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Shoulder pseudoparalysis in a child after massive cuff tear interposed within the glenohumeral joint: a case report

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Massive rotator cuff tears (RCTs) in the context of shoulder dislocations are relatively uncommon in children.[20,23] Acute traumatic posterior glenohumeral dislocation most commonly results from axial loading of the adducted internally rotated arm with violent muscle contraction typically seen in electric shock or seizures.[15] Post-traumatic shoulder dislocation may also cause impaction fractures of the humeral head,[3,7] proximal humeral shaft, humeral tuberosities, and glenoid. Associated RCTs are not uncommon, seen in up to 20% of cases.[19] Even more rarely, traumatic rotator cuff injury may be associated with interposition of stumps or more than 1 of the rotator cuff tendons between the humerus and the glenoid, which may lead to shoulder dysfunction, including a locked or irreducible glenohumeral joint.[1,9,13,16,17,25] The most common soft-tissue block is an interposed long head of the biceps tendon; however, the literature contains occasional reports of irreducible shoulder dislocations caused by rotator cuff interposition.[22,25] This case describes a massive RCT in a skeletally immature patient in which soft-tissue interposition of the rotator cuff caused an irreducible dislocation of the glenohumeral joint.

Case report

Institutional review board approval was not necessary for this case report. We have permission from the patient and his parents to report this case.

A 15-year-old boy, helmeted motorcyclist moving at approximately 15-20 mph sustained an injury of his right shoulder with pain after falling off his motorbike. The mechanism of injury was due to direct trauma of the shoulder. The main symptoms initially described were pain, swelling, and inability to move his shoulder (Fig. 1). He demonstrated a complete right shoulder pseudoparalysis and had 0° active forward elevation, internal rotation, and external rotation.

Initial radiographs (anteroposterior, lateral Y scapula view) were obtained, with the suspicion of posterior glenohumeral dislocation (Fig. 2). There was no neurologic or vascular deficit.

Gentle closed reduction of the shoulder with him under general anesthesia by use of fluoroscopy was attempted. Stable reduction was impossible with widening of the glenohumeral space on the image intensification, probably because of soft-tissue interposition. Surgery was delayed 4 days to extend preoperative imaging study.

Magnetic resonance imaging (MRI) could not be performed owing to his claustrophobia. Ultrasound of the shoulder was subsequently performed and further demonstrated a massive RCT (Fig. 3). Interposition of the supraspinatus and infraspinatus tendons in the glenohumeral joint and dislocation of the long head of the biceps tendon were found. In the meantime, a conventional computed tomography (CT) of the shoulder was performed to assess the probable cause of soft-tissue interposition in the glenohumeral joint (Fig. 4). Several bone fragments torn from the greater and lesser tuberosity were found in the joint. The humeral head was left posterior (Fig. 4). After the initial reduction, it was proven on the CT scan that there was no anterior or posterior dislocation but increased glenohumeral space was found. The diagnostic suspicion was after the ultrasound was performed, and

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Figure 1 Preoperative image of the right shoulder compared with the contralateral side. Presents swelling and hematoma in the proximal third of the arm.

the diagnostic confirmation was made at the time of the arthroscopic surgery.

Surgical manipulation and operative treatment

An arthroscopic repair of the cuff was carried out. Preoperatively, he received an interscalene block, and general endotracheal anesthesia was administered. He was then placed in a beach-chair position. A standard posterior portal was created, and a 30° arthroscope was inserted into glenohumeral joint. Anterior, anterosuperior, posterosuperior, and lateral portals were established *via* an outside-in technique. Copious hemarthrosis was evacuated from the joint. At surgery revealed a massive full-thickness RCT involving both the supraspinatus and infraspinatus, avulsion fracture of the lesser tuberosity at the subscapularis attachment with the presence of bone fragments in the glenohumeral joint and persistent posterior subluxation of the humeral head. A medially dislocated long head of the biceps tendon was also visualized extending into the glenohumeral joint underneath the fractured fragment (Fig. 5). Inferior and middle glenohumeral ligaments were intact. The interposition of supraspinatus and infraspinatus was the most likely impediment to initial closed reduction (Fig. 6). Supraspinatus and infraspinatus tendons required reduction through the anterosuperior portal. The supraspinatus/infraspinatus (Fig. 6) and subscapularis (Fig. 7) were repaired with three and two 4.5-mm suture anchors, respectively. A simple lateral row construct was performed to repair supraspinatus and infraspinatus. Visualization from the lateral portal confirmed an excellent restoration of the tendon to the footprint. As the long head of the biceps tendon was torn too proximally, the decision was made to tenodese the biceps at a subpectoral location.

Postoperative recovery

He was placed in an internal rotation sling. From day 14 after surgery, he was advised to start engaging in gentle passive pendulum exercises but was still kept in the internal rotation sling. Gradually increasing passive range of motion (ROM) exercises including forward flexion with the support of a therapist. Two week postoperatively, his ROM was 90° of passive flexion as compared with 180° in the opposite shoulder. At 4 weeks, passive external rotation exercises were introduced. Active assisted ROM exercises were introduced at 6 weeks after surgery. Six week postoperatively,

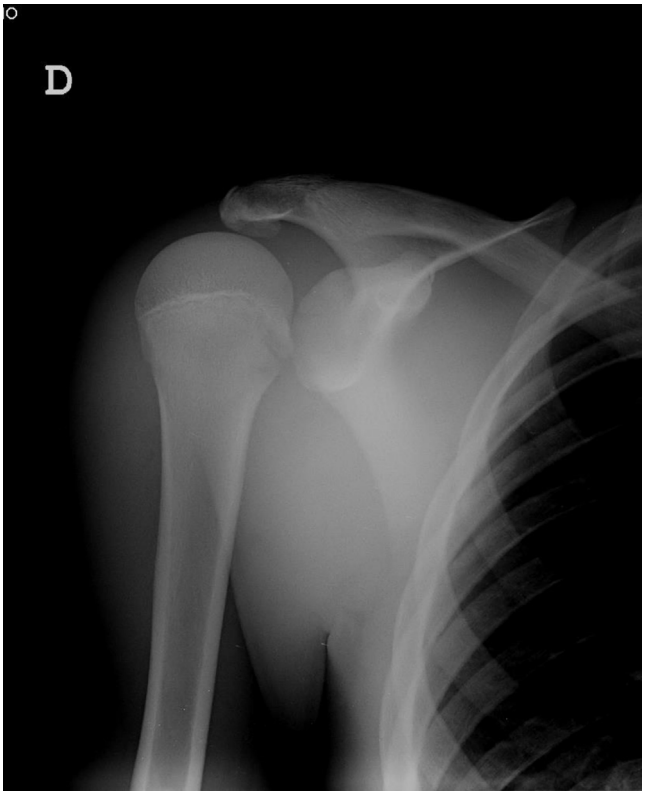

Figure 2 Initial radiographs (anteroposterior view).

pain and stiffness were significantly diminished, with much improved rotator cuff strength. At 6 weeks after surgery, pain had nearly disappeared. Active forward flexion, internal rotation, and external rotation were 130°, 45°, and 30°, respectively. Finally, at 12 weeks after surgery, gradually increasing muscle strengthening exercises were introduced.

Six month postoperatively, he was fully recovered with full ROM and strength (5/5 on Medical Research Council grading scale) in terms of internal and external rotation, abduction, flexion, and extension compared with the opposite shoulder (Fig. 8). At the 2-year follow-up, he was pain-free with 180° of active elevation, 60° of active external rotation, and internal rotation to D12. The Constant score was 74 points, The University of California-Los Angeles Shoulder score 32 points, and The Disabilities of the Arm, Shoulder and Hand score 4,2 points (sports 31,3 points). X-rays and ultrasound showed correct joint congruence and good condition of the rotator cuff repair (Fig. 9). He was able to swim and ride a motorbike normally.

Discussion

Complete rotator cuff tendon avulsion with glenohumeral joint incarceration is rare, but well described. An entrapped rotator cuff is a rare cause of irreducibility and was first described by Herbert[8] in 1946. The interposed soft tissues can be the long head of the biceps[10] or the rotator cuff itself.[9,22,25]

The most common clinical presentation is articular blockage, many times with persistence of subluxation and/or irreducible dislocation of the glenohumeral joint.[4,9,22,25] Orthopedic surgeons must maintain a low threshold of suspicion in young patients with a high-energy mechanism of injury. In our case, the clinical

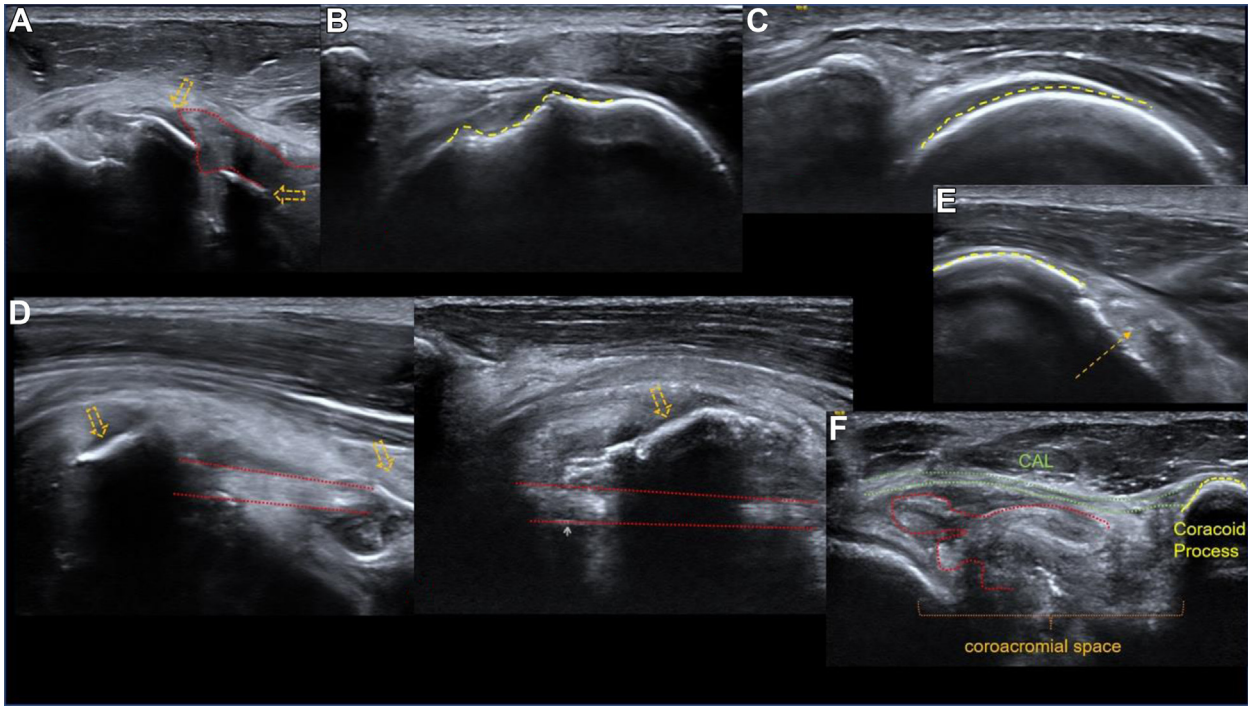

Figure 3 Preoperative dynamic right shoulder ultrasound, with stress maneuvers against resistance in rotations and abduction. Demonstration of complete rupture with retraction of subscapularis (**A**), supraspinatus (**B**), posterosuperior humeral head bare due to complete infraspinatus rupture (**C**), medial dislocation of the biceps (*red line*) below avulsed bone fragments (*arrow*) (**D**) and, teres minor myotendinous junction with avulsed bone fragments (**E**). Retraction of supraspinatus tendon (**F**).

Figure 4 Conventional computed tomography of the shoulder was performed to assess the probable cause of soft-tissue interposition in the glenohumeral joint.

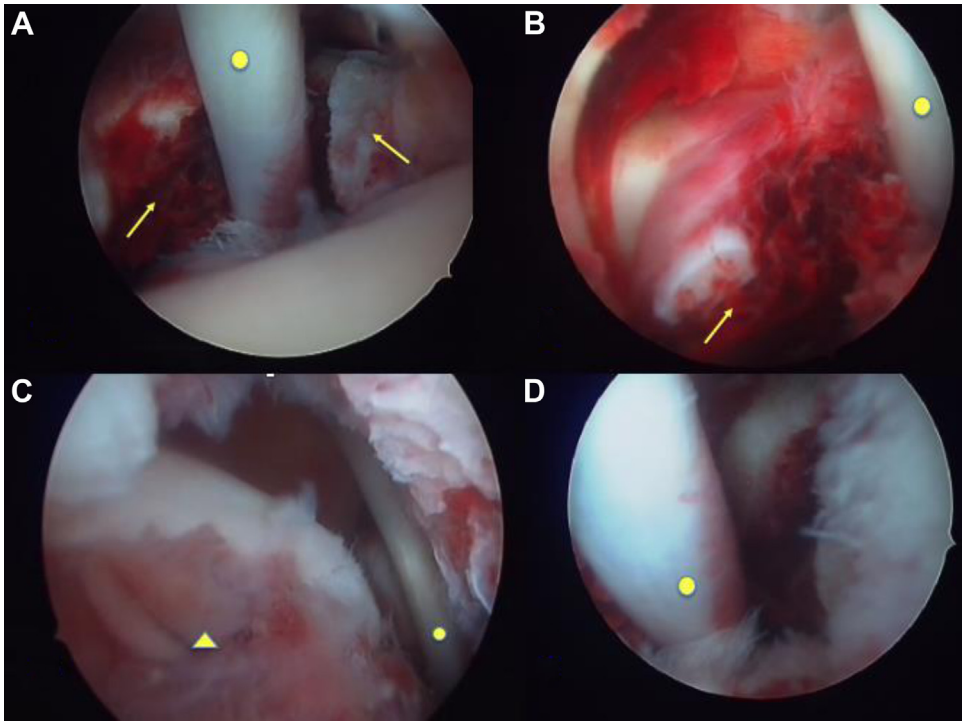

Figure 5 Subscapularis tear. (**A** and **B**) Medial dislocation of the biceps (*circle*) below avulsed bone fragments of lesser tuberosity (*arrow*). View from posterior portal. (**C**) Medial dislocation of the biceps and bare humeral head (*triangle*). View from anterosuperior portal.

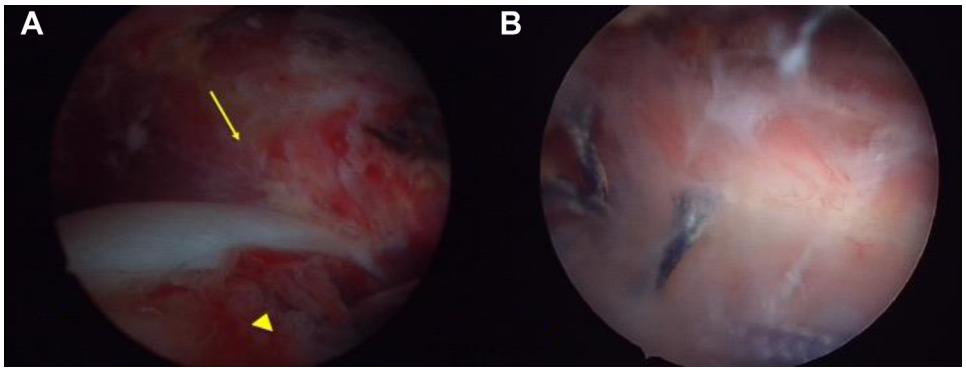

Figure 6 (**A**) Interposition of supraspinatus and infraspinatus at the glenohumeral joint. Rotator cuff stumps interposition (*arrow*) with avulsion of humeral head (*triangle*). (**B**) Supraspinatus and infraspinatus tendon repair. View from the lateral portal.

suspicion was for disproportionate pain and swelling of the shoulder in addition to functional inability for active mobilization of the joint. Clinically, it is difficult to diagnose these injuries. Severe disproportionate pain[2] or the inability of abduction after reduction[6] should make us suspect a massive cuff tear. In plain radiography, it can be suspected by the increase of the glenohumeral space after reduction.[25]

The early detection of rotator cuff interposition is not easy because the radiological findings are subtle. Thus, the rate of delayed diagnosis was reported to be up to 70%.[1,4,9,13,17,22,25] Robinson et al[18] proposed that surgeons should lower their threshold for performing early ultrasounds or MRIs if RCTs were suspected, despite a much-decreased prevalence of these injuries among young patients.[21] In our case, it was not possible to perform an MRI owing to his claustrophobia, which is why a CT scan and ultrasound were performed before surgery. Computed tomography may be used to better identify bone fragments blocking the reduction, but method is limited to evaluate soft tissues.[4,5,9,17,25] Afterward, the follow-up was performed with simple x-rays and periodic ultrasound scans.

Reports of traumatic massive RCTs in skeletally immature patients exist in very small numbers in literature.[24] Cuff tears in the young are usually partial thickness tears or contusions due to chronic overuse in athletes.[24] A massive RCT, in the context of dislocations and trauma, is more often seen in older patients, who may already have frail rotator cuff muscles due to overuse. Lin et al[14] suggests that the injury preceding full-thickness RCTs in young, high-demand patients is usually high-energy trauma.

There are few cases of interposition of the rotator cuff after traumatic shoulder dislocation.[1,4,9,13,17,22,25] We have not found in the literature a case of arthroscopic repair of a massive rotator cuff

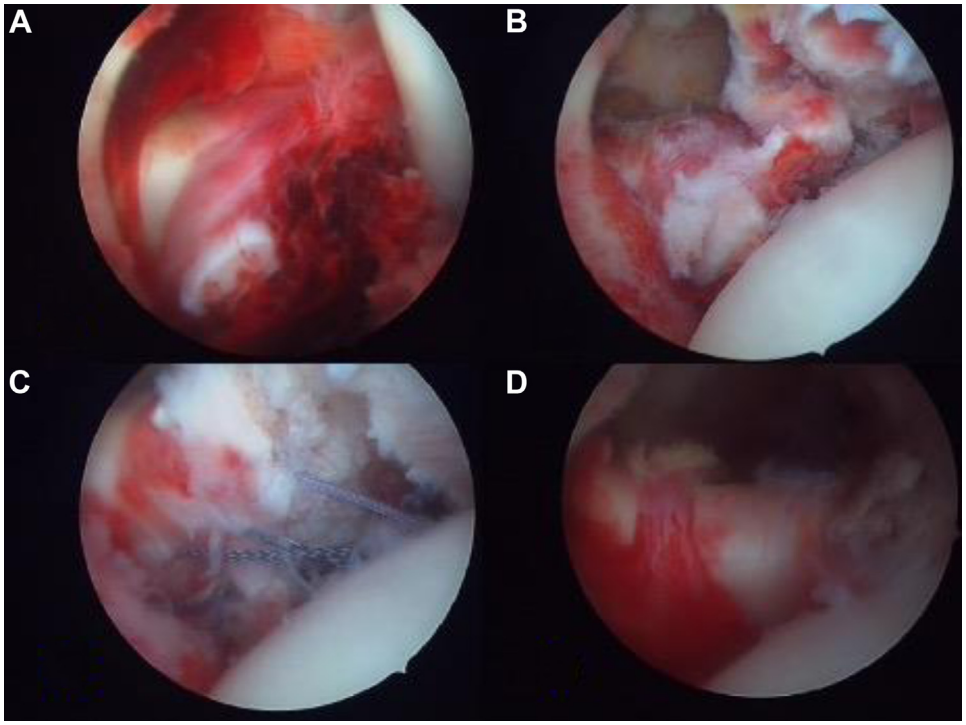

Figure 7 View from the posterior portal. (**A**) Subscapularis tear and dislocation of long head of the biceps tendon. (**B**) Removal of hematoma and resection of the rotator interval (**C**) Suture anchor repair of the torn subscapularis muscle of the rotator cuff. (**D**) Subscapularis muscle repair.

Figure 8 Range of motion documented 6 months (**A**) and 24 months (**B**) after surgery with patient returning to full function.

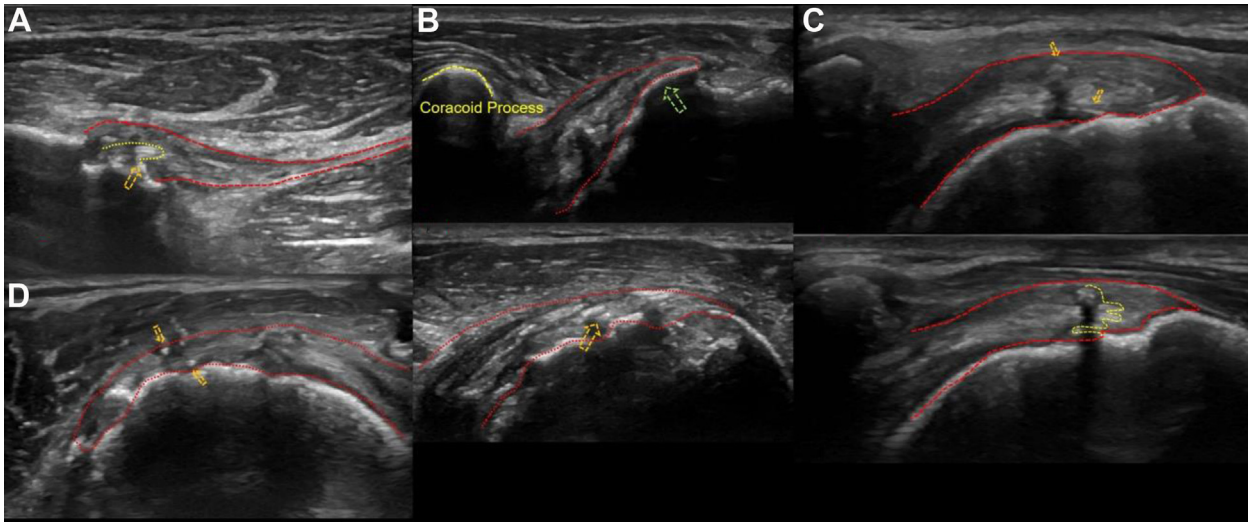

Figure 9 Postoperative dynamic ultrasound of the right shoulder ultrasound with stress maneuvers 24 months after surgery. Integrity of sutures without rupture or retraction and integration of bone fragment of the lesser tuberosity. (**A**) Bicipital tendon (*red line*) tenodesis; tenodesis suture (*arrow*). (**B**) Subscapular tendon reinserted (*red line*); avulsed fragment reinserted (*arrow*). (**C**) Supraspinatus tendon (*red line*) repaired. (**D**) Infraspinatus tendon reinserted. *Arrow* shows the sutures.

tear in a patient with a skeletally immature patient. Walch et al[25]described a case of a 13-year-old patient who required surgery 15 months after the traumatic episode with a Constant result of 51 points.

Management of these types of shoulder injuries should be surgical and an early diagnosis can minimize the damages to the involved muscle bellies and tendons, improving the postoperative results.[4,9,17,25] The results of the different series are poor and attributable to the delay in diagnosis and the consequent delay in surgical treatment.[25] In addition, young patients have biological mechanisms for better healing after repair.[11,12] In our case, the young age of the patient, early diagnosis, and surgical treatment can be related to good objective and subjective results.

Conclusion

We present an atypical case of interposition of the rotator cuff after traumatic posterior dislocation in a young patient treated by arthroscopic surgery. Interposition of the rotator cuff after traumatic dislocation of the shoulder is a rare complication that should be suspected after persistent joint incongruence on plain radiography and disproportionate pain after closed reduction. MRI, ultrasound, or CT scan may be helpful in diagnosing this injury. A delay in diagnosis may make arthroscopic repair of these lesions more difficult and may impoverish functional outcomes.

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