Pectoralis Major tendon rupture . MR and US evaluation

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Learning objectives

Knowing the MR anatomy and protocol to optimally scan humeral insertion of the pectoralis maior muscle.

Describe the findings in both complete and partial rupture of the pectoralis muscle tendon

Describe the normal findings in successful postoperative repair of the tendon

Background

Rupture of the pectoralis major muscle is becoming more prevalent due to increasing number of both professional and recreational athletes increase.

Complete rupture typically occurs when the muscle is under full tension and subject to additional stress, is particularly common in activities that include weight lifting and are seen most often in young, athletic males.

Patients with a ruptured pectoralis major present in the acute phase, with pain, extensive swelling, and ecchymosis of the anterior chest wall, axilla, and medial aspect of the affected arm. A "pop" at the time of the injury is often reported.

At clinical examination, patients may have a palpable defect along the course of the pectoralis major muscle and there is asymmetry of the muscle. There is also a decrease in adduction strength.

Preoperative and prompt diagnosis is critical to choose the best treatment option, if surgery is indicated early reconstruccin produces the best cosmetic and functional results

Imaging findings OR Procedure Details

Anatomy

The pectoralis major muscle is a fanshaped muscle with three origins (clavicular, sternal and abdominal) separated by a distinct interval.
- The clavicular head forms the anterior lamina of the tendon and arises from the anterior surface of the medial two thirds of the clavicle and upper sternum.

- The sternal head comprises the manubrial head (middle lamina) arising from the mid portion of the sternum and the first-to-fifth costal cartilages.

- The abdominal head (posterior lamina) arises from the fifth and sixth ribs and the fasciae of the external oblique and transversus abdominis muscles.

The muscle fibers converge into three laminae and twist 180° coalescing into a single tendon to insert at the lateral lip of the intertubercular groove, crossing over the biceps tendon. As a result of the 180° twist, the clavicular and upper sternal fibers insert most distally, whilst the lower sternal and abdominal fibers insert proximaly.

One **reliable landmark** for the superior margin of the pectoralis insertion is the quadrilateral space, best seen in the axial plane. The superior edge of the pectoralis major insertion typically is identified at the level of, or within 1-1.5 cm inferior to the quadrilateral space (range, 0-1.2 cm).

**Another landmark** is the origin of the lateral head of the triceps muscle. The superior edge of the pectoralis major insertion is identified on the anterior aspect of the humerus, approximately 5-10 mm superior to the level at which the lateral head of the triceps is first identified.

**MRI Technique**

Connell et al. (Radiology 210:785-791, 1999) described the proper technique used to image the pectoralis major.

MR studies are optimally obtained using phased-array surface coil and planes coronal-oblique and axial, with a combination of T1, STIR and T2 sequences.

The tendon is normally depicted as a low signal intensity structure, its length is variable between 5 and 15 mm and the cephalocaudal dimension of the insertion ranges between 4 and 6 cm.
US Technique

Ultrasound imaging of the pectoralis muscle is optimally obtained using a linear 5-12 MHz transducer.

The three heads of the muscle have to be scanned in both planes, axial and longitudinal, at rest and dynamically. In particular the pectoralis muscles are evaluated with the arm abducted and externally rotated (ABER position) to stress the myotendinous region.

Complete rupture

Complete ruptures tend to occur at the humeral insertion, hemorrhage and edema are seen anterior to the humerus without visualization of the inserting pectoralis major tendon fibers, the clavicular, sternal or the entire tendon can be affected. The tendon retraction can be depicted and measured.

Rupture of the sternal head occurs more frequently than rupture of the clavicular head(3), although in older individuals the frequency of avulsion of the two major heads is probably the same. Often, the intact clavicular portion makes the clinical diagnosis more difficult.

Partial ruptures

Partial ruptures are more common at the myotendinous junction, it is crucial to scan the whole tendon distal to exclude the possibility of full thickness tear since partial ruptures are usually treated conservatively.

Postsurgical evaluation

Surgical repair is used for full-thickness tears, tears involving the distal tendon, and injuries in athletes. Several perils of delayed diagnosis exist, including adhesions, muscle retraction, muscular scar and fibrosis, atrophy, and overall poor surgical outcome.

The ruptured tendon is usually anchored to the humerus by means of a metallic plate. Postoperative patients are optimally scanned using T1 and Stir sequences with high band width to avoid artifacts.
Fig. 1: Quadrilateral space (red arrow) Note The uppermost part of the pectoral muscle insertion (blue arrow) and origin of the lateral head of the triceps muscle.
**Fig. 2:** Pectoral muscle insertion (blue arrow) crossing over the long head of the biceps tendon. Origin of the lateral head of the triceps muscle. Lattissimus dorsi muscle insertion (yellow arrow)
**Fig. 4:** Ultrasound Axial plane. Easily depicts tendon insertion onto the lateral aspect on the lateral lip of the intertubercular groove.
Fig. 5: Pectoralis muscle tendon is optimally scanned in the axial plane following a longitudinal direction.
**Fig. 6:** Sternal head rupture (axial) Retracted distal tendon (blue arrow) Anteriorly displaced biceps tendon (long head) Lateral head of the triceps muscle (green arrow)
**Fig. 7**: Retracted sternal head muscle belly (red arrow) Note distally normal insertion of the clavicular head tendon (blue arrow)
Fig. 9: Torn and retracted tendon. Edema within muscle belly.
Fig. 8: Sternal head rupture (coronal) Retracted distal tendon (blue arrow) Anteriorly displaced biceps tendon (long head) Lateral head of the triceps muscle (green arrow)
**Fig. 12:** Partial rupture of the clavicular head. Edema is identified in the muscle belly and fluid in the adjoining soft tissue. Distal tendon insertion was normal.
Fig. 10: Surgeon holding the distal pectoralis tendon prior to its reattachment.
**Fig. 11:** Tendon reattachment

**Fig. 14:** T1 PostQ T1 and STIR sequences allow accurate assessment of tendon reinsertion despite metallic artifact. Tendon is thickened and shows slight high signal intensity.
**Fig. 13:** STIR PostQ T1 and STIR sequences allow accurate assessment of tendon reinsertion despite metallic artifact. Tendon is thickened and shows slight high signal intensity.
Conclusion

Pectoralis mayor muscle tendon rupture is an increasing lesion that should be readily diagnosed to allow early surgical specially in young athletic individuals.

Ultrasound and MRI are reliable to depict muscle tendon ruptures and distinguish between partial and compete tendo ruptures

References


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