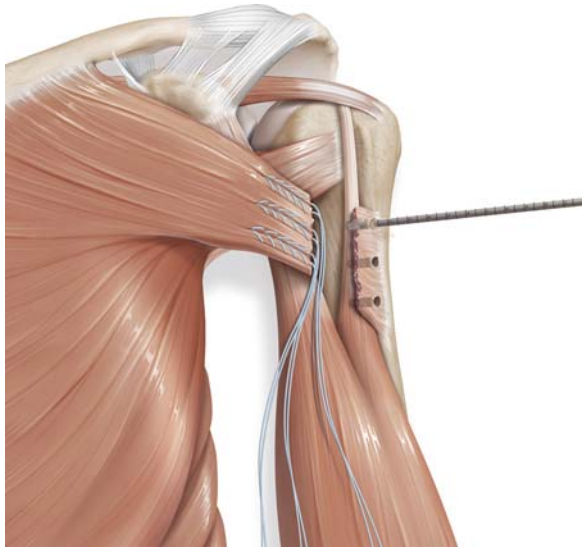

FIGURE 2. Number 2 Fiberwire is whip-stitched in the ruptured tendon and 2 to 3 holes are drilled in the humerus at the tendon footprint in preparation for the cortical button.

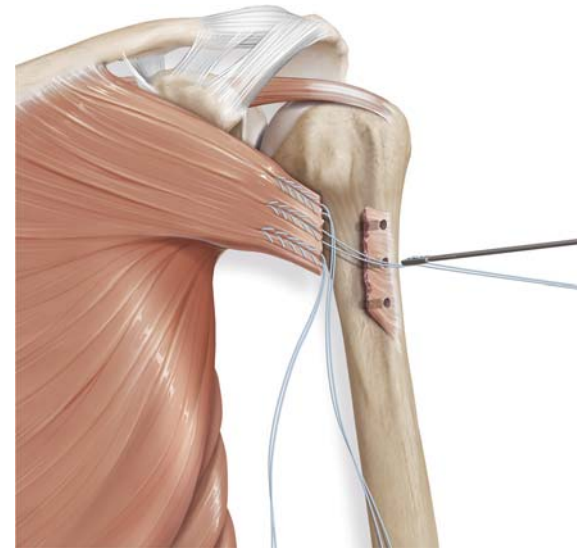

FIGURE 4. The button is then inserted into the humerus and toggled into place.

pectoralis tendon. This will give a total of 4 to 6 suture limbs passing though the end of the avulsed tendon (Fig. 2). The 2 free ends of each suture are then passed through an Arthrex bicep button, for a total of 2 to 3 buttons (Arthrex, Naples, FL) (Figs. 3–5). The number of buttons needed is dependent on the pectoralis major tear size. When possible, we recommend using fewer buttons as to decrease the number of drill holes thus stress risers in the humerus. We show a 3 button construct in our illustrations but have had success with a 2 button construct as well (Fig. 6).

A Darrach retractor or blunt Homan, is then carefully placed over the lateral aspect of the humerus, retracting the deltoid. The insertion site of the pectoralis tendon is identified lateral to the bicipital groove. Locating the commonly present residual tendonous fibers helps identify the insertion site. Once identified, the footprint is then prepared by lightly decorticating the area with a rongeur or burr to bleeding bone. Two unicortical drill holes are then placed in the prepared footprint using the 2.6 mm drill and placing the drill holes approximately 1.5 cm apart. Care should be taken not to place the drill holes too close together as there is concern for cortical failure in this area of the humerus. When preparing the drill holes, we have found that if the drill is angled superiorly approximately 15 degrees while drilling the 2 tunnels, then this will aid in flipping the button in the intramedullary canal. Otherwise, there may not be enough room to fully insert and flip the buttons if the holes are simply drilled perpendicular to the intramedullary. If the button cannot be flipped in the intramedullary canal, one can drill bicortically and flip the button safely on the posterior aspect of the humerus.

The cortical button along with the threaded suture is inserted in the drill hole and the drill tip or Arthrex insertor is used to pass the cortical button into the intramedullary canal. Pulling of the suture allows the button to be "flipped" in the canal, and the button will no longer extrude through the drill holes. Tactile fixation is tested by pulling on the fiberwire.

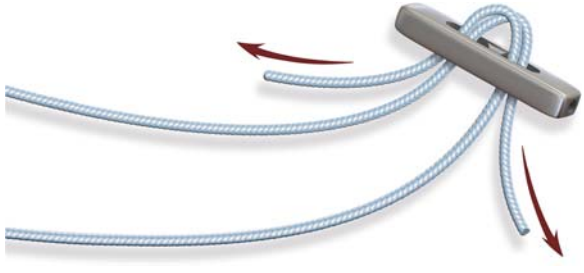

FIGURE 3. The suture is then threaded through the button.

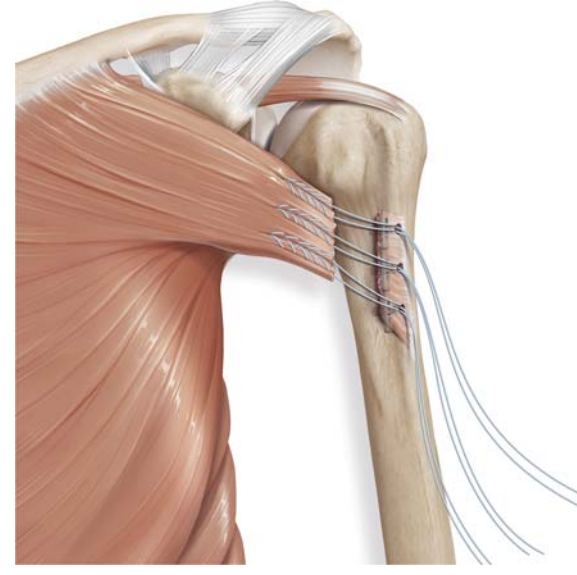

FIGURE 5. The pectoralis major is then reduced onto the humerus and the sutures are tied off.

FIGURE 6. The pectoralis major is then reduced onto the humerus and the sutures are tied off.

With the arm in neutral rotation, tension is place on both limbs of the fiberwire which will reduce the tendon to its footprint. Once reduced, a free curved needle is used to whip-stitch a suture limb from each cortical button. The remaining free limb is then adequately tied to the corresponding whip-stitch for both cortical buttons and excess suture is cut. The avulsed tendon should now be adequately secured to the humerus in its anatomical position. The wound is then thoroughly irrigated and closed. After application of sterile dressings, the patient is placed in a sling and swathe.

The patient is kept in the sling for 6 weeks to allow sufficient tendon-bone healing. Passive pendulum exercises are started immediately. However, the patient is instructed to avoid active abduction, forward elevation, and external rotation. At the conclusion of the 6 weeks, the patient is started on a gradual physical therapy program with passive ROM exercises initially then progressed slowly to active ROM exercises. No loaded shoulder adduction, or internal rotation exercises are permitted for the first 2 to 3 months at which time light adduction exercises are begun and progressed as tolerated.

DISCUSSION

The pectoralis major is a powerful adductor, internal rotator, and flexor of the shoulder. When complete injuries occur to this structure, surgery is often necessary to restore function. Constructs should be strong and able to withstand early loading in the face of postoperative noncompliance with therapy restrictions. Several techniques have been described for the fixation of pectoralis major muscle avulsion injuries. To the best of our knowledge, this is the first time the cortical button technique has been described. Little biomechanical data exists on the different treatments of pectoralis major tendon avulsion injuries thus making it difficult to compare the strength of each repair.

One technique calls for making 4 drill holes and bone trough in the anterior cortex of the humerus. The sutures are passed through the bone trough out 4 separate drill holes and are tied while pulling the tendon into the bone trough.[6,7] Though no objective evidence exists, we feel that this technique has the potential to significantly weaken the anterior cortex of the humerus thus leading to a potential stress riser. Suturing the tendon to the periosteum of the anterior humeral cortex has been described.[6,8,9] Though good outcomes were reported with the use of this construct, we feel that stronger constructs are available and should be used to prevent postoperative failure resulting in noncompliance with activity restrictions.

Our theoretical advantage for using this technique over other techniques arises from biomechanical data from distal biceps repair constructs. Mazzocca et al[10] compared 4 techniques of distal biceps repairs. A biomechanical model was used to compare bone tunnel, cortical button, suture anchor, and interference screw techniques. The cortical button technique had a statistically significant higher load to failure (440 N) compared with the suture anchor (381 N), bone tunnel (310 N), and the interference screw (232 N). In a study of 13 different distal biceps repair techniques, Kettler et al[11] also demonstrated the superiority of the cortical button in regard to failure loads. Though this evidence is anecdotal, we feel that it may be applicable to pectoralis major tendon avulsion injuries in that cortical button fixation may provide the strongest possible method of fixation.

We describe here a technique that is safe and easy to perform in the setting of pectoralis major tendon injury. To date we have performed this operation on 6 patients with acute rupture of the pectoralis major tendon and have not seen any failures with mean 7 months follow-up. Further study with longer term outcomes will be necessary to adequately evaluate this technique. In the interim, the technique show promise for complete acute and chronic ruptures of the pectoralis major tendon.

REFERENCES

1. Bak K, Cameron EA, Henderson IJ. Rupture of the pectoralis major: a meta-analysis of 112 cases. *Knee Surg Sports Traumatol Arthrosc.* 2000;8:113–119.
2. Park JY, Espiniella JL. Rupture of pectoralis major muscle. A case report and review of literature. *J Bone Joint Surg Am.* 1970;52:577–581.
3. Zeman SC, Rosenfeld RT, Lipscomb PR. Tears of the pectoralis major muscle. *Am J Sports Med.* 1979;7:343–347.
4. He ZM, Ao YF, Wang JQ, et al. Twelve cases of the pectoralis major muscle tendon rupture with surgical treatment-an average of 6.7-year follow-up. *Chin Med J (Engl).* 2010;123:57–60.
5. Hanna CM, Glenny AB, Stanley SN, et al. Pectoralis major tears: comparison of surgical and conservative treatment. *Br J Sports Med.* 2001;35:202–206.
6. Petilon J, Carr DR, Sekiya JK, et al. Pectoralis major muscle injuries: evaluation and management. *J Am Acad Orthop Surg.* 2005;13:59–68.
7. Schepsis AA, Grafe MW, Jones HP, et al. Rupture of the pectoralis major muscle. Outcome after repair of acute and chronic injuries. *Am J Sports Med.* 2000;28:9–15.

8. McEntire JE, Hess WE, Coleman SS. Rupture of the pectoralis major muscle. A report of eleven injuries and review of fifty-six. *J Bone Joint Surg Am.* 1972;54:1040–1046.
9. Berson BL. Surgical repair of pectoralis major rupture in an athlete. Case report of an unusual injury in a wrestler. *Am J Sports Med.* 1979;7:348–351.
10. Mazzocca AD, Bicos J, Santangelo S, et al. The biomechanical evaluation of four fixation techniques for proximal biceps tenodesis. *Arthroscopy.* 2005;21:1296–1306.
11. Kettler M, Lunger J, Kuhn V, et al. Failure strengths in distal biceps tendon repair. *Am J Sports Med.* 2007;35:1544–1548.