Radiology of acute shoulder injuries

Introduction

Shoulder injuries are common, particularly following trauma. It may be helpful to group injuries into certain age categories. For example, fractures to the clavicle are commonly witnessed in childhood or early adulthood. Shoulder dislocations are commonly seen from teenage years up to the 4th decade of life. Finally, fractures of the humeral head are seen more frequently in elderly patients. Plain radiographs are the mainstay in the initial evaluation of these injuries, but other modalities like ultrasound and magnetic resonance imaging can aid diagnosis and management of more chronic symptoms and soft tissue injuries. It is essential to identify injuries early so that appropriate management is implemented and early recovery of normal function is seen. This article reviews basic anatomy, classical radiological signs and common shoulder injuries.

Standard radiographic projections

1. Anteroposterior (*Figure 1*)
2. Lateral scapular (*Figure 2*)
3. Axial.

The anteroposterior projection tends to be standard in all hospitals, but the choice of second projection can vary.

Anatomy

The pectoral girdle consists of three bones: the scapula, humerus and clavicle; and three joints: the glenohumeral, acromioclavicular and sternoclavicular joints. The scapula is a triangular flat bone with a glenoid cavity and coracoid and acromion processes that project laterally. The glenohumeral joint is formed by the articulation of the humeral head with the glenoid labrum.

The humeral head has greater and lesser tuberosities with a bicipital groove running between them. The anatomical neck lies superomedial to the tuberosities and the surgical neck below. The acromioclavicular joint is stabilized predominantly by strong coracoclavicular ligaments. The glenohumeral joint is stabilized predominantly by the rotator cuff muscles and tendons. The axillary vessels and distal branches of the brachial plexus lie anterior to the glenohumeral joint and can be injured in anterior glenohumeral dislocations or displaced proximal humeral fractures.

Radiological assessment and classical signs

The ABCS system of radiological assessment is followed for systematic evaluation:

- Adequacy
- Alignment
- Bones
- Congruity
- Soft tissue.

Adequacy

Ensure at least two projections are available to adequately assess the shoulder joint. The gleno-humeral joint alignment should be visible on both projections.

Alignment

Anteroposterior projection

The humeral head should lie in the glenoid fossa, and the joint surfaces should be

Figure 1. Anteroposterior radiograph of the shoulder.

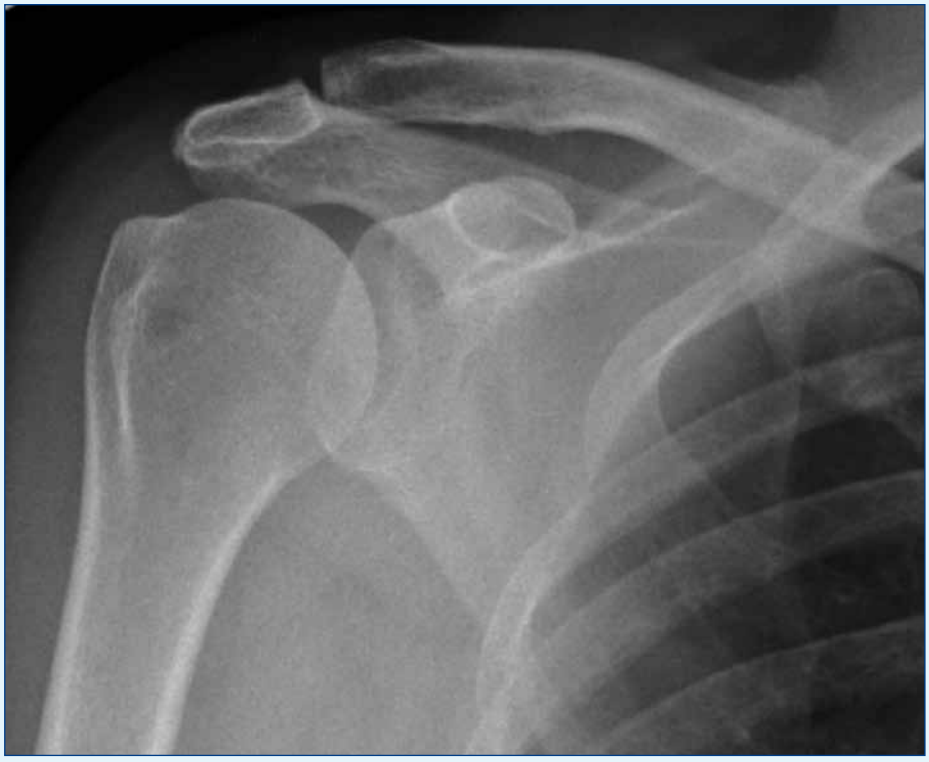

Figure 2. 'Y' scapular radiograph of the shoulder with the humeral head lying superimposed on the glenoid.

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congruent and parallel from top to bottom, running down the anterior margin of the glenoid. The inferior process of the acromion should align with the inferior border of the clavicle (*Figure 1*).

Axial projection

The humerus sits on the glenoid like a golf ball on a tee. The acromion and coracoid processes are finger-like projections and help identify the anterior side of the film.

Y-scapula projection

This is useful in determining a posterior dislocation. The rib cage is anterior. The stem of the Y depicts the blade of the scapula. The limbs of the Y are the coracoid process and the spine of the scapula. The junction formed by the stem and the limbs of the Y indicate the centre of the glenoid. The centre of the humeral head should overlie this junction (*Figure 2*).

Bones

Fractures are seen as a disruption in the continuity of the cortex. In children, there may be buckling of the cortex without an overt break in the cortex. In patients who present with shoulder dislocations, it is appropriate to look for fractures in the post-manipulation radiograph. Do not forget to look at the visualized lungs, ribs and clavicle.

Congruity

This is particularly important in the assessment of dislocations of the glenohumeral joint. It is important to assess two different projections to exclude dislocation. If the radiographs are still inadequate to exclude dislocation, then do not be afraid to request another view. On the anteroposterior projection, the space between the glenoid surface and humeral head should be uniform, suggesting no dislocation.

Soft tissues

Soft tissue findings in shoulder injuries are limited.

Pitfalls

1. Growth plate lines can mimic fractures in the proximal humerus in children
2. Being unfamiliar with a certain projection can lead to missing subtle fractures or dislocations.

Injuries

Fractures

Fractures of the humeral neck are fairly common, particularly in the elderly (*Figure 3*). They may be associated with dislocation. Isolated fracture of the greater tuberosity is seen following a history of fall (*Figure 4*).

Clavicular fractures are common after falls onto the shoulder or outstretched hand. The majority of fractures involving the middle third of the clavicle are seen in patients under 20 years of age. Lateral third fractures predominate after the age of 20 years (*Figure 5*).

Scapula fractures are uncommon and indicate severe trauma and usually high velocity impact (*Figure 6*).

Dislocations

Anterior glenohumeral

Dislocation of the anterior glenohumeral joint is a common injury, accounting for over 90% of dislocations, especially in young patients. The humeral head typically lies anterior, medial and inferior to the glenoid. On the anteroposterior view, the head of the humerus lies under the cora-

Figure 3. a. Axial and (b) anteroposterior radiographs showing a fractured neck of humerus.

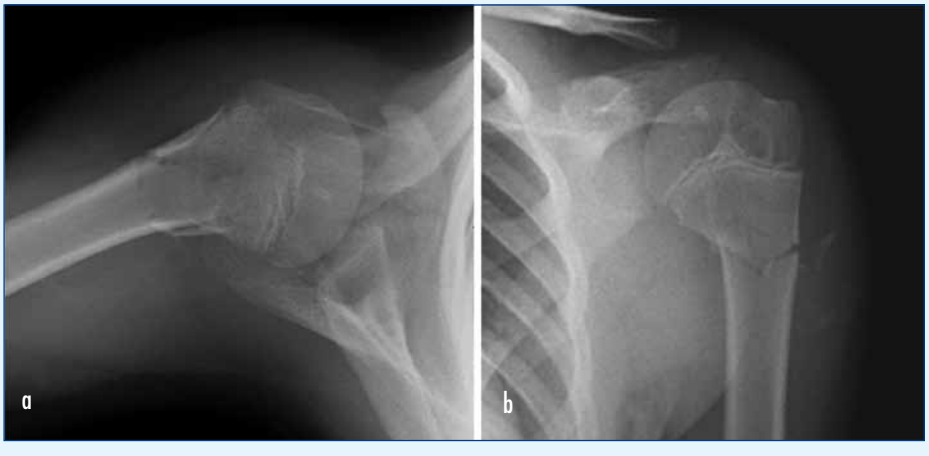

Figure 4. Anteroposterior radiograph showing greater tuberosity fracture.

Figure 5. Anteroposterior view of fracture to midshaft of left clavicle with angulation.

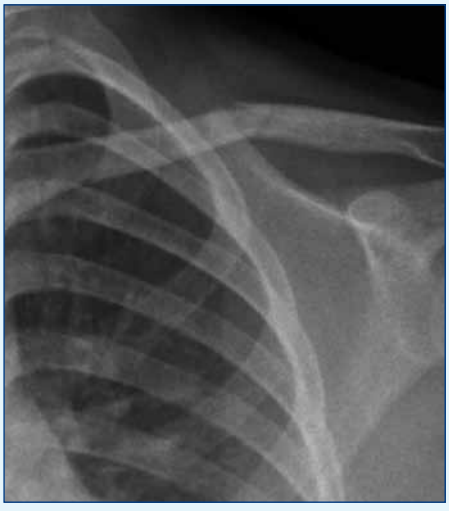

Figure 6. Anteroposterior radiograph showing scapula fracture inferior to the glenoid.

coid process. The axilla projection demonstrates the head of the humerus lying anterior to the glenoid. The Y-scapula view shows the head of the humerus displaced anteriorly, and no longer projected over the glenoid (centre of the Y) (*Figure 7*).

A second view of the shoulder is always necessary to exclude any fractures. A compression fracture of the posterolateral aspect of the humeral head is known as a Hill–Sachs deformity. A fracture of the anteroinferior glenoid is known as a Bankart's lesion.

Posterior glenohumeral

Less than 10% of glenohumeral dislocations are posterior. Signs are more subtle and often result from seizures. The anteroposterior projection will illustrate the humeral head appearing symmetrical, or a 'lightbulb' appearance, as the humerus is internally rotated (*Figure 8*). The axilla projection demonstrates the head of the humerus lying posterior to the glenoid. The Y-scapula view shows the head of the humerus displaced posteriorly, and no longer projected over the glenoid (centre of the Y).

Acromioclavicular joint

Evaluation of the acromioclavicular joint should be easy on the anteroposterior view. The normal joint space width should be no more than 7 mm. The inferior cortices of the acromion process and clavicle respectively should be in alignment. If there is a step, then subluxation should be suspected. If diagnosis is tricky, one can consider weightbearing views of both acromioclavicular joints for comparison (*Figure 9*). BJHM

Figure 8. Anteroposterior radiograph showing posterior dislocation. The humeral head has a 'lightbulb' appearance with internal rotation of the humerus.

Conflict of interest: none.

Further reading

Chan O (2007) *ABC of Emergency Radiology* 2nd edn. Blackwell, Oxford

Nicholson DA, Lang I, Hughes P, Driscoll PA (1993) ABC of Emergency Radiology. The Shoulder. *BMJ* **307:** 1129–34

Raby N, Berman L, Lacey G (2005) *Accident & Emergency Radiology. The Survival Guide.* 2nd edn. Elsevier Saunders, Philadelphia

Figure 7. a. Anteroposterior and (b) axial radiographs of the shoulder showing anterior humeral head dislocation. The axial radiograph demonstrates the impacted posterior humeral head on the glenoid producing the Hill–Sachs depression.

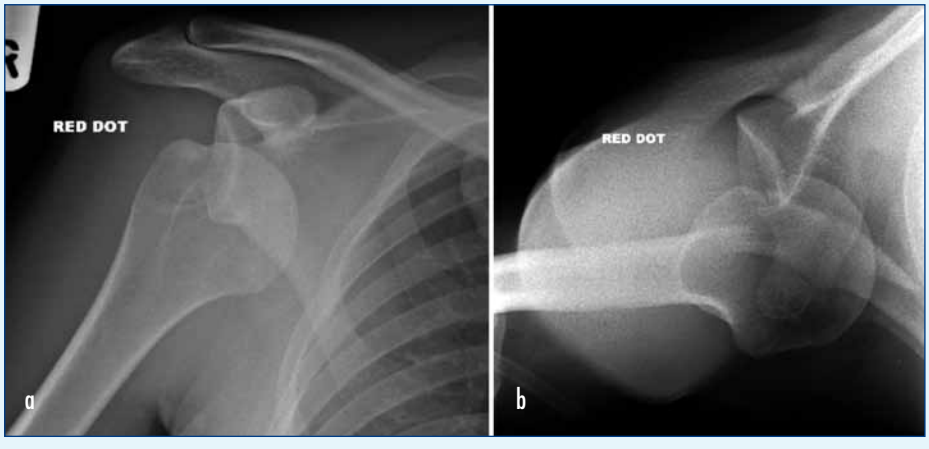

Figure 9. Anteroposterior radiograph showing acromioclavicular joint subluxation. The lateral end of clavicle is completely subluxed, lying superior to the acromion.

KEY POINTS

- At least two views are crucial for diagnosis, especially with posterior dislocations.
- Anterior dislocations are easy to diagnose.
- Do not forget the acromioclavicular joint. If injury is suspected, do not be afraid to get weightbearing views.
- Always look at the scapula, lungs and ribs for any other injuries.