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Shoulder dislocation and greater tuberosity fracture with isolated radial nerve palsy: A case report and review of management options

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Abstract

The glenohumeral joint of the shoulder is the most dislocatable joint in the human body, and the anterior dislocation is the most frequent type. Associated fractures occur in approximately 30% of the shoulder dislocations. The most common fractures include the Hill Sachs lesion (compression fracture in the posterolateral aspect of the humeral head) by 54-76% and avulsion fracture of greater tuberosity 15-30%. Accompanied nerve injury is rare complications, such as the axillary nerve, which is the most commonly injured nerve with an incidence of 9-10%, and to a rarer extent the brachial plexus injury, and the rarest type of nerve injury is an injury to the radial nerve.

We discuss a case of a 60-year-old lady who presented with an anterior dislocation of the right shoulder complicated by greater tuberosity fracture after a fall on her hand with a wrist drop. Neurological examination revealed complete radial nerve palsy. Closed reduction with the Kocher method was done at the emergency department under sedation to reduce the dislocated glenohumeral joint, then an arm sling was used to immobilize the shoulder and wrist support for wrist drop. Definitive treatment with open reduction and internal fixation for displaced greater tuberosity fracture with multiple (ethibond) sutures, suture Anchor, and one cannulated screw were done after a few days. The physiotherapy program was started post-operatively for the wrist and fingers to maintain a passive range of motion, while shoulder physiotherapy was started 3 weeks after surgery.

isolated radial nerve injury with shoulder dislocation is very rare, so complete neurological assessment is mandatory for proper management and prevention of future complications and to enhance full recovery.

Keywords: Anterior shoulder dislocation, radial nerve palsy, greater tuberosity fracture

Introduction

Case Report

A 60-year-old right-handed lady was presented to the Accident and Emergency department after falling on her right arm with pain and inability to move her right arm. On clinical examination, she had a deformation, swelling, and tenderness over the right shoulder, with severe restriction of range of motion (ROM), also the patient could not extend her right wrist and fingers actively (wrist drop) with decreased sensation over the first web space and dorsal aspect of the right hand. The radial pulsation was intact.

X-ray showed fracture-dislocation of the right shoulder, (anterior dislocation with displaced greater tuberosity fracture) figure 1.

Closed reduction using the Kocher technique under conscious sedation (Fentanyl and propofol) was done in the Emergency department, post-reduction revealed stable glenohumeral joint.

The neurological examination that followed reduction revealed numbness along the radial sensory nerve with complete wrist drop as pre-reduction. The median, axillary and ulnar nerve was intact in addition to good radial pulsation.

Post-reduction radiographs (x-ray and CT scan) confirmed the right position of the humeral head in the glenoid (Figure 2,3) and displaced comminuted fracture the greater tuberosity.

The shoulder was immobilized with an arm sling and wrist support for wrist drop was applied.

The nerve conduction study showed an abnormal study with electrophysiological evidence of right radial neuropathy.

After three days, open reduction and internal fixation (ORIF), was done for the patient to fix the displaced greater tuberosity fracture with lateral deltoid splitting approach using multiple

(ethibond) sutures of rotator cuff tendons, one Anchor suture just distal to fracture line, and one cannulated screw to achieve a secure and stable reduction of greater tuberosity bony piece.

Post-operatively, the patient was doing well. Physiotherapy was started: Stretching of muscles and strengthening exercise with early ROM of the right shoulder, passive and assisted active ROM to the wrist, hand, and finger exercises with dynamic cock-up splinting.

The patient was discharged after a few days with follow-up to continue shoulder and wrist physiotherapy and ROM.

At follow-up of 8 weeks, the patient was almost fully recovered regarding the wrist drop, with excellent wrist and fingers extension, with nearly full ROM, of the right shoulder (Figure7,8).



Fig 1: AP X-ray of the right shoulder and humerus showing anterior shoulder dislocation with greater tuberosity fracture.



Fig 2: An AP X-ray of the shoulder post-reduction, with restoration of the normal position of the humeral head in the glenoid with comminuted displaced fracture of the greater tuberosity.



Fig 3: CT scan of the shoulder illustrating well-reduced humeral head with comminuted displaced fracture greater tuberosity.



Fig 4: Intraoperative view showing multiple suturing of the Rotator cuff tendons over greater tuberosity.

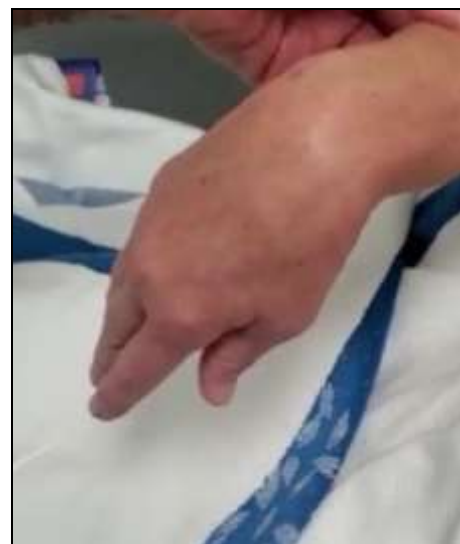


Fig 5: Photo illustrating hand and wrist drop of the patient at the time of presentation.



Fig 6: Post ORIF, Greater tuberosity fracture with cannulated screw, and suture anchor (bioabsorbable).



Fig 7: After 3 months with excellent ROM, right shoulder



Fig 8: Complete recovery of the wrist drop after 10 weeks Introduction

The shoulder is one of the most commonly dislocated joints and is associated with neurologic damage^[1]. Shoulder joints make up approximately 50% of all joint dislocations^[2]. Anterior shoulder joint dislocations may inflict damage to the bones, tendons, nerves, and vasculature and were proven to have a clinical diagnosis of nerve compromise in 3-21% of all cases, and with the use of electromyography (EMG), this rate rises to make up about 9-65%, with a higher chance of rotator cuff injuries in older patients. In addition to dislocations, nerve injury may occur due to fractures, and it can be concluded by paresis and inability to move the arm^[1, 2-5]. Most frequently, the axillary nerve is the most susceptible nerve to damage following a shoulder dislocation due to its direct relationship with the glenohumeral joint, additionally, some nerves such as the brachial plexus (reported in 18-86% of patients in other studies), and in rarer events, the radial nerve may get compromised (despite having conflicting incidence rates in other studies, as some mentioned 7% and some other study series mentioned 18%). Risk factors associated with a higher risk of nerve damage include being in an older age group (aged 50 and above), the degree of trauma, and for how long had the joint been left dislocated^[1-2, 4-5]. 95% of all anterior shoulder joint dislocations require a reduction in an emergency setting^[6], but prior to that, it is crucial to examine the patient to assess the nerves and identify any neurovascular injuries. This is useful for quick recognition and management of acute shoulder dislocations and isolated nerve injury before and after initiating any reduction, as any delay would impact the healing process and function after the healing was over^[2, 5].

Discussion

The shoulder joint is the most frequently dislocated joint in the body which makes up about 45% of body joint dislocations^[7], due to its anatomical and functional reasons, shoulder dislocation with greater tuberosity fracture can happen, especially anteriorly, whereas around 15% to 30% of all cases of anterior shoulder dislocations occur with greater tuberosity fracture^[8].

The cause of fracture-dislocation of the shoulder is high-energy trauma, especially in young males, while low-energy trauma is usually the offender in older people, especially women^[6]. Various types of complications can be associated with shoulder dislocations, such as Bankart lesion, Hill Sachs and, recurrent dislocation mainly in younger patients (less than 25 years). On the other hand, greater tuberosity fractures can still happen, but commonly in older populations, while rotator cuff tear can be present in (14% - 43%) of these patients^[6].

Mutch *et al.* in 2014^[9] classified GT fractures morphologically as: Avulsion, split, and depression fracture. 40% of GT fractures were of avulsions, 40% were split fractures, and finally, 20% were depression fractures. The impaction of GT is like a Hill-Sachs lesion, but with a more lateral site on GT. About 46% of depression fractures are associated with anterior glenohumeral dislocations^[9], so what is different in our report is that the CT scan of fracture revealed a combination of avulsion and depression type on the same humerus, which makes it one of the rarest presentations, and this combination was explained with the nature of our patient, which was an old woman with osteoporotic bone quality and the mechanism of trauma. The actual mechanism was that during anterior glenohumeral

dislocation the GT and posterior aspect of the humeral head was impacted from the glenoid, then the rotator cuff muscles pulled the GT posteriorly and superiorly. Lastly, this type of fracture with radial nerve injury has been hypothesized to result from the mechanism of trauma (hyperabduction and traction of the humerus).

In case of fracture-dislocation and nerve injury (terrible triad shoulder), urgent closed reduction of joint was attempted, followed by advanced imaging like a CT scan and MRI for more details about the morphology of fractures and associated injuries. If the GT displacement was more than 5mm, then surgical options should be considered. Additionally, multiple works of the literature revealed bad outcomes with conservative treatment; so the trend of surgical treatment is rising.

Michael *et al.* [19] revealed that in the case of minimally displaced fractures, the nonsurgical treatment usually results in a good outcome. On the other hand, surgical management is recommended for significantly displaced fractures (> 5mm GT displacement), and regaining ROM early is necessary for successful surgical and nonsurgical treatment. Literature has described multiple surgical techniques to GT fracture, open or arthroscopic techniques may be suggested depending on the type, pattern, and preference of the surgeon. Therefore, in this type of GT fracture with anterior shoulder dislocation, we often have an area of impaction on the posterior aspect of the humeral head. A common mistake is to reduce GT into this impaction defect, which will result in malreduction of the GT. As a consequence, using the anterior fracture lines as a reduction guide is recommended [18].

We used a recommended technique with our modifications, a mini-open deltoid-split approach, preliminary fixing the GT with Kirschner wires, then K wires changed by 3.5 mm screws, after that, a suture-anchor technique was performed by taking a strong, nonabsorbable (Ethibond) suture in the superior and posterior RC (Rotator Cuff) tendons that were incorporated into the bone anchor distal to the fracture line, better use the metallic anchors, but in this case, we used bioabsorbable anchors. This technique as a tension band effect optimized fracture compression and prevented GT migration.

Nerve injury complications are rare with shoulder dislocations, as Robinson *et al.* [8] around 90.5% of these injuries occur like mononeuropathies, and 13.5% occur as a persistent neurological deficit, so in more details for nerve complications, the most common nerve to be damaged was the axillary nerve, with an incidence of damage accounting for about 66.9%, the radial nerve 1.8%, and musculocutaneous nerve 1.2%. Neurologic examination is mandatory before and after the reduction procedure and must be documented clearly. According to an old study showed 10% of cases did not have a good neurological assessment in the emergency department [10]. Any nerve deficits could easily be attributed to the physician if he had not assessed any neurologic deficits before any manipulations as iatrogenic nerve injury [11].

According to Visser *et al.* [3] based on EMG studies, of 77 patients who underwent low-energy glenohumeral dislocations, it was found that 42% of patients had axillary nerve injury followed by 14% suprascapular nerve damage, 12% musculocutaneous nerve, 8% ulnar, 7% radial nerve and 4% median nerve neuropathy. Also, Hems *et al.* [12] studied 55 patients of anterior shoulder dislocation with

injuries of the terminal branches of the infraclavicular brachial plexus and proved that the axillary and ulnar nerve were most frequently injured.

Injury of the radial nerve, in this case, could be due to overstretching or compression of the nerve during trauma and/or directly hit at the humeral head [13], and possible iatrogenic nerve injury due to reduction manipulations. Additionally, and most commonly, neuropraxia may occur due to nerve over-traction in low-energy trauma, similar to the presentation in this case. It was a fall onto a fully abducted, externally rotated, and extended arm as the patient hung onto a wall for support as she fell.

We have to diagnose and document any nerve injury by proper clinical examination before and after manipulation, along with EMG and NCV to detect and localize any nerve damage, whereas EMG and NCV tend to improve 3-4 weeks post-injury [3, 14, 15]. In the presented case, clinical examination revealed a complete wrist drop. However, axillary nerve function was intact, then NCV study was done 10 days after injury and showed normal distal latencies and low CAMP amplitudes on the radial nerve with normal CVs and electrophysiological evidence of radial nerve neuropathy.

As most articles suggested that nerve injury is neuropraxia, this indicates that treatment is usually conservative, which includes physiotherapy and wrist fingers extension splint. Signs of recovery start appearing after 3 months, and full recovery may take 18 months [16, 17]. Fortunately, our patient had full radial nerve recovery within 3 months of injury time and other options of nerve deficit treatment were not considered.

Conclusion

In case of greater tuberosity fracture, its crucial to do post dislocation's reduction enough imaging, like ct scan for proper fracture identification and select the most suitable management options in surgical option, proper fracture fixation can allow early ROM rehabilitation, which would finally be resulting to the best outcome. Clinician should properly assess and document the neurovascular status of involved limb whereas impact the final outcome.

Conflict of interest

Nil

Source of support

Nil

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