

Case Series of Pectoralis Major Muscle Tears in Joint Special Operations Task Force-Philippines Soldiers Diagnosed by Bedside Ultrasound

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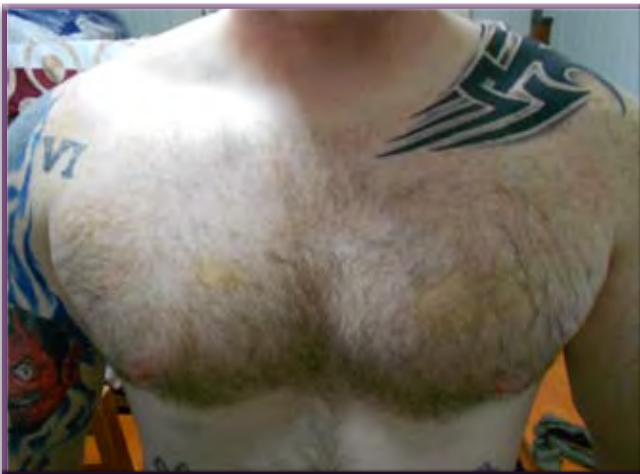
ABSTRACT

Pectoralis major muscle tears are an uncommon injury although reported most prevalently among young male athletes (e.g. SOF personnel). We describe two cases occurring in Joint Special Operations Task Force-Philippines (JSOTF-P) Soldiers, review the physical examination and sonographic findings suggestive of a high-grade injury, and discuss treatment options.

Case 1

A 31-year-old Special Forces Soldier presented complaining of right chest pain that started while bench-pressing the day prior. The avid lifter was pressing 225 pound and felt a pop and “zipper-like” pain to his lateral chest. He denied previous illness, injury, and use of steroids. His previous medical history was unremarkable. On examination (Figure 1A) he had small areas of ecchymosis on the bilateral pectoral major muscles and focal tenderness to palpation, but no visible abnormality at the lateral pectoral region. He was able to forwardly flex the humerus against mild resistance with the shoulder in abduction and external rotation simulating a bench press, but was weaker (4/5) than the unaffected side (5/5). The

Figure 1A Frontal view of Patient 1



remainder of the examination including examination and function of his biceps and rotator cuff was unremarkable. We performed a bedside ultrasound over the area of tenderness, which revealed a large hematoma (Figure 1B). We placed the patient in a sling and provided analgesia and anti-inflammatory medications. We obtained magnetic resonance imaging (MRI) at a host-nation hospital, which was interpreted as a high-grade tear of the pectoral major muscle at the musculo-tendinous junction. We routinely evacuated the patient from the theater for surgical evaluation and rehabilitation.

Case 2

A 27-year-old Special Forces Soldier presented complaining of right chest pain, which started while bench-pressing the day prior. He was lifting a light-weight during the end of his workout when he felt a “pop.” He related having previous pain in the same area with an unremarkable MRI of the rotator cuff one year prior. He denied other medical history, trauma, and use of steroids. On examination he had an area of ecchymosis on his upper anterior biceps. He had focal tenderness

Figure 1B Ultrasound of right lateral pectoral major at area of tenderness. H-hematoma.

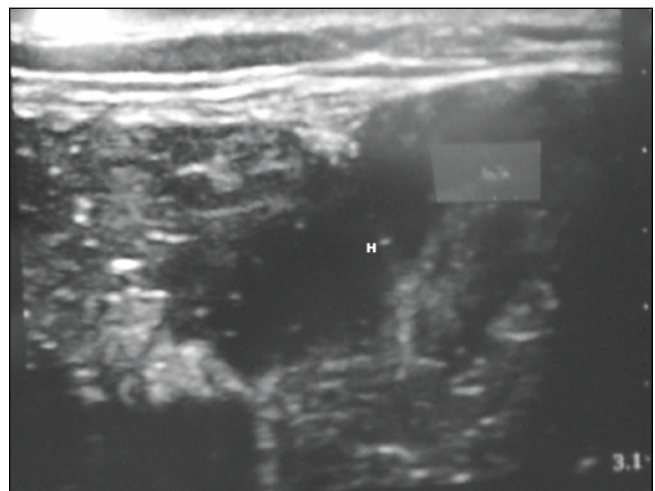
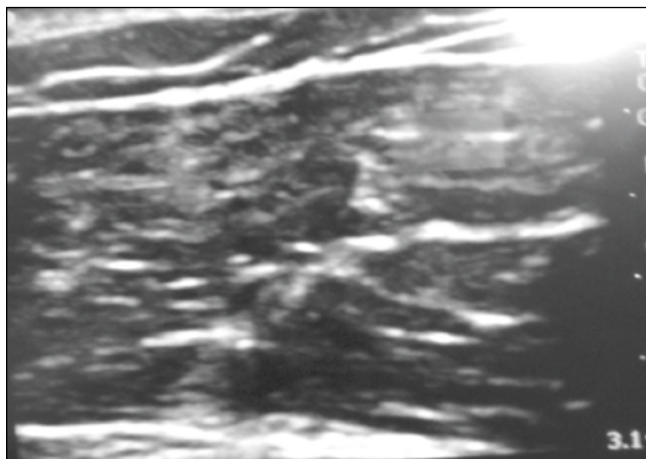


Figure 1C Unaffected left pectoral showing normal muscle tissue.



to palpation at the lateral pectoralis major muscle and was unable to forwardly flex his humerus against gravity with his shoulder abducted in external rotation. A bedside ultrasound (Figure 2A, B) identified a large hematoma. We placed the patient in a sling and provided analgesia. A subsequent MRI identified a complete disruption of his pectoralis major at the musculo-tendinous insertion (Figure 2C). The patient was evacuated from the theater for surgical evaluation.

Discussion

The pectoralis major is a large sheet like muscle, which has its origins in two heads (the clavicular and sternal heads), which insert on the lateral aspect of the bicipital groove of the humerus. The fibers from the sternal head twist 180 degrees so that fibers that are superior at the origin insert inferiorly and vice-versa (Figure 3). It is supplied by the medial and lateral pectoral nerves and by the pectoral branch of the thoracoacromial artery. It

Figure 2A Linear ultrasound probe scanning near insertion of pectoral major at area of tenderness.



Figure 2B Ultrasound image of hematoma (H).

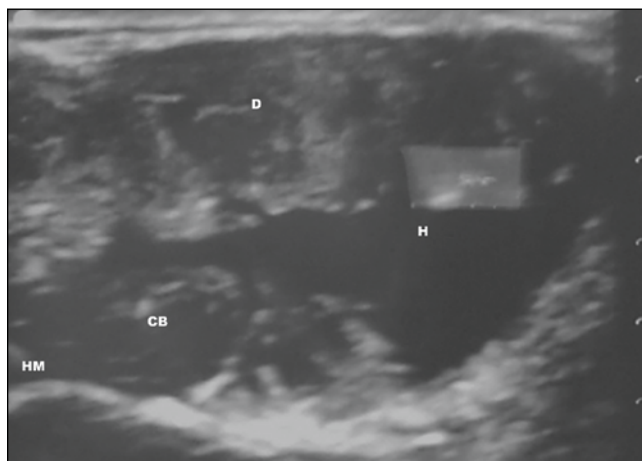
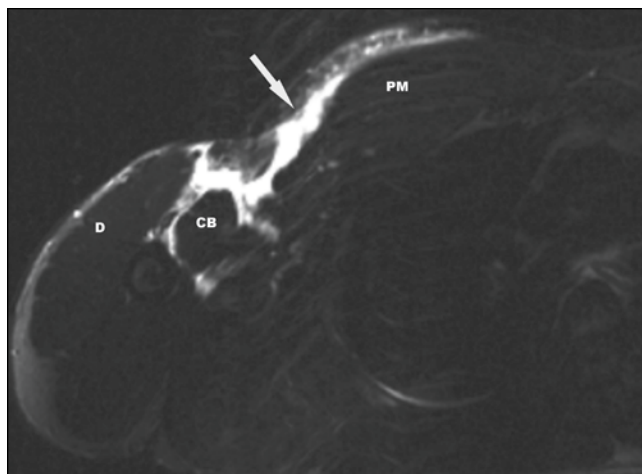


Figure 2C Corresponding MRI showing complete tear at musculo-tendinous junction (arrow). D-deltoid CB-coracobrachialis HM-humerus PM-pectoralis major.

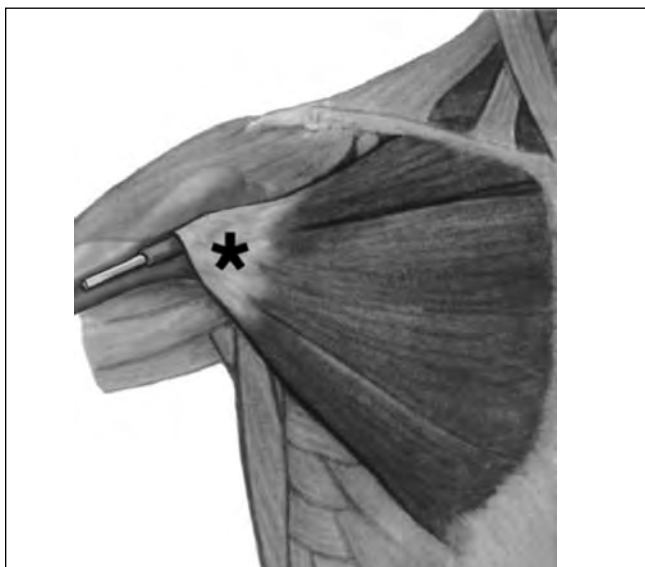


is primarily responsible for movement of the shoulder joint, responsible for adduction, internal rotation, and forward flexion of the humerus.

Complete pectoral muscle rupture is a relatively rare condition, with fewer than 200 cases reported in the literature to date, most occurring in the past 30 years.¹ As can be expected, it is most commonly seen among athletes, though there are case reports from a variety of populations including elderly nursing home residents.² Tears among athletes occur almost exclusively in men. While a variety of activities cause rupture of the pectoralis major, the most frequent is weight lifting, especially the bench press.

Pectoral muscle injury is typically described by extent of the tear as a percentage of the total muscle size and location. A commonly recognized muscle tear classification system breaks tears down into Grades 1, 2, or 3. Grade 1 is defined as less than 5% of the muscle involved; Grade 2,

Figure 3 Normal pectoralis major muscle showing the clavicular, sternal, and abdominal heads forming the tendon, astericks, inserting into the humerus.



as a partial tear of the muscle with > 5% involvement; and Grade 3 as a complete tear of the muscle head.³ Another classification system is the Tietjen system. In this system, sprains and contusions are type I injuries, partial tears are type II, and complete tears are type III. Type III injuries are then further divided according to location into muscle origin ruptures (IIIA), belly ruptures (IIIB), musculo-tendinous junction ruptures (IIIC), muscle/tendon avulsions (IIID), bony avulsion from the insertion (IIIE), and muscle/tendon substance ruptures (IIIF).⁵ Type III injuries are most common, representing 91% of reported injuries, with type IIID the most common subtype with 65% of all injuries.⁴ This apparent predominance of severe injuries may be confounded by publication bias given the small number of cases reported.

The mechanism involved in pectoral muscle rupture is typically either direct trauma, such as breaking a fall, or indirect trauma, such as from extreme muscle tension while the arm is in abduction and external rotation.⁴ In the case of injuries during the bench press, the injury occurs while the weight is lowered to the chest. They are usually a result of uncoordinated motions due to muscle fatigue, which result in excessive muscle loading against an eccentric contraction (i.e. while the weight is being lowered). The mechanism is particularly important in evaluating these injuries because it is linked to location of the rupture within the muscle. Direct traumatic mechanisms typically lead to rupture within the pectoral muscle belly, while indirect trauma is associated with avulsion of the humeral insertion.⁶

Patients typically present with specific recollection of an event causing the injury. They may or may not report

hearing/feeling a popping or snapping sound or a tearing sensation in the axilla associated with immediate pain. On exam, patients will typically have significant weakness to flexion, adduction, and internal rotation of the arm. Acutely, swelling and ecchymosis overlying the injury will severely limit the ability to detect muscular defects. Once this resolves, the patient will demonstrate an asymmetric contour of the anterior axillary fold, often with a palpable defect. An abnormal bulge to the anterior chest wall may also be seen, indicating medial retraction of the pectoralis.¹ Historically, the diagnosis of pectoral muscle rupture was entirely clinical. Clinical distinction between a partial and complete tear can be difficult as other muscles such as the deltoid and coracobrachialis function to flex and abduct the humerus. Additionally, an injury to the biceps or supraspinatus muscles or tendons must be considered in the differential diagnosis of a pectoralis major muscle tear. Tenderness to palpation of the biceps muscle or tendon or weakness with flexion of elbow suggests biceps abnormality while tenderness of the supraspinatus muscle or tendon near its insertion at the greater tubercle of the humerus is suggestive of supraspinatus (rotator cuff) abnormality. The authors recommend palpation of each muscle and tendinous insertion to exclude these differentials and recommend sonographic examination if abnormality is suspected. A palpable defect and lack of firing of the pectoralis major muscle on contraction are suggestive of injury and necessitate imaging. The provider can rule out a pectoralis major muscle tear by a normal physical examination and lack of hematoma on ultrasound.

Imaging

Plain radiographs are of limited utility except in cases involving bony avulsion at the muscle or tendinous insertion. Computed tomography (CT) has been similarly limited in detecting these injuries. At present, the imaging study of choice, although not readily available in austere environments, is MRI.^{1,4-6} MRI reliably identifies the presence and location of injuries, as shown in a study of fifteen patients whose injuries were later confirmed surgically.⁷ Use of ultrasound to diagnose pectoral muscle rupture was first described among the elderly.² As shown in the cases reported here, sonography of the area of suspected rupture will demonstrate a hematoma, which is depicted as a hypoechoic (darker than the surrounding tissues) area that disrupts the normal pattern of muscle fibers. A hematoma is suggestive of a torn muscle. A large hematoma, combined with a palpable deficit and significant muscular weakness is concerning for a complete disruption. Given the availability of ultrasound and its ability to both diagnose and localize the injury, it is considered a very useful adjunct in the early diagnosis of pectoral muscle rupture.⁵ It has not yet replaced MRI as the definitive imaging study in this injury. Optimal

sonographic images are obtained by utilizing a linear, high megahertz transducer. The authors recommend starting the scan along a normal portion of the muscle and scan toward the area of tenderness or palpable deficit. One may scan the unaffected side for comparison. As most pectoralis major tears occur at the lateral musculo-tendinous junction, careful attention is necessary to identify and distinguish the adjacent deltoid and coracobrachialis muscles and humerus (Figure 2B, C).

An important item in the differential diagnosis of pectoral muscle rupture is biceps rupture. Both injuries can have similar causes and presentations but can be easily distinguished with physical examination and sonography. Also of note in the differential diagnosis is congenital absence of the pectoral muscle. The pectoralis major is the most commonly absent muscle and while this absence is frequently associated with other characteristic anatomic changes including webbing of the fingers on the same side of the absent pectoralis major (Poland's syndrome), there is at least one reported case of a Soldier who was able to complete routine military tasks, albeit with some difficulty, despite absence of the pectoralis major.⁸

Treatment

Two broad treatment approaches exist for pectoralis major muscle tears – conservative and surgical. Surgical management can then be further subdivided into early (within weeks) and late (months later). Given the relative rarity of the condition in the reported literature, studies comparing these options are generally small, leading to an overall poor quality of evidence and difficulty in determining the optimal approach to care. This is further exacerbated by the disparate nature of the groups where pectoral ruptures have been reported (young athletes and elderly nursing home residents). Current expert opinion favors early surgical management for highly active patients with physically demanding vocational and avocational needs such as Special Operations, with conservative management reserved for more sedentary and elderly patients. This is supported by several small studies and case series showing improved outcomes with surgical management, especially early surgery, but further research is needed.^{5,9-11} The authors recommend orthopedic surgeon evaluation within two weeks of injury of any patient with suspected Grade 2 (partial tear of the muscle with > 5% involvement) and Grade 3 tears (complete tear of the muscle head) as it is difficult to distinguish between a large Grade 2 and Grade 3 disruptions.

Case Resolution

Case 1

Upon return to home duty station the patient underwent a repeat MRI that identified a partial pectoralis major

muscle tear at the musculo-tendinous junction. Orthopedic surgery evaluated the patient and concluded he was not a surgical candidate. The patient was kept in a sling for two weeks and started rehabilitation immediately upon redeployment.

Case 2

Upon return to home station the patient underwent surgical repair for his complete musculo-tendinous tear and at eight weeks postoperatively was improving steadily.

Conclusion

Pectoralis major muscle tears are an uncommon injury in the general population, but can be expected among Special Operations Soldiers. Tears most often occur along the musculo-tendinous insertion near the insertion into the humerus. Point of care ultrasound can reliably identify a hematoma indicative of a muscle tear and distinguish the extent of the muscle disruption, although MRI is the definitive diagnostic modality. The limited literature supports early surgical repair of active young adults with complete or high grade musculo-tendinous disruptions. In a deployed environment, a thorough physical examination and point-of-care ultrasound can assist in determining who needs further imaging and consultation with orthopedic surgery.

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