INTRODUCTION

The most common bony injuries associated with anterior shoulder dislocation are Hill-Sachs lesions and corresponding bony Bankart lesions. Depending upon the mechanism and severity of injury, a range of other fractures i.e. greater tuberosity fracture, humeral shaft fracture, coracoid fracture, humeral neck fracture, and avulsion fractures of anterior glenoid rim are possible. Avulsion fractures (the so-called chip fractures) of the anterior glenoid rim are common with the usual mechanism of abduction and external rotation at the time of dislocation. Large glenoid fractures can cause shoulder instability, if the fracture involves one-fifth of the anterior part of the glenoid cavity or if the size of fragment is greater than half of the largest diameter of the glenoid. Anterior dislocation, associated with large glenoid fracture and displaced greater tuberosity fracture, needs surgical fixation. Herbert et al. showed that significant proportion of greater tuberosity fracture patients, treated non-operatively, will have tuberosity migration, which may impact shoulder function. However, the question then arises which one of these two fractures (greater tuberosity and glenoid) should be fixed first and whether a single or two surgical approaches should be used.

We report a case of anterior shoulder dislocation with large glenoid fracture and displaced greater tuberosity fracture, managed with open reduction and internal fixation using two surgical approaches. The rationale of using two surgical approaches and the sequence of fracture fixation is discussed hereunder.

CASE REPORT

A 48-year right-handed male sustained injury to the left shoulder while skiing in Switzerland. His shoulder was dislocated and needed sedation for relocation by the skiing resort medical team. He presented to our accident and emergency department one week after the injury. X-ray of shoulder taken in the hospital showed greater tuberosity and glenoid fractures with reduced glenohumeral joint (Figure 1a). He was referred to the orthopaedic team for further management.

His neurovascular examination was normal and his shoulder was immobilised in a shoulder immobiliser. An urgent computed tomogram (CT) with three-dimensional (3D) reconstruction was requested to assess the fracture displacement. CT scan confirmed a large anterior glenoid fracture and comminuted greater tuberosity fracture (Figure 1b). After discussion with the senior shoulder surgeon, a decision was made for open reduction and internal fixation of both the glenoid and greater tuberosity fractures.

The glenoid fracture was fixed first, using deltopectoral approach. The coracoid was exposed and pectoralis minor was released medially. The coracoacromial ligament was released laterally from the coracoid. The coracoid was predrilled with 2.5 mm drill and osteotomized at 2.5 cm from the tip at the level of the knee of coracoid, using 90-degree saw blade. The subscapularis tendon was split at the junction of superior two-thirds and inferior one-third. After splitting the subscapularis and incising the capsule, the socket was exposed. A displaced 2.6 cm long fracture fragment was identified. This was reduced and held to the glenoid with
two guide wires. The position was confirmed under image guidance and final fixation achieved with two partially threaded 4.0 mm cannulated screws. The coracoid was fixed back with 4.0 mm cancellous screw. The anterior wound was closed in layers. Fukuda retractor was used to retract the humeral head for better view of the joint surface while fixing the glenoid fracture.

The McKenzie’s approach was used for fixation of the greater tuberosity fracture. The fracture was identified and reduced. Two holes were made in the proximal humeral shaft, just below the fracture, making sure that the split in the deltoid muscle was less than 5 cm to protect the axillary nerve. Fibre wire was used in a figure-of-eight fashion, passing distally through the holes and proximally through the supraspinatus tendon. The fibre wire was then tied together for extra security. Two guide wires were passed to hold the fracture. The final fixation was achieved with two cannulated screws over the guide wires (Figure 2a). Although the greater tuberosity fracture was comminuted, the combination of fibre wire being used as tension band wire, and two cannulated screws provided acceptable stability.

The shoulder was immobilised in shoulder immobiliser allowing elbow, wrist and finger exercises. Pendular exercises for shoulder were allowed after 2 weeks. The immobiliser was discarded at 6 weeks and physiotherapy was initiated. At final follow-up (12 weeks), his X-ray showed satisfactory healing of the fracture (Figure 2b).

DISCUSSION

True fractures of the glenoid rim should be distinguished from the small avulsion fractures. These fractures are larger and usually result from the direct lateral force driving the humeral head against the glenoid fossa. Most of the small avulsion fractures can be treated non-operatively. However, displaced anterior glenoid fractures can cause incongruity of the glenoid fossa, resulting in shoulder instability as well as early-onset osteoarthritis of the glenohumeral joint. Many authors believe that these fractures should be treated with open reduction and internal fixation.\(^3\) Size of the displaced fracture is an important factor for joint stability. Itoi et al. in a cadaveric study concluded that bony defects of more than 20% of the glenoid fossa could cause joint instability.\(^5\) Schandelmaier et al. suggested that intrarticular displacement of more than 5 mm should be an indication for surgery.\(^6\)

Although combination of glenoid and greater tuberosity fractures with traumatic shoulder dislocation are rare, isolated greater tuberosity fractures are very common with anterior shoulder dislocation.\(^2,4\) The goal of operative management is to prevent painful malunion and to maintain the integrity of the rotator cuff.\(^7\) In this case, there was comminution and posterior displacement
of the greater tuberosity. Posterior displacement can result in block to external rotation of the shoulder joint. This can result in major limitation of upper limb function, especially when there are associated neurological injuries with traumatic anterior shoulder dislocation. The management of combined greater tuberosity and the glenoid fractures as a result of shoulder dislocation can be challenging. Displaced fractures with unstable glenohumeral joint preferably require operative treatment. Cottias et al. reported on a case of bilateral shoulder dislocation. Their case had coracoid, greater tuberosity and anterior glenoid fractures on the right side. They performed open reduction and internal fixation of the greater tuberosity fracture. For the greater tuberosity fracture, they used the avulsed coracoid process as anterior bone block. In our view, if the glenoid fragment is large, then it is better to be fixed with cannulated screws without coracoid bone block. In this case, the glenoid fragment was large (2.6 cm) and could easily take two 4.0 mm cancellous screws; hence, the coracoid was not used as bone block. This decision, however, should only be made after assessing the size and quality of fracture fragment as the imaging sometimes cannot predict the greater degree of comminution.

For the fixation of fractures involving the anterior aspect of the glenoid, deltopectoral approach is used. Aston et al. showed that coracoid osteotomy makes the exposure easier, especially if the fracture is significantly displaced. The conjoint tendon lies just in front of the displaced fragment. Without coracoid osteotomy, the retraction of the conjoint tendon is difficult and can potentially result in musculocutaneous nerve damage. The coracoid can be used as bone block if the fracture fragment is small or very comminuted and satisfactory reconstruction of fossa using the fracture fragment is not possible. Coracoid osteotomy was performed for two reasons in this case. Firstly, it gave a better exposure for anteroinferiorly displaced glenoid fracture, which in this case was quite displaced inferiorly. Secondly, in case there was greater bone loss and comminution then the coracoid would be used as anterior bone block. In the senior author’s experience, splitting of the subscapularis gives better exposure compared to incising and reflecting the tendon medially. This is especially true with medially or inferiorly displaced fracture fragments. In addition to that, it will preserve the attachment of subscapularis.

This case was unique in the way that there were two fractures of the shoulder girdle, which we thought should be fixed using two approaches. The extensive deltopectoral approach is ideal for anterior glenoid fractures and the anteriorly displaced greater tuberosity fractures, can be exposed and fixed with the same deltopectoral approach. The greater tuberosity fracture in our case was displaced posteriorly and we decided to use the McKenzie’s approach for greater tuberosity fracture fixation. The authors think in this unique situation the use of two approaches is a better strategy. With single deltopectoral approach, the glenoid fracture would have been fixed with ease but it would be difficult to reduce and fix the posteriorly displaced greater tuberosity fracture.

It was decided to fix the glenoid fracture first and then the greater tuberosity fracture. This decision was based on the fact that the exposure of glenoid fracture needed excessive tissue retraction and manipulation. Had the glenoid fracture been fixed second, there was risk of losing reduction of the greater tuberosity fracture fixation.

REFERENCES