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Alayna Vaughan

Tyler Luthringer

Joseph Abboud

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## Traumatic anterior shoulder dislocation with concomitant pectoralis rupture and Bankart lesion



Alayna Vaughan, BA<sup>\*</sup>, Tyler Luthringer, MD, Joseph Abboud, MD, MBA

Department of Orthopaedic Surgery, The Rothman Orthopaedic Institute at Thomas Jefferson University, Philadelphia, PA, USA

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Traumatic anterior shoulder dislocation is frequently associated with injury to the static soft tissue stabilizers of the glenohumeral joint, with the most common injury being an anterior inferior labral avulsion (Bankart lesion) in 73% of patients after a first time dislocation<sup>1</sup>. Bony injury can also occur from a single episode of instability. Glenoid rim fractures occur in 5.4%–11% of patients.<sup>3,10,12,13</sup> Greater tuberosity fractures occur in 12%–15% in primary anterior shoulder dislocations.<sup>3,10</sup> Hill-Sachs lesions occur in 38%–90% of primary anterior shoulder dislocations.<sup>3,10,15</sup> Less commonly there can be vascular and nerve injury. Additionally, in patients over the age of 40, rotator cuff tears can occur with anterior shoulder dislocation.<sup>6,9</sup>

Pectoralis major tendon rupture commonly occurs in 20- to 40-year-old males secondary to a rapid eccentric contraction. Of 365 identified pectoralis injuries, 83% were due to indirect trauma, 48% of those occurring in weight-training activities.<sup>7</sup> To our knowledge, this is the first report of a pectoralis major tendon rupture and a Bankart lesion with both lesions treated surgically, and only the second report in the literature of this combined pathology resulting from traumatic injury.<sup>2</sup> In this report, a 20-year-old male patient dislocated his shoulder during an incline bench press causing pectoralis major rupture, Hill-Sachs defect, and an acute Bankart lesion. Only the pectoralis major tendon was repaired in this case.<sup>2</sup> In a retrospective study looking at pectoralis major tendon rupture in the military, 53% of tears occurred during bench pressing.<sup>4</sup> There have been few cases described where pec rupture occurred by another mechanism.

### Case presentation

A 28-year-old left-hand dominant male presented for evaluation of his right shoulder as a second opinion one month after an altercation. His right shoulder was forcibly abducted and extended while tackling someone into a parked vehicle. He experienced immediate onset of right shoulder pain and inability to move the arm, with delayed swelling and bruising of the right chest wall and anterior shoulder. He was seen in urgent care the following day and was referred to an outside orthopedist who ordered advanced imaging two weeks after the date of injury. The patient denied any prior shoulder injuries and gave no report of needing an attempted closed reduction following the incident.

On physical exam at the time of presentation, ecchymosis had resolved but a persistent retraction deformity of the pectoralis major muscle was evident. Shoulder range of motion was painful and guarded. Actively, he was able to forward elevate to 80 degrees, abduct to 40 degrees, and externally rotate to 20. Passive forward elevation and abduction were limited to 90 and 70 degrees, respectively. He was unable to tolerate active or passive internal rotation. Anterior apprehension testing was positive. Other physical exam testing was deferred due to pain and stiffness.

Right shoulder magnetic resonance imaging without intra-articular contrast showed marrow edema of the greater tuberosity, a small Hill-Sachs lesion with a complex anterior inferior labral tear from the 3-5 o'clock position suggesting prior traumatic anterior dislocation, as well as a pectoralis major tendon rupture with 3.5cm retraction (Figs. 1-4).

After discussion of nonoperative and operative options as well as risks and benefits, the patient decided to proceed with surgery.

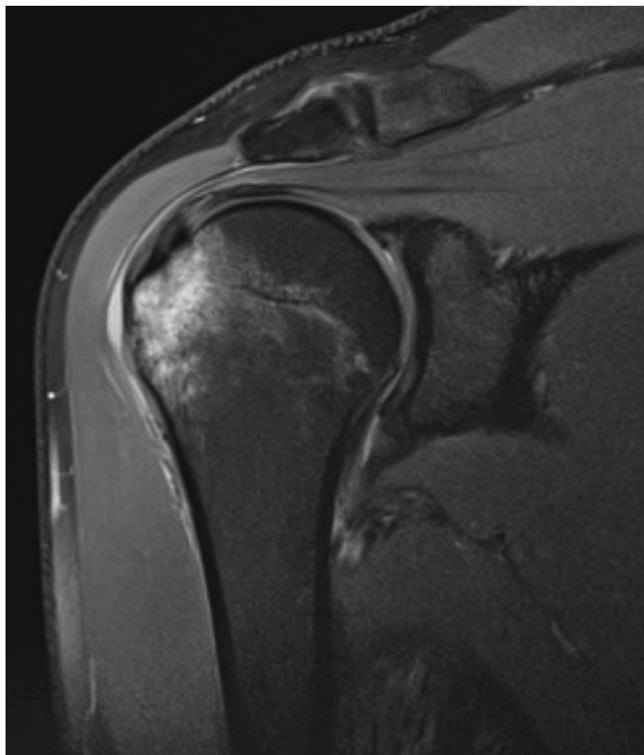
### Surgical technique

After an interscalene nerve block and induction of general endotracheal tube anesthesia, the patient was positioned in the

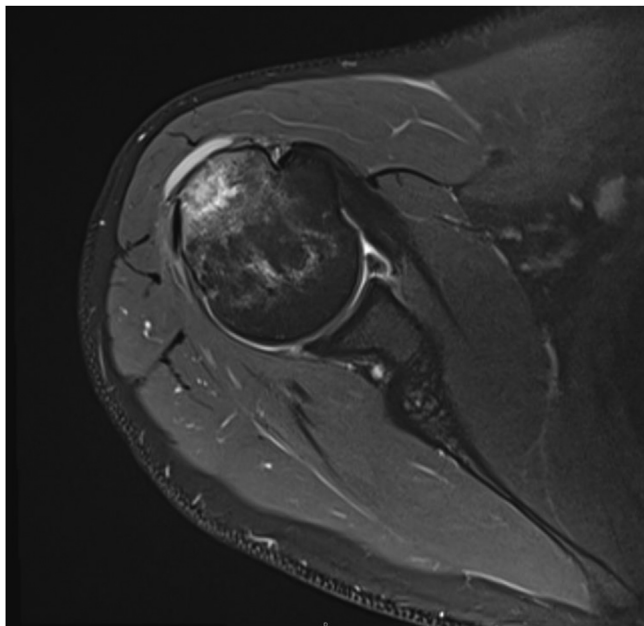
Institutional review board approval was not required for this case report.

<sup>\*</sup>Corresponding author: Alayna Vaughan, BA, Shoulder & Elbow Surgery, Rothman Orthopaedic Institute at Thomas Jefferson University, 925 Chestnut St. 5<sup>th</sup> Floor, Philadelphia, PA 19107, USA.

E-mail address: [Alayna.Vaughan@rothmanortho.com](mailto:Alayna.Vaughan@rothmanortho.com) (A. Vaughan).

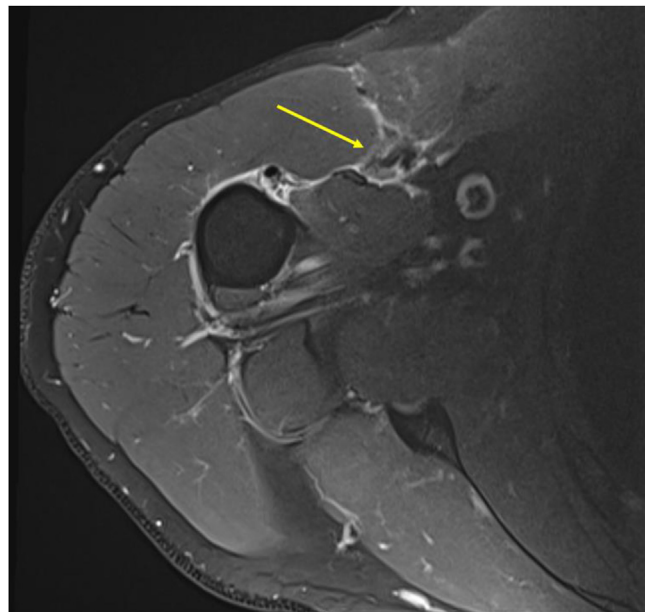


**Figure 1** Coronal T2-weighted MRI of the right shoulder demonstrating bone marrow edema of the greater tuberosity with intrasubstance signal abnormality of supraspinatus tendon without high-grade partial or full-thickness tear. MRI, magnetic resonance imaging.



**Figure 2** Axial T2-weighted MRI demonstrating anterior labral tear (Bankart lesion), humeral head marrow edema, and small Hill-Sachs lesion following acute anterior traumatic dislocation. MRI, magnetic resonance imaging.

beach chair position at approximately 70-degree inclination. Stabilization surgery is typically performed in the lateral decubitus position; however, in the setting of the pectoralis major tear, the beach chair provided better visualization and repair angle. The

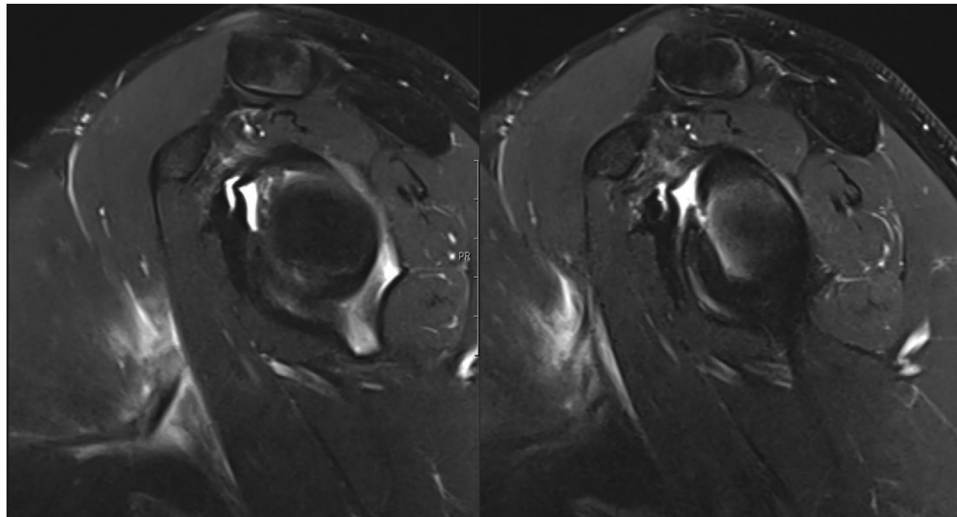


**Figure 3** Axial T2-weighted MRI demonstrating pectoralis major tendon rupture with 3.5 cm medial retraction. MRI, magnetic resonance imaging.

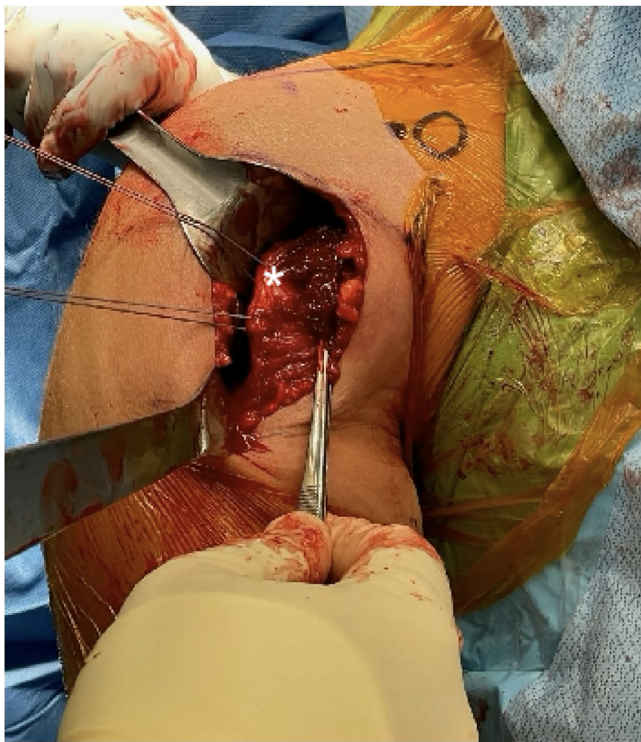
patient was prepped and draped in standard sterile fashion. In order to avoid arthroscopic swelling during repair, the pectoralis was repaired first. A 6 cm deltopectoral incision was made through the epidermis and continued with electrocautery to the level of the deltopectoral fascia. The deltopectoral interval was developed with blunt dissection and the cephalic vein was taken laterally with the deltoid. A blunt Homan retractor was placed under the deltoid insertion on the lateral humeral cortex and the deltoid muscle and cephalic vein were retracted laterally with a large Richardson retractor at the superolateral aspect of the incision. The ruptured sternocostal head of the pectoralis major tendon was identified, mobilized, and tagged with two heavy nonabsorbable sutures to ensure appropriate lateral excursion to the pectoralis major insertion lateral to the bicipital groove (Fig. 5). Careful attention was paid during tendon mobilization as the sternocostal head is frequently folded back and adherent to the deep surface. The pectoralis major insertion site was débrided to remove soft tissue and promote bleeding of cortical bone. Two 5.5 mm suture anchors doubled-loaded with #2 heavy nonabsorbable suture with needles (5.5 BioComposite FT; Arthrex, Naples, FL, USA) were drilled, tapped, and placed 15 mm apart into the proximal humerus just lateral to the bicipital groove (Fig. 6).

An additional Army-Navy retractor was placed medially to delineate the myotendinous junction of the sternocostal head of the pectoralis major. A single limb of each suture was then passed into the pectoralis tendon in a locked Krackow fashion from inferior to superior in sequential fashion (approximately 3-5 passed per suture) and clamped to its corresponding free limb (Fig. 7). The shoulder is then internally rotated approximately 10-15 degrees while superolateral traction is applied to the previously placed tagging sutures. The four Krackow sutures were then sequentially tied from inferior to superior to reapproximate the pectoralis tendon to its anatomic insertion (Fig. 8). The wound was then closed in standard layered fashion prior to the arthroscopic portion of the procedure.

A posterosuperior portal is established and diagnostic arthroscopic examination of the glenohumeral joint is performed. A complex anterior inferior labral tear (Bankart lesion) with a radially oriented component from the 3-5:30 o'clock position on the right



**Figure 4** Sequential sagittal T2-weighted MRI demonstrating rupture pectoralis major tendon rupture and Bankart lesion with anterior radial tear component. MRI, magnetic resonance imaging.



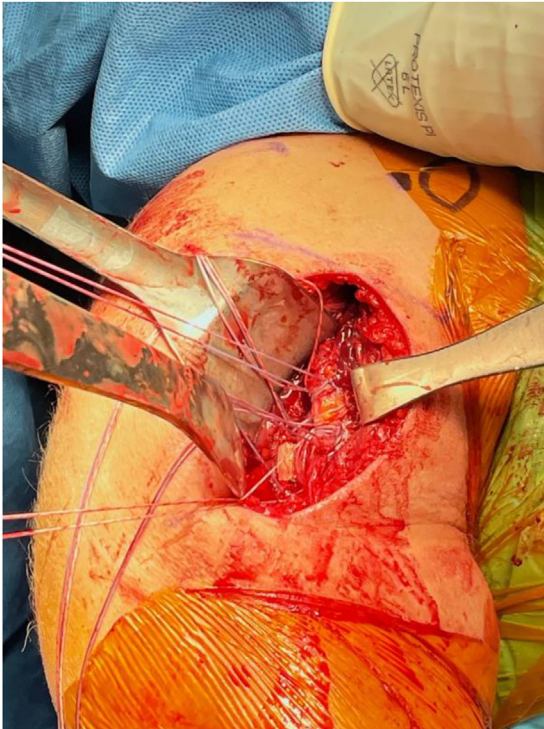
**Figure 5** Two heavy nonabsorbable tagging sutures are shown here. These were used to ensure appropriate lateral excursion to the pectoralis major insertion lateral to the bicipital groove. (\* pectoralis major head)

shoulder was identified (Fig. 9). An anterosuperior working portal was localized with a spinal needle then made sharply with an 11-blade directly behind the biceps tendon. A labral elevator and mallet were used to gently ensure adequate mobilization of the labrum and capsule from the anterior inferior glenoid rim with care not to further disrupt the traumatized tissue. A second antero-inferior portal was established just above the subscapularis tendon at its lateral insertion onto the lesser tuberosity and a 5.5 cannula was inserted. The drill guide is inserted via the cannula,

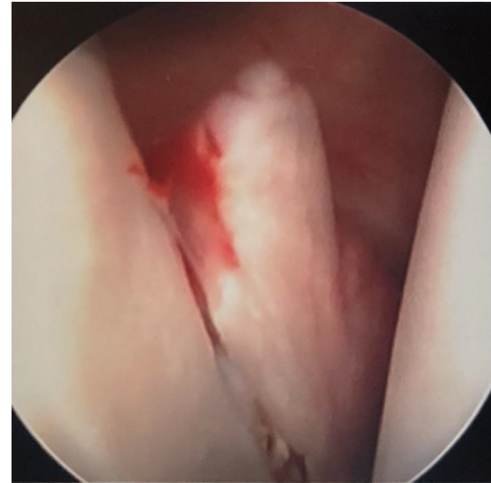


**Figure 6** Two suture anchors drilled, tapped, and placed 15 mm apart on the proximal humerus.

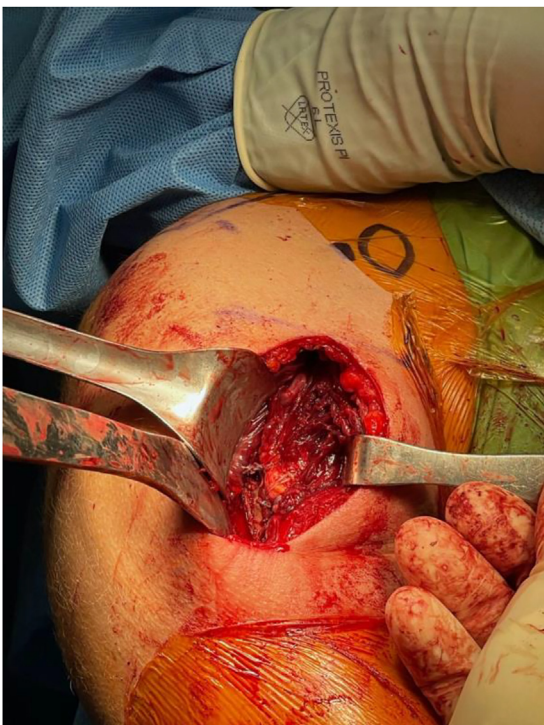
positioned at the inferior-most (5:30) position of intended anchor placement and then drilled. A suture lasso was inserted from the anterosuperior working portal and passed around the injured labrum inferiorly and retrieved via the cannula. The looped portion of a #2 nonabsorbable suture (FiberWire; Arthrex, Naples, FL, USA) is passed through the Nitinol wire and fed back beneath the torn labrum, which is then retrieved via the cannula cinched down in luggage tag fashion and loaded into a 2.9 mm knotless suture anchor (2.9 PEEK PushLock; Arthrex, Naples, FL, USA). The anchor is inserted into the previously drilled tunnel to reduce and tension the capsulolabral complex antero-inferiorly (Fig. 10). A second anchor was inserted at the 3 o'clock position in the same fashion



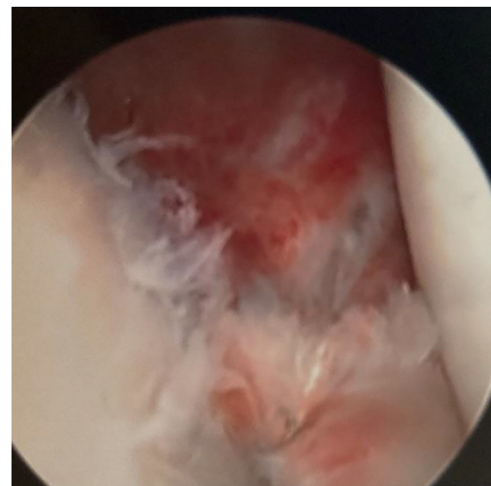
**Figure 7** Suture passed into the pectoralis tendon in a locked Krackow fashion from inferior to superior.



**Figure 9** Bankart lesion. 3-5:30 o'clock labral tear.

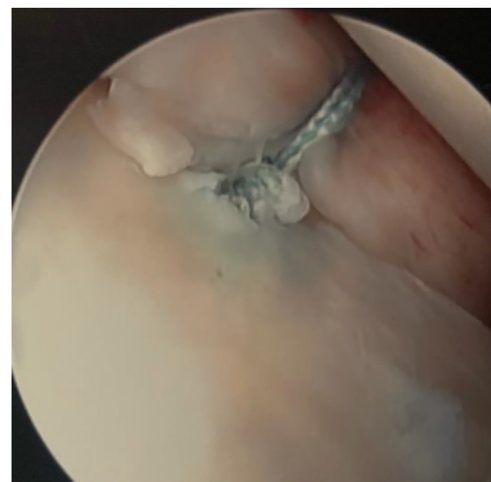


**Figure 8** Four Krackow sutures are then sequentially tied from inferior to superior to reapproximate the pectoralis tendon to its anatomic insertion.



**Figure 10** Location of anterior anchor to reduce and tension the capsulolabral complex.

(Fig. 11). Arthroscopic portals were closed and the patient was placed in a sling with an abduction pillow and waist strap to immobilize the shoulder in internal rotation for 4 weeks. The patient underwent rehabilitation and physical therapy which



**Figure 11** Location of the second anchor.

included passive range of motion for 4 weeks, followed by active range of motion exercises, and strengthening beginning at 12 weeks. This is similar to our isolated Bankart injury rehabilitation protocol.

## Conclusion

To our knowledge, this is only the second report of a pectoralis major tendon rupture with concomitant Bankart lesion resulting from traumatic anterior shoulder dislocation. A single report in 1997 described a similar injury pattern but surgical technique and injury mechanism differed.<sup>2</sup> Pectoralis tendon rupture is an uncommon occurrence and most cases are due to a high eccentric load. Anterior shoulder dislocation is a more common injury but often associated with Hill-Sachs lesions, labral avulsion.<sup>3,10,13,15</sup> Here, we were able to describe a possible series of events eliciting this type of injury pattern.

Frequency at which first time dislocators are operated on has been estimated to be 38%.<sup>5</sup> Primary contraindications to nonoperative treatment include multiple instability events, high recurrence probability, severe glenoid bone loss, multiple instability events, collision athletes, and competitive athletes.<sup>11</sup> Concomitant pectoralis major rupture may not be suspected as a potential additional pathology and thus has the potential to be missed. Oftentimes acute dislocators are too painful and guarded in the office, therefore much of the physical exam is deferred, leading to missed diagnoses. Advanced imaging can also miss a pectoralis major rupture due to the lack of visibility on shoulder specific magnetic resonance imaging. These injuries are only visible on more inferior cuts which are not routinely captured.

If a concomitant pectoralis rupture is missed in a first time who opts for initial conservative management, the pectoralis rupture may become permanently retracted, scarred and irreparable, thus requiring more complex delayed reconstruction or eliminating the possibility of surgical repair. Patients can expect significant improvement in strength, pain, satisfaction, and cosmesis<sup>14</sup> as well as greater recovery of peak torque and work performed<sup>8</sup> following acute operative repair as compared to those who were treated nonoperatively.

The senior author typically prefers the lateral decubitus position for most arthroscopic stabilization procedures. However, in the presented case requiring additional open pectoralis tendon repair, we would advocate for beach chair to avoid the need to reposition the patient between the open and arthroscopic portions of the procedure. Additionally, the senior author prefers to perform the open portion of the procedure prior to arthroscopy to avoid operating on edematous tissue from arthroscopic fluid extravasation, which may make tissue planes harder to identify and can potentially impact the ability to perform a stable anatomic repair. Furthermore, we have not experienced difficulties with visualization during arthroscopy following adequate closure of the open incision.

Multiple fixation options are available for pectoralis tendon repair; our preference is to use suture anchors to avoid the potential risk of neurovascular injury and minimize the introduction of stress risers that could be associated with multiple points of bicortical fixation.

In this case report, the patient's mechanism of injury is unique in that most pectoralis injuries have been found to occur when the arm is extended and externally rotated with concomitant heavy eccentric load.<sup>8</sup> Anterior shoulder dislocation commonly occurs with the arm in an abducted and externally rotated position while pressure is applied anteriorly. Because there is a discord in positions in which these two injuries occur, this case was of interest.

While these injuries occur rarely in a simultaneous setting, this case report demonstrates that it is possible. Concomitant pectoralis major rupture in anterior dislocations could easily be missed by even the most experienced of surgeons. An abbreviated physical exam, incomplete advanced imaging, and instability specific examinations preoperatively, can lead to a missed diagnosis. Possible pectoralis major rupture should be assessed in traumatic first-time dislocations.

Patient Outcome: Single Assessment Numeric Evaluation score was 95% at six months postoperative.

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Conflicts of interest: Joseph Abboud, MD, MBA: This author reports the following conflicts of interest: Aevumed: Stock or stock Options; American Shoulder and Elbow Society Foundation, Board of Trustees: Board or committee member; American Shoulder and Elbow Surgeons: Board or committee member; Arthrex, Inc: Research support; Bioventus: Paid consultant; Department of Defense: Research support; DJ Orthopaedics: IP royalties; Paid consultant; Globus Medical: IP royalties; Paid consultant; Integra: Research support; Journal of Shoulder and Elbow Arthroplasty: Editorial or governing board; Journal of Shoulder and Elbow Surgery: Editorial or governing board; Lima: Research support; Marlin Medical Alliance, LLC: Stock or stock Options; Mid Atlantic Shoulder and Elbow Society, Executive Board and Founder: Board or committee member; OBERD: Stock or stock Options; OREF: Research support; Orthofix, Inc.: Research support; Orthopedics Today: Editorial or governing board; Orthospace: Research support; OsteoCentric Technologies: IP royalties; OTS Medical: Stock or stock Options; Shoulder JAM LLC: Stock or stock Options; SLACK Incorporated: Publishing royalties, financial or material support; Smith & Nephew: IP royalties; Stryker: IP royalties; Paid consultant; Wolters Kluwer Health - Lippincott Williams & Wilkins: Publishing royalties, financial or material support; Zimmer: IP royalties; Paid consultant; Research support. The other authors, their immediate families, and any research foundation with which they are affiliated have not received any financial payments or other benefits from any commercial entity related to the subject of this article.

Patient consent: The patient consented to all parts of this case report.

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