Pectoralis Major Tendon Repair: Transosseous Suture Technique

John W. Belk,*† BA, Jonathan T. Bravman,† MD, Rachel M. Frank,† MD, Adam J. Seidl,† MD, and Eric C. McCarty,† MD
Investigation Performed at the University of Colorado School of Medicine, Aurora, Colorado, USA

Background: Pectoralis major ruptures are rare injuries that occur in young men between 20 and 40 years of age, typically during resistance training in the eccentric phase of muscle contraction. As the incidence of these ruptures increases with increasing activity levels and use of anabolic steroids, it is important to understand effective repair techniques.

Indications: Repair of the ruptured pectoralis major tendon is indicated for young, active patients seeking to regain full functionality of the affected upper extremity.

Technique Description: In short, after the pectoralis major is identified, the insertion site is revealed just lateral to the biceps tendon. The site for the bone trough is then exposed through cauterization of superficial tissue, and a cortical bone trough is drilled vertically using a small round burr. The location of 3 pilot holes is identified just lateral to the cortical bone trough, and then the holes are drilled to allow for placement of the anchors later in the procedure. The tendon itself is then identified, and sutures are placed in the bulk of the muscle tendon in a Krackow fashion. After the tendon is properly sutured, it is placed under tension to test the structural integrity of the suture pattern and ensure proper load capacity. The sutures are then passed through the pilot holes, the tendon is pulled down into the trough, and the sutures are tied down to the bone.

Results: After an appropriate rehabilitation protocol is followed for up to 6 months postoperatively, the transosseous suture technique in the context of pectoralis major tendon repairs allows for adequate tissue to bone healing and near-complete restoration of patient functionality and strength.

Conclusion: Acute repair of pectoralis major tendon tears using a transosseous suture technique is effective in restoring upper extremity strength and functionality and is associated with high patient satisfaction.

The author(s) attests that consent has been obtained from any patient(s) appearing in this publication. If the individual may be identifiable, the author(s) has included a statement of release or other written form of approval from the patient(s) with this submission for publication.

Keywords: pectoralis major; tendon; rupture; transosseous suture; repair

VIDEO TRANSCRIPT

Pectoralis major tendon repair, as presented by John Belk and Drs Jonathan Bravman, Rachel Frank, Adam Seidl, and Eric McCarty.

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The pectoralis major has 2 heads, a clavicular head and a sternocostal head, both of which insert on the greater tubercle of the humerus.

In the event of a ruptured pectoralis major tendon, the tear can occur in the musculotendinous junction, in the intratendinous substance, or at the humeral insertion. Fifty-nine percent of pectoralis tears have been shown to be complete tears, with nearly 50% occurring at the humeral insertion and approximately 40% at the musculotendinous junction.

In several cadaveric studies, the mean proximal to distal border length spans almost 81 mm with a mean width of 6.1 mm. The distance of the apex of the tendon to the humeral head is around 60 mm.

The primary function of the pectoralis major occurs at the glenohumeral joint and provides internal rotation, flexion, and adduction. It is the main source of power for the upper torso.

Pectoralis ruptures occur most commonly during violent, eccentric muscle contractions in 20- to 40-year old men, usually in sports-related environments when the muscle is under high tension.

Pectoralis ruptures are typically associated with significant bruising, loss of muscle contour, strength deficits, and possible medial and lateral pectoral nerve disruption.

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As indicated by the black arrow, you can see an obvious loss of muscle contour due to a ruptured pectoralis tendon.

Patients often present with a history of anterolateral chest and upper arm pain. The acute injury is often accompanied by a sudden popping sensation, followed by tenderness to palpation over the intertubercular groove.

Radiographs are used to exclude any bony avulsions, and magnetic resonance imaging (MRI) helps differentiate between complete, partial, and intramuscular tears.

Due to the athletic population, the primary complaint from patients is functional limitation, including range of motion and strength deficits.

Nonoperative management is reserved for patients with partial ruptures, with tears at the musculotendinous junction, or for low-demand patients. Nonoperative management includes early sling immobilization, rest, ice, and nonsteroidal anti-inflammatories. Operative management has been indicated for either complete or partial tendon avulsion from the bone. This is the treatment of choice for high-level athletes and is likely to show improvement in functionality regardless of the tear location.

More than 85% of patients have reported good to excellent results with operative management compared with just 27% of patients undergoing nonoperative treatment.

Excellent outcomes include minimal and infrequent pain, full range of motion, no cosmetic complaints, return to normal sport, and minimal strength deficits.

For high-level athletes, which make up most of this population, we should assume that operative management is the appropriate line of treatment. Open repair has been shown to relieve anterior shoulder and anterolateral chest pain, restore upper limb functionality, and increase strength.

Ninety percent of high-level athletes undergoing operative management have been shown to return to sport at a mean of 6.1 months, with 74% returning to their preinjury level and 95% successfully returning to work at a mean of 6.9 months.

There are 3 primary techniques used in open repair of ruptured pectoralis major tendons, including the transosseous suture technique, the suture anchor technique, and the unicortical button technique, with the transosseous suture technique pictured here.

Studies have shown that out of these 3 techniques, the probability of achieving excellent-to-good outcomes is highest with the transosseous suture technique.

The structures most at risk are the biceps tendon, which sits directly medial to the insertion of the pectoralis major tendon, and the cephalic vein, which sits directly superficial and medial to the tendon insertion.

For this case, we will discuss a 46-year-old man Special Weapons and Tactics (SWAT) team leader with acute left shoulder pain following an jujitsu incident. He reported feeling a popping sensation with immediate pain and deformity and was unable to use his left upper extremity due to pain. His goal is to return to full function without restrictions.

Upon examination, he has tenderness to palpation over the pectoralis major tendon as it inserts into the humerus, thinning of the anterior axillary fold that is indicative of a pectoralis tendon rupture, and clear bruising of the anterior biceps. His range of motion is normal, but he has obvious weakness with pressing movements.

Upon MRI review, you can see the near-complete tear of the sternal and clavicular heads of the left pectoralis major tendon at the humeral insertion, retracted by approximately 4.4 cm as measured by the radiologist. A more inferior sternal head tendon appears to remain intact. Based on these results, the patient is indicated for open repair of the ruptured tendon.

The patient is placed in the beach chair configuration with his left arm placed in a holder in a slightly abducted and externally rotated position.

Next, a distal deltopectoral incision is made over the medial proximal humerus, and dissection is carried down the proximal humerus until the bicipital groove is visualized.

After palpating underneath the pectoralis, the pectoralis major is identified, and self-retaining retractors are used to allow for use of both hands.

After the pectoralis major is identified, the insertion site is revealed just lateral to the biceps tendon. The site for the bone trough is then exposed through cauterization of superficial tissue, and a cortical bone trough is drilled vertically using a small round burr.

The location of 3 pilot holes is identified just lateral to the cortical bone trough, and then the holes are drilled to

*Address correspondence to John W. Belk, BA, Department of Orthopaedics, University of Colorado School of Medicine, University of Colorado, 13001 East 17th Place, Aurora, CO 80045, USA (email: Wilson.belk716@gmail.com).

†University of Colorado, Aurora, Colorado, USA.

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allow for placement of the anchors later in the procedure. The tendon itself is then identified, and sutures are placed in the bulk of the muscle tendon in a Krackow fashion.

After the tendon is properly sutured, it is placed under tension to test the structural integrity of the suture pattern and ensure proper load capacity. The sutures are then passed through the pilot holes, the tendon is pulled down into the trough, and the sutures are tied down to the bone.

The postoperative rehabilitation protocol is important to ensure proper healing of the repaired tendon. The primary goals of rehabilitation are to protect the tendon insertion site itself and reach full shoulder range of motion. In the first 1 to 6 weeks of rehabilitation, the patient will concentrate on healing and passive range of motion, followed by resistance training beginning at 6 to 12 weeks postoperatively. Return to sport should be at a minimum of 6 months.

Roughly 18% of patients experience complications with surgery, including re-rupture, cosmetic deformity, or wound infection.

In summary, nonoperative management should be considered for low-demand, older patients who would be accepting of potential cosmetic deformities, but it is not recommended for athletes, for patients with complete ruptures, or for workers' comp patients. If proceeding with open repair, the transosseous suture technique has been shown to be reliable and has demonstrated good to excellent outcomes in clinical studies.

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