Other full case

Acromial impression fracture of the greater tuberosity with massive rotator cuff tear: this need not be a nightmare!

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Summary

An avulsion fracture of the greater tuberosity of the humerus with associated rotator cuff tear is rare. The authors describe the unusual case of a shoulder injury with an isolated, displaced greater tuberosity fracture associated with a massive rotator cuff tear. Due to the rotator cuff dysfunction, this patient presented with significant functional loss.

BACKGROUND

Typically, greater tuberosity fracture of the humerus are described in combination with proximal humeral fractures or in association with shoulder dislocation.^{1–4} According to the AO statistics, less than 2% of all operatively treated proximal humeral fractures were isolated, mildly to moderately displaced fractures of the greater tuberosity.⁵ However, undisplaced greater tuberosity fractures of the humerus may be under-diagnosed and therefore be more common than suggested in the literature.⁶ Very few similar cases have been reported. More specifically, Kaspar and Mandel⁷ reported the first case of a full-thickness tear of the rotator cuff associated with an extensive cavitory bone defect in the superolateral proximal humerus. This case was described as "acromial impression fracture of the greater tuberosity with rotator cuff avulsion". More

recently, Dodson *et al*⁸ reported complete rotator cuff tendon avulsion and glenohumeral joint incarceration in a young patient.

CASE PRESENTATION

The patient was of 47-year-old, right hand dominant male weighing 70 kg. Other than having tablet-controlled diabetes mellitus, he was fit and healthy. He was ex-army personnel, having left the service about 17 years previously and experienced nightmares related to his previous army placement. One night, dreaming he was being chased by enemy troops trying to bomb his base, he jumped off his bed and landed with his body weight onto his right upper extremity. Trying to protect his head, he hyper-abducted his right shoulder and as a result, hit his right shoulder against the wall. The next morning, he experienced severe

Figure 1 Plain radiograph, AP view showing avulsion fracture of the superolateral end, proximal humerus.

Figure 2 Preoperative CT scan.

right shoulder pain. He attended an A&E department, where he was assessed clinically. At this stage, no radiological investigation was requested. On the basis of the clinical assessment, he was advised to use painkillers, rest his right arm and was discharged to the care of his general practitioner (GP). He continued to experience worsening pain and inability to use his arm, so he re-presented to his GP with a painful, tender, immobile right shoulder. His GP then referred him to an A&E department closer to his normal residence. This time, a plain radiograph of his right shoulder was obtained. An anteroposterior view of his

right shoulder (figure 1) was reported as a fracture of the greater tuberosity of the proximal humerus. Subsequently, he was advised to use an arm-sling for comfort, prescribed pain killers and referred to the orthopaedic clinic for further assessment.

He presented to our institution for evaluation subacutely, 10 days after the initial injury. At the time of evaluation, his main complaint was inability to use his right arm and localised shoulder pain. Physical examination revealed no evidence of deltoid or trapezius atrophy, or of scapular winging. The patient demonstrated a complete

Figure 3 Intraoperative findings.

right shoulder pseudoparalysis and had 0° active abduction or forward flexion. Passive forward flexion to 80°, internal and external rotation to 40° was possible but limited because of severe pain. He had intact sensation throughout

the upper extremity, including in the axillary nerve distribution. The range of motion and strength of the elbow, wrist and digits were full and intact. He denied any paraesthesia in the right upper extremity.

Figure 4 Postoperative check x-ray.

INVESTIGATIONS

Further review of the radiographs demonstrated an avulsion fracture of the greater tuberosity of the right humerus. An urgent CT scan of the shoulder was performed within 72 h (figure 2). This demonstrated “a comminuted acromial impression fracture of the greater tuberosity, with displacement of the fragments superomedially to lie in the subacromial space/superior to the head of the humerus”. Because of the severity of the secondary functional deficits, the patient was counselled and surgical repair of the massive rotator cuff tear was advised.

TREATMENT

Through a superiolateral approach, the deltoid muscle was split and partially peeled off the acromion. The axillary nerve was identified and protected. Although the preoperative CT scan described the fracture fragments at the level of the superior pole of the humeral head, intraoperatively the rotator cuff tendon as well as the fragments were retracted to the level of the glenoid (figure 3). To achieve proper fragment reduction into the cavitory defect as well as lateral mobilisation of the rotator cuff tendon, a combination of intra-capsular and extra articular soft tissue releases were necessary. This was fixed using a double row technique as follows: anchor used for the medial row and five modified Mason-Allen sutures^{9 10} tied onto a low profile cancellous

screw for the lateral row. The deltoid was reattached using trans-osseous sutures. Postoperative radiographs were taken (figure 4).

OUTCOME AND FOLLOW-UP

Postoperatively the patient was advised to keep his arm in a poly-sling for 8 weeks in total, with the aim of restoring full range of motion and function in 3 months. He underwent the following rehabilitation programme: the first 2 weeks, gentle pendular exercises; weeks 2–4 passive external rotation to neutral position while in the sling; weeks 4–6 passive forward elevation of the shoulder; and weeks 6–8 active assisted shoulder exercise. Using the Oxford Shoulder Score, he achieved significant improvements from a score of 1 preoperatively to a score of 22 at 6 weeks postoperatively.

DISCUSSION

Greater tuberosity fractures of the proximal humerus may be caused by various mechanisms of injury, more specifically, following seizures, by glenohumeral dislocation or forced abduction with direct impaction of the acromion onto the greater tuberosity.

Un-displaced and minimally displaced fractures of the greater tuberosity are frequently reported to be sports related injuries, particularly skiing.¹¹

In a case review analysis, 141 patients sustained greater tuberosity fractures either isolated or as a concomitant injury in shoulder dislocation. The study identified multiple fragment fractures in 13%, two or three fragments in 5%, and a single-fragment fracture in 13% of cases. The entire greater tuberosity was involved in 18%. Less than 50% involvement of the greater tuberosity was described in 5% and only 3% were described as small fragment fractures. Patients with isolated greater tuberosity fractures may present with symptoms of rotator cuff pathology at their initial assessment.¹²

The association between rotator cuff tears and diabetes mellitus has been reported.⁶

Conventional radiography of the shoulder could potentially fail to identify minimally displaced fractures of the greater tuberosity.¹¹ This group of patients benefits from early referral for more detailed studies, namely ultrasound, CT scan or MRI of the shoulder. Identification of these fractures, whether isolated or associated with rotator cuff symptoms, facilitates early appropriate management plans for these patients, optimising functional outcome. Because the fragment is pulled medially, posteriorly and superiorly by the rotator cuff, these fractures require anatomic reduction and internal fixation. If the fracture is left unfixed, superior displacement of the bone fragments will

result in narrowing of the subacromial space and lead to significant impingement. If the tuberosity is allowed to heal with significant posterior displacement, it may produce the functional equivalent of a rotator cuff tear and create a bony block to external rotation. Non-union of the greater tuberosity fracture associated with full-thickness rotator cuff tear has also been reported.¹³ In their study in 1998, Mason *et al*¹¹ reviewed retrospective reports of 712 shoulder MR examinations performed over 2 years and identified 12 patients with single-part greater tuberosity fractures. MR identified partial tears or tendinosis of the rotator cuff, which were confirmed arthroscopically in only three patients.¹¹

Competing interests None.

Patient consent Obtained.

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Learning points

- ▶ A thorough history including mechanism of injury, full functional assessment and radiological study are mandatory.
- ▶ Small single-part fracture of the proximal humerus can cause present with significant dysfunction of the shoulder joint.
- ▶ Contusions and partial thickness tears of the rotator cuff are more commonly encountered than full thickness tears.
- ▶ However, full thickness tears must be considered in the evaluation of patients with a traumatic shoulder injury, particularly with a history of direct injury to the shoulder joint associated with reduction in the range of movement and joint function.

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