Acute massive rotator cuff rupture with posterior shoulder dislocation: arthroscopic novel repair of a rare injury. A case report

German Alejandro Jaramillo Quiceno,1 Sergio Andres Arroyave Rivera 2, Margarita Maria Ortiz3

ABSTRACT
Acute massive rotator cuff tears and posterior shoulder dislocations are an extremely rare association, and a vast majority are treated by open surgery. We present a case of a man in his 20s who suffered closed left shoulder trauma after a road traffic accident. He was initially diagnosed with posterior shoulder dislocation and a reduction was successfully performed. However, the patient still complained of persistent weakness during active movements. We found a massive rotator cuff tear involving all the rotator cuff tendons, with significant supraspinatus retraction and persistent posterior shoulder subluxation. He underwent an all-arthroscopic repair of the rotator cuff with a double-row technique in the subscapularis, supraspinatus and infraspinatus muscles. Capsular repair and tenodesis of the biceps tendon were also performed. The patient had good recovery, reaching full preinjury function 3 months after surgery with a successful return to his regular activities.

INTRODUCTION
Rotator cuff tears are a relatively common entity usually affecting previous degenerated tendons. Acute tears only account for 8% of all symptomatic tears,1 and massive involvement (defined as a compromise of two or more tendons) represents 60% of cases. However, four-tendon full-thickness tears are unusual, representing only 1.6% of acute tears.2

An extensive knowledge about massive degenerative rotator cuff tears exists; however, little attention has been given to acute traumatic massive tears. This condition mainly affects the young population and is usually secondary to high-energy trauma.3 The association with posterior dislocation is extremely rare,4 and the diagnosis may be initially overlooked due to the absence of fractures on plain films. Thus, clinicians are prone to attribute the symptoms to other more common conditions such as cuff contusion or brachial plexus injuries.1 Because acute traumatic massive injuries are quite infrequent, there is a lack of standardised management protocols, and almost all reports4–7 have carried out open surgery as part of treatment, sometimes requiring more than one approach.

We report a case of acute and massive rotator cuff tear involving all the rotator cuff tendons, with posterior shoulder dislocation. Initially, only the posterior shoulder dislocation was diagnosed; however, the persistent pain and weakness led to further clinical and imaging investigations. Once the massive rotator cuff rupture was diagnosed, the patient underwent an all-arthroscopic repair of the rotator cuff with a double-row technique in the subscapularis, supraspinatus, infraspinatus and teres minor muscles. Three months after surgery, the patient almost fully recovered complete range of movements progressively recovered and reached full preinjury function 3 months after surgery.

The case
A man in his 20s suffered closed left shoulder trauma after a road traffic accident, presenting posterior shoulder dislocation and acute massive rotator cuff tear. He underwent an all-arthroscopic rotator cuff repair, posterior capsular reattachment and biceps tendon tenodesis. The patient was cooperative with the rehabilitation protocol, and external rotation strength and shoulder arc of movement progressively recovered and reached full preinjury function 3 months after surgery.

Lessons learnt
This is a case of an unusual association between acute massive rotator cuff tear and posterior shoulder dislocation. Clinicians should keep a high suspicion index in patients with posterior shoulder dislocation in the absence of associated fracture. Thus, a focused rotator cuff physical examination and MRI evaluation are strongly suggested in this scenario. Timely diagnosis is crucial to avoid atrophy, fatty infiltration and irreparable injuries. Early treatment usually leads to good outcomes. Complex cases require adequate surgical preoperative planning with the aim to achieve anatomical repair. Although open surgery is considered the procedure of choice, arthroscopic repair is an option to achieve anatomical repairs while minimising morbidity and complications of extensive surgical approaches.

To cite: Jaramillo Quiceno GA, Arroyave Rivera SA, Ortiz MM J. ISAKOS 2021;6:375–379.
denied any history of shoulder symptoms or previous trauma. After obtaining shoulder X-rays in a local hospital, posterior shoulder dislocation was diagnosed and a closed manipulation was attempted under sedation, with traction–countertraction manoeuvre successfully achieving anatomical reduction without complications. Following this procedure, pain was immediately relieved. However, during the early follow-up, the patient emphatically complained of marked weakness when performing active movements, defined as ‘pseudoparesis’.

The patient was referred to a shoulder specialist 12 days after discharge. On physical examination, there were no deformities during osteomuscular inspection and left shoulder passive movements were unaltered. However, active range of movement was notably decreased, abduction was 0°–30°, anterior flexion 0°–40°, and external rotation 0°–40°, and a positive external and internal rotation lag sign on infraspinatus drop test. Provocative manoeuvres such as sulcus sign and jerk tests were negative; however, the patient complained of some discomfort and pain during the posterior stress test without evident subluxation or dislocation. Sensation in the upper limb, including the axillary nerve territory, was preserved. Neurological evaluation revealed unaffected muscle strength in the deltoid and all muscular groups distal to the shoulder. The only positive finding was the decreased strength during the external rotation of the shoulder. There were no signs of vascular deficit of the limb. Findings in other systems were unremarkable.

**INVESTIGATIONS**

In the present case, the initial suspicions were persistent posterior dislocation/subluxation, occult fracture or brachial plexus injury. However, the plain films did not show evidence of any fracture or dislocation, and despite shoulder weakness the patient was neurologically intact. Therefore, it was opted to perform a simple MRI of the left shoulder to rule out soft tissue injuries. MRI revealed a massive rupture of the rotator cuff with global compromise of the supraspinatus (figure 1A), infraspinatus, teres minor and subscapularis muscles associated with medial dislocation of the long biceps tendon (figure 2A). Retraction of the supraspinatus and infraspinatus was 37 mm, and none of the rotator cuff muscles showed atrophy or significant fatty infiltration. MRI also demonstrated posterior subluxation, with the humeral head resting on the posterior glenoid edge (figure 2A,B). The posterior capsule suffered detachment from the humeral side. Additional findings were mild synovial hypertrophy, as well as fluid in the subacromial, subdeltoid and subcoracoid bursae (figure 1A). Other articular and periarticular structures were intact.

**TREATMENT**

Following the diagnostic work-up, the decision to perform arthroscopic repair was taken. A complete preoperative plan was carried out based on the MRI findings, and the availability of the necessary arthroscopic materials was ensured.

The patient underwent surgery 16 days after the initial trauma. He was initially positioned in lateral decubitus position, and conventional anterior, posterior, lateral and some accessory anterolateral portals were performed to access the joint and the subacromial space. Afterwards, the posterior capsular tear was reinserted with three all-suture anchors (figure 3A) and glenohumeral stability was achieved.

To perform the second part of the surgery, the patient was repositioned to a beach chair position. First, the long biceps tendon was reduced with a traction suture. The subscapularis muscle had significant retraction, so the footprint was prepared and a traction suture was successfully applied, reattaching the tendon to the bony footprint. A double-row technique using a
self-punching knotless anchor was used in this step. Continuing with the surgical plan, the subscapularis tendon was extra-articularly repaired through the superior lateral portal, and a tenotomy of the long biceps tendon was performed near the labral origin. The distal end of the latter was transferred and tenodesed in the bicipital groove using a triple-loaded all-suture anchor. We used these strands to make the first medial row in the supraspinatus muscle.

The supraspinatus and infraspinatus muscles were initially repaired with two triple-loaded sutures (figure 3B) in their respective bony footprint, and three Mason-Allen and two mattress stitches were performed to cover all the footprints of both tendons. Due to the requirement for multiple-suture anchors in the proximal humerus, triple-loaded sutures were chosen to save the bone.

Finally, a lateral accessory portal was used to fix some strands of the supraspinatus and infraspinatus tendon repair using a self-punching knotless anchor in parachute double-row configuration (figure 3C).

The patient was immobilised with a sling and was admitted to an orthopaedic ward for postoperative recovery care. In the immediate postoperative period, there were not any acute complications. He was discharged home from the hospital in the afternoon of the first postoperative day.

OUTCOME AND FOLLOW-UP
The patient was scheduled for assessment on the 14th postoperative day. He was cooperative with rehabilitation protocol and in wearing the sling. The wounds were healthy and the pain was controlled. Pendular shoulder movements were started on the second week after surgery, with passive assisted mobilisation and isometric exercises around the shoulder and scapulothoracic joints. At sixth postoperative week, the sling was removed and he was encouraged to begin active assisted movements of the shoulder. Eight weeks after repair, a strengthening programme was started as part of the rehabilitation process.

At 10th week after rotator cuff repair, the patient was able to complete almost all ranges of motion of the shoulder (figure 4), with abduction of more than 120°, and recovered the strength of his external rotators. Fifteen weeks after surgery, the patient was released to his regular activities and he denied any shoulder pain returning to his daily job duties.

One year after surgery, the patient demonstrated a fairly symmetrical active range of motion and near-normal strength in the supraspinatus muscles and external rotation testing without any signs of shoulder instability. There were some signs of subacromial impingement, while the rest of the examination was unremarkable. He was tolerating work without complaints.

DISCUSSION
An extensive knowledge has been developed in the investigation of massive degenerative rotator cuff tears; however, little attention has been given to acute massive tears, mainly due to their low incidence and the difficulties during the early clinical and imaging diagnosis.8 9

The definition of acute rotator cuff tears is controversial. Majority of the authors have defined it as an injury that causes sudden onset of symptoms, such as pain and limitations in active forward elevation or abduction, in a patient without previous shoulder pain or disability.2 10–13 A massive tear encompasses full-thickness tears of two or more tendons,14 and in the young population is usually secondary to high-energy trauma such as traffic road crashes. There are also some reports of contact sports injuries.3

Massive rotator cuff tear with posterior dislocation is an extremely rare association.4 Even though some authors have reported a prevalence of full-thickness rotator cuff tears of between 23% and 32% in acute anterior dislocations, the rates are lower in posterior dislocations, with percentages varying
between 2% and 19%. The probability of this type of lesion is increased in dislocations in the absence of fracture or reverse Hill-Sachs pattern. The mechanism of injury is usually due to proximally directed axial force on a flexed, adducted and internally rotated shoulder. These lesions may be initially overlooked and the symptoms are usually attributed to more common conditions such as cuff contusion or brachial plexus neurapraxia; this can lead to a high-risk of tear progression which can rapidly reach the point of irreparability. Mukovozov et al performed a systematic review of patients with acute rotator cuff tears and showed a trend of better Constant Score and active range of movement in abduction and elevation in patients who underwent surgical repair before 3 months of the injury. Timely diagnosis is therefore crucial and clinicians should raise suspicion in cases of persistent weakness in abduction above the shoulder level or external rotation (especially if not limited by pain) after posterior dislocation reduction in the absence of fractures on X-rays. In these cases, an early ultrasound or MRI may be pertinent.

To our knowledge, there are few reports of acute massive rotator cuff rupture in association with this dislocation. Luenam and Kosiyratuk inferred two cases, both of which suffered high-energy trauma from a road traffic crash, with one patient involving the supraspinatus and infraspinatus muscles, and the other also having a tear in the subscapularis and teres minor muscles. Both had a tear of the posterior and superior glenohumeral capsule. Schoenfeld and Lippert reported a case of a 22-year-old man who sustained an injury from a motorcycle accident with an initial diagnosis of posterior dislocation and a late diagnosis of massive rotator cuff rupture (supraspinatus and infraspinatus muscles). Arthroscopy was performed as a diagnostic tool, demonstrating a 3 cm width tear with a medial retraction of 1.5 cm, which required open repair with transosseous suture.17 Three months after the trauma, Steinitz et al reported a case of a 27-year-old man, a professional football player, who suffered left shoulder trauma to an outstretched arm. The opposing player landed on him, loading the patient’s posterior thorax to the left side. MRI confirmed a massive tear involving the subscapularis, supraspinatus, and infraspinatus muscles. The patient also underwent open repair with suture anchors. Soon et al presented an atypical case of acute massive rotator cuff rupture involving the supraspinatus, subscapularis, and long biceps tendon which intersected with the glenohumeral joint, impeding closed reduction. The patient required open reduction and repair without clarity of the posterior capsule repair technique. Interestingly, in all the studies reported and in our patient, the capsular avulsion was from the humeral attachment. In general, the patients revealed intact glenoid labrum, posterior humeral head subluxation, and those involved subscapularis tear had a medial luxation of the long biceps tendon. However, there are interesting findings in this case that have not been reported in other previous studies. The retraction of the supraspinatus and infraspinatus tear was 3.7 cm compared with a mean of 2.4 cm in the previous series, and there was also global involvement of all the rotator cuff tendons. Mall et al reviewed a case series of traumatic rotator cuff tears showing evidence of a low proportion of massive involvement, 10% of three-tendon compromise; however, they did not report any case of four-tendon injury.

With regard to the surgical approach, there is a lack of standardised management protocols due to the rarity of the injury. Massive tears are usually treated with open procedures and frequently require more than one approach, especially when they involve the subscapularis tendon. In contrast to the degenerative or single full-thickness tears, all-arthroscopic repair is not usually performed in acute massive injuries. Some aspects make the procedure technically more challenging compared with the open repair, specifically fluid leakage, difficult visualisation secondary to haemorrhage and failure to obtain adequate distension of the glenohumeral joint as a result of posterior capsular injuries.

In some reports, arthroscopy was performed as a diagnostic tool to confirm radiological lesions or as a coadjuvant mainly for long biceps tenodesis. We found only one report, from Sanghera and Funk, performing an all-arthroscopic repair of an acute massive tear in a 14-year-old teenager. However, in contrast to our case, there was evidence of avulsed greater tuberosity fracture involving full-thickness infraspinatus and teres minor and only partial-thickness tear of the supraspinatus muscles. There was no evidence of posterior capsular tear or posterior dislocation.

With regard to fixation technique, we present a double-row repair, in contrast to majority of reports of single-row techniques. We hypothesise that double-row repair would increase the rate of tendon healing by increasing the contact area especially in young patients with higher demands.

In contrast to massive degenerative rotator cuff tears, traumatic ones are reported to have better outcomes. This might be explained by the fact that younger patients have several mechanical and biological qualities that increase the probability of a successful rotator cuff repair and in the long term these patients exhibit a function near preinjury level.4 21 We believe this report highlights the importance of a timely diagnosis of the entity, preventing misdiagnosis initially and long-term morbidity of a condition that if appropriately treated could result in a near-normal preinjury level.11 Even though many authors have investigated the quality of arthroscopic repair, there is increasing literature supporting this trend in acute rotator cuff tears.19 24 Our patient exhibits an excellent outcome reaching almost preinjury level. Despite being a technically demanding procedure, we believe this report could encourage use of arthroscopic repair for acute massive ruptures to achieve less morbidity during patients’ recovery period, all in terms of surgical infection, early mobilisation, shoulder stiffness and work reinstatement.

This study had some limitations. First, our experience is too limited to make any generalised conclusions about the clinical outcomes of this management over open surgery; this is a case report with the inherent methodological disadvantages. Besides, the current literature lacks gross evidence to support the superiority of all-arthroscopic repair over open surgery in acute and massive rotator cuff tears due to the infrequent presentation of this entity. Also, the few cases are usually treated by open surgery due to the surgical challenges and the lack of arthroscopic experience in this scenario. Despite being theoretically a less invasive surgery, some reports point out the danger of fluid leakage in large capsular or circumfrential tears.21

Another drawback is that due to the surgical complexity of the injury, even in the hands of shoulder specialists, arthroscopic repair could be a very demanding procedure.

CONCLUSIONS

Acute massive rotator cuff tears and posterior shoulder dislocations are an unusual association, particularly when they involve more than two tendons. Suspicion should be raised in posterior dislocations without any evident associated fracture especially when the patient is unable to abduct the arm above the level of the shoulder (‘pseudoparesis’). Early diagnosis is crucial during the clinical approach, and the literature supports that early surgery leads to better clinical outcomes in matters of function.
and pain. All-arthroscopy repair could be a tentative option for experienced hands, avoiding the morbidity and the potential complications of open extensiue surgical approaches often necessary for these scenarios. Future directions and studies are needed to improve our knowledge on the clinical outcomes of acute massive rotator cuff tears repaired by arthroscopy, ideally comparing outcomes head to head with those of patients treated by open surgery.

**References**
