Injuries to the clavicle and acromioclavicular joint

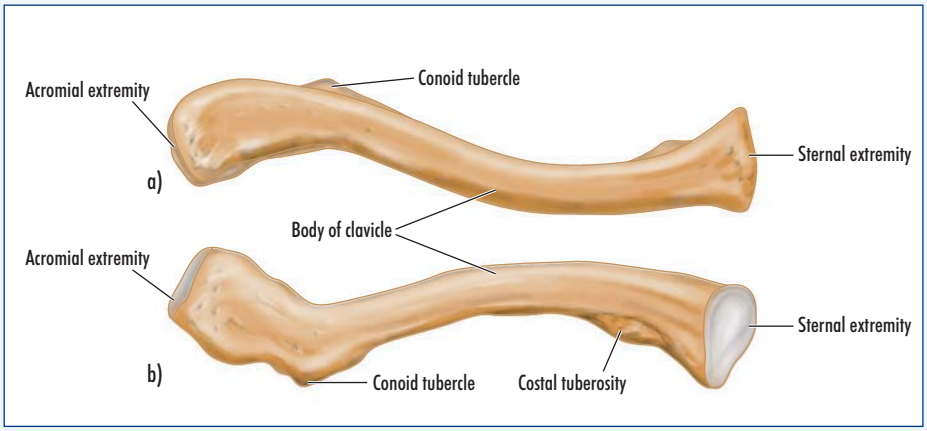

Figure 1. a. Anterior and (b) posterior views of the clavicle.

Anatomy and function

The clavicle is a doubly-curved long bone which acts as the only osseous strut connecting the trunk to the shoulder and arm (*Figure 1*). Medially the clavicle articulates with the manubrium of the sternum at the sternoclavicular joint, while laterally it articulates with the acromion of the scapula at the acromioclavicular joint. Trapezius and deltoid muscles attach to the flat outer third, as do the acromioclavicular and coracoclavicular ligaments. The tubular medial third is a boundary of the cervicoaxillary canal, and as such affords protection to the neurovascular bundle supplying the upper limb, including the brachial plexus, subclavian and axillary vessels. The junction between these two different cross-sectional configurations occurs in the middle third, which constitutes an area vulnerable to injury.

The acromioclavicular joint is also vulnerable to injury. Its horizontal stability is maintained by the acromioclavicular ligaments, while its vertical stability is maintained by the coracoclavicular ligaments.

Mechanisms of injury

It is a commonly held belief that the majority of clavicle fractures result from a fall onto the outstretched hand. However, the commonest mechanism is in fact a fall onto the shoulder, accounting for some 87% of injuries; direct impact on to the clavicle leads to 7%, and a fall onto the outstretched hand is responsible for the remaining 6% (Stanley et al, 1988).

Following fracture, the sternocleidomastoid muscle elevates the medial fragment, while the weight of the upper limb leads to a depression of the lateral fragment.

Injuries to the acromioclavicular joint follow similar mechanisms. A fall onto the shoulder with the arm in adduction leads to the acromion being driven medially and inferiorly. A fall onto the outstretched hand can also lead to acromioclavicular joint disruption.

Clinical presentation

The patient with a clavicle fracture usually presents with the ipsilateral arm splinted in adduction across the chest, its weight supported by the contralateral arm, thus unloading the injured clavicle. As described above, the clavicle plays an important role in protecting the neurovascular structures of the upper limb as they traverse the cervicoaxillary canal. Thus clinical examination must include a careful neurovascular assessment of the affected upper limb, comparing with the contralateral side. The integrity of the skin over the clavicle should be assessed. As the medial fragment is elevated by the action of sternocleidomastoid it often leads to tenting of the overlying skin (*Figure 2*).

Associated injuries which should be excluded include:

Figure 2. Tenting of the skin over a clavicle fracture.

- Ipsilateral pneumothorax following apical lung injury
- Head injury
- Cervical spine injury
- Acromioclavicular injuries
- Sternoclavicular injuries
- Scapulothoracic injuries
- Rib injuries.

Radiographical examination should include an anteroposterior view and a 45° caudal tilt view. These usually suffice to show injury to the proximal and middle thirds. However, these views tend to overexpose the distal third. If an injury to the distal third is suspected, then anterior and posterior 45° oblique views centred over the distal clavicle should be obtained. If injury to the ligamentous structures of the acromioclavicular joint is suspected, then stress views can be obtained, with the patient having a 10-pound weight strapped to the ipsilateral wrist.

Injuries to the acromioclavicular joint may present in a similar fashion. Examination of the patient in a sitting position with the affected arm dependant will help to accentuate any deformity. A 'step-off' of the injured acromioclavicular joint may be noted, with possible tenting of the skin over the distal clavicle. Tenderness is often elicited over the injured joint, together with a reduced range of motion of the affected shoulder, limited by discomfort. Once again, associated injuries should be excluded.

Radiographic examination with standard shoulder views (anteroposterior, scapular-Y and axillary) often suffices. Further examination of the ligamentous structures can be obtained through stress radiography, obtained in a similar fashion to that described above.

Mr Sam Oussedik *is Specialist Registrar in the Department of Trauma and Orthopaedics, Central Middlesex Hospital, London NW10 7NS*

Classification of injuries

Clavicle fractures are commonly classified according to anatomical description, including:

- Open *vs* closed injuries
- Location – proximal, middle or distal third
- Displacement
- Angulation
- Pattern – transverse, oblique, spiral, greenstick
- Comminution.

In addition, the Allman classification can be used (Allman, 1967). This groups fractures according to their anatomical site, with subgroups according to the fracture pattern (*Table 1*).

Disruption of the acromioclavicular joint is classified according to the displacement of the distal clavicle, and the associated ligamentous disruption (*Figure 3*). A type I injury results from a force applied to the shoulder insufficient to disrupt either acromioclavicular or coracoclavicular ligaments. This represents an acromioclavicular ligament strain. Type II injuries result from a tear to the acromioclavicular ligaments while the coracoclavicular ligaments remain intact. A separation is seen between the distal clavicle and the acromion. Types III and IV injuries result from complete disruption of both acromioclavicular and coracoclavicular ligaments, with displacement of the distal clavicle either superiorly or posteriorly. Type V shows greater superior displacement of the distal clavicle, resulting from additional disruption of the muscular attachments. Type VI occurs when the distal clavicle is displaced inferiorly to the coracoid process and posteriorly to the biceps and coracobrachialis tendons.

Table 1. Allman classification of clavicle fractures

Group I Fractures of the middle third	
Group II Fractures of the distal third	Type 1 Minimal displacement
	Type 2 Fracture medial to the corococlavicular ligaments
	Type 3 Intraarticular fractures
Group III Fractures of the medial third	Type 1 Minimal displacement
	Type 2 Displaced
	Type 3 Intraarticular
	Type 4 Epiphyseal separation
	Type 5 Comminuted

From Allman (1967)

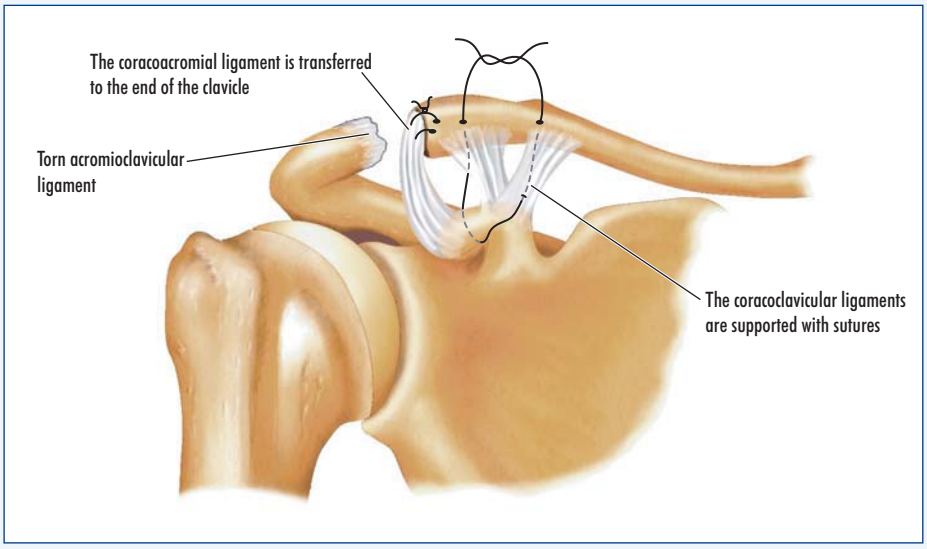

Figure 3. Rockwood classification of ligamentous injuries to the acromioclavicular joint. From Rockwood et al (1996).

Management

Non-operative treatment is appropriate for most clavicle fractures. Comfort and pain relief are the main treatment goals, with the arm held in a broad-arm sling for 4–6 weeks. The overall prevalence of non-union at 24 weeks after the fracture in non-operatively treated clavicle fractures has been found to be 6.2%, with 8.3% of the medial end fractures, 4.5% of diaphyseal fractures, and 11.5% of lateral end fractures remaining ununited (Robinson et al, 2004).

Operative treatment should be considered in the following cases:

- Open fractures
- Associated neurovascular injuries
- Gross displacement of the fracture with tenting of the skin.

Management of acromioclavicular joint disruption depends on the pattern of injury according to the classification system shown below.

Type I: Non-operative management, provision of a broad arm sling and adequate analgesics. Rest for 7–10 days and refrain from full activity until a painless full range of motion is restored.

Figure 4. The Weaver–Dunn procedure for the treatment of chronic acromioclavicular joint disruption. From Weaver and Dunn (1972).

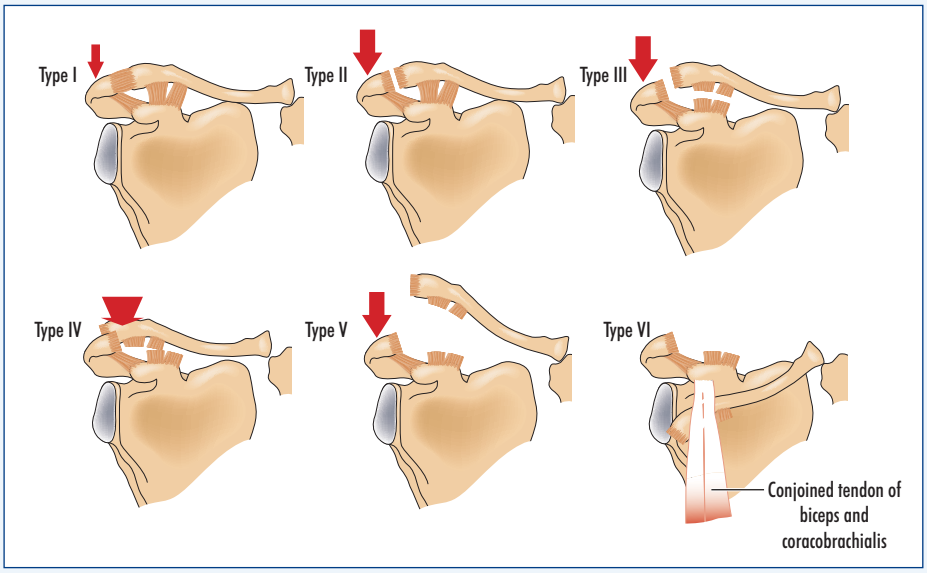

Figure 5. A fracture of the middle third of the clavicle, with superiorly displaced medial fragment endangering the overlying skin.

***Figure 6. The same fracture following open reduction and internal fixation. Operative management of acromioclavicular joint disruption involves open reduction of the displaced distal clavicle and stabilization of the acromioclavicular joint. This can be accomplished by the Weaver–Dunn procedure, as illustrated in* Figure 4.**

Type II: Non-operative management, provision of a broad arm sling and adequate analgesics. Gentle range of motion exercises should be commenced as soon as possible, with a return to full activities at around 6 weeks.

Type III: Treatment for these injuries is controversial. Schlegel (2001) reports reasonable results for non-operative treatment at 1 year. However, operative management may be necessary for heavy labourers and young active patients in order to ensure an earlier return to full activity.

Type IV, V and VI: Operative treatment by open reduction and surgical repair of the coracoclavicular ligaments for vertical stability (*Figure 4*).

Operative management

Operative treatment of clavicle fractures involves open reduction and internal fixation, usually by a combination of plate and screws (*Figures 5* and *6*). BJHM

Conflict of interest: none.

Allman FL Jr (1967) Fractures and ligamentous injuries of the clavicle and its articulation. *J Bone Joint Surg Am* **49:** 774–84

Robinson CM, Court-Brown CM, McQueen MM, Wakefield AE (2004) Estimating the risk of nonunion following nonoperative treatment of a clavicular fracture. *J Bone Joint Surg Am* **86:** 1359–65

Rockwood CA Jr, Green DP, Bucholz RW, Heckman JD, eds (1996) *Rockwood and Green's fractures in adults*. 4th edn. Lippincott-Raven, Philadelphia: 1354

Schlegel TF (2001) A prospective evaluation of untreated acute grade III acromioclavicular separations. *Am J Sports Med* **29:** 699–703

Stanley D, Trowbridge EA, Norris SH (1988) The mechanism of clavicular fracture. A clinical and biomechanical analysis. *J Bone Joint Surg Br* **70**(3): 461–4

Weaver JK, Dunn HK (1972) Treatment of acromioclavicular injuries, especially complete acromioclavicular separations. *J Bone Joint Surg Am* **54:** 1187

KEY POINTS

- Clavicle fractures commonly result from a fall onto the affected shoulder.
- The vast majority can be treated non-operatively.
- Accurate classification of acromioclavicular joint injuries allows early intervention in those requiring operative management.