BRITISH JOURNAL OF HOSPITAL MEDICINE



# Clavicle fractures

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## Abstract

Clavicle fractures account for approximately 2–5% of all fractures in adults and 10–15% in children. There is a bimodal distribution, with two peaks occurring in patients <25 years of age as a result of direct trauma and in those >55 years of age secondary to a fall onto an outstretched arm. Approximately two-thirds of all clavicle fractures occur in men. This article provides an overview of the presentation, assessment and management of clavicle fractures for both core surgical trainees and acute care common stem/emergency medicine trainees.

Key words: Clavicle; Fracture; Orthopaedic surgery; Trauma

Submitted: 9 April 2020; accepted after double-blind peer review: 22 April 2020

## Anatomy

The clavicle is the only osseous connection between the upper limb and the trunk. It is an S-shaped bone with the proximal half curving outward (convex), providing space for the upper limb neurovascular bundles, and the distal half curving back (concave). It articulates laterally with the acromion forming the acromioclavicular joint and medially with the sternum forming the sternoclavicular joint.

## Pathoanatomy

The clavicle is easily fractured because of its subcutaneous location. The midshaft of the clavicle is the thinnest segment and does not have any ligamentous or muscular attachments, thus is the location of the majority of clavicle fractures. Deforming forces are important to consider when understanding the fracture pattern in midshaft clavicle fractures. The medial segment is pulled posterosuperiorly by the sternocleidomastoid muscle. The weight of the arm pulls the lateral segment inferiorly, which is opposed by the trapezius. The pectoralis major and latissimus dorsi pull the lateral segment inferomedially, resulting in shortening.

The clavicle is in close proximity to the apical pleura, the brachial plexus and the subclavian artery and vein. These structures are at risk of being injured by a fracture fragment or during fracture fixation.

## Classification

Although numerous different clavicle fracture classification systems (AO, Neer, Craig, Robinson) have been described (Neer, 1968; Craig, 1990; Robinson, 1998), the simplest and most commonly used is the Allman classification, which categorises clavicle fractures into three groups based on their anatomical site (Table 1) (Allman, 1967).

**Table 1. Allman classification of clavicle fractures**

| Allman classification | Anatomical location | Frequency |
|---|---|---|
| Group 1 (Figure 1) | Middle third | 80% |
| Group 2 (Figure 2) | Lateral third | 15% |
| Group 3 (Figure 3) | Medial third | 5% |

*From Allman (1967)*

How to cite this article:
Morgan C, Bennett-Brown K, Stebbings A, Li L, Dattani R. Clavicle fractures. Br J Hosp Med. 2020. https://doi.org/10.12968/hmed.2020.0158


**Figure 1.** Radiograph demonstrating a left middle third clavicle fracture (group 1).

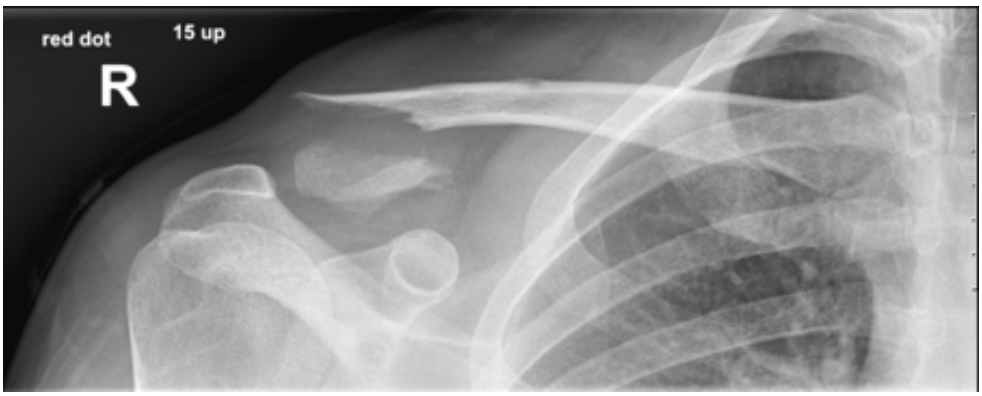


**Figure 2.** Radiograph demonstrating a right lateral third clavicle fracture (group 2).

**Figure 3.** Computed tomography scan demonstrating a right medial third clavicle fracture (group 3).

## Presentation

Clavicle fractures are usually evident on initial inspection. The affected extremity is usually held close to the body and patients often report localised pain over the fracture site. On physical examination, there may be a visible or palpable deformity around the clavicle with associated ecchymosis and tenderness to palpation. Open fractures and true skin tenting are rare but can occur in older patients with poor skin quality or after high-energy trauma. An abrasion over the clavicle may be seen, suggesting direct trauma. A thorough assessment of associated injuries should be performed, which is summarised in Table 2.

| Table 2. Clinical findings of associated injuries | |
|---|---|
| **Associated injury** | **Clinical findings** |
| Brachial plexus | Distal neurological deficit |
| Subclavian vessels | Reduced distal pulses, limb discolouration, increased capillary refill time |
| Lung | Difficulty breathing or reduced breath sounds on affected side may represent a lung injury, for example pneumothorax |
| Scapula and rib fractures (Figure 4) | Pain on palpation and associated movements |

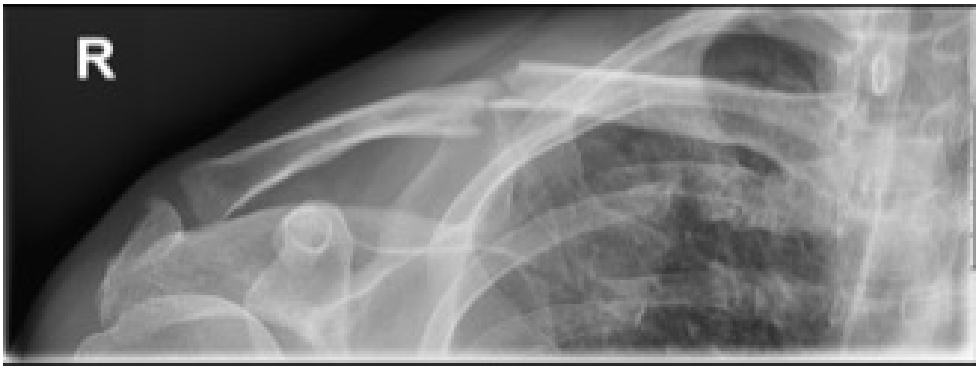


**Figure 4.** Radiograph demonstrating associated posterior rib fractures.

## Imaging

In the emergency department, radiographs of the clavicle should be obtained, including an anteroposterior view and a 15–45° cephalic tilt view. Computed tomography is not routinely required but may be useful in medial fractures or in the presence of an associated ipsilateral scapula neck fracture (floating shoulder). In high-energy injuries with a clavicle fracture, computed tomography is indicated as part of the trauma series to assess for associated injuries (scapula, lung or chest wall). Angiography may be required if associated vascular injury is suspected.

## Treatment in emergency department

Indications for an immediate orthopaedic referral are summarised in Table 3. In the remainder of cases, after a thorough assessment for possible associated injuries, the patient should be immobilised in a polysling (a sling that supports the weight of the elbow), discharged home with analgesia and given an orthopaedic fracture clinic follow up in 5–7 days. There is no significant advantage to the use of a figure-of-8 brace compared with a polysling in terms of pain relief, fracture displacement or cosmesis (Andersen et al, 1987). The summary flow diagram (Figure 5) can help guide the decision-making process.

## Management of middle third clavicle fractures (group 1)

Most patients with undisplaced or minimally displaced middle third clavicle fractures can be treated non-operatively in a sling. Range-of-motion exercises can begin at 4–6 weeks and strengthening at 6–10 weeks. Return to sports can usually be expected at 3 months.

The management of displaced clavicle fractures remains controversial. Multiple studies have shown improved early functional outcomes with lower rates of non-union and symptomatic malunion with surgical treatment of clavicle fractures compared with non-surgical treatment (McKee et al, 2006, 2012; Canadian Orthopaedic Trauma Society, 2007; Ahrens et al, 2017). However, there is no strong evidence to show that the long-term functional outcome of surgery is significantly superior to non-operative treatment (McKee et al, 2012).

| Table 3. Indications for immediate orthopaedic review |
|---|
| Open fractures |
| Skin tenting (impending open fracture) |
| Associated neurovascular injury |
| Polytrauma |
| Floating shoulder (ipsilateral clavicle and scapular neck fracture) |

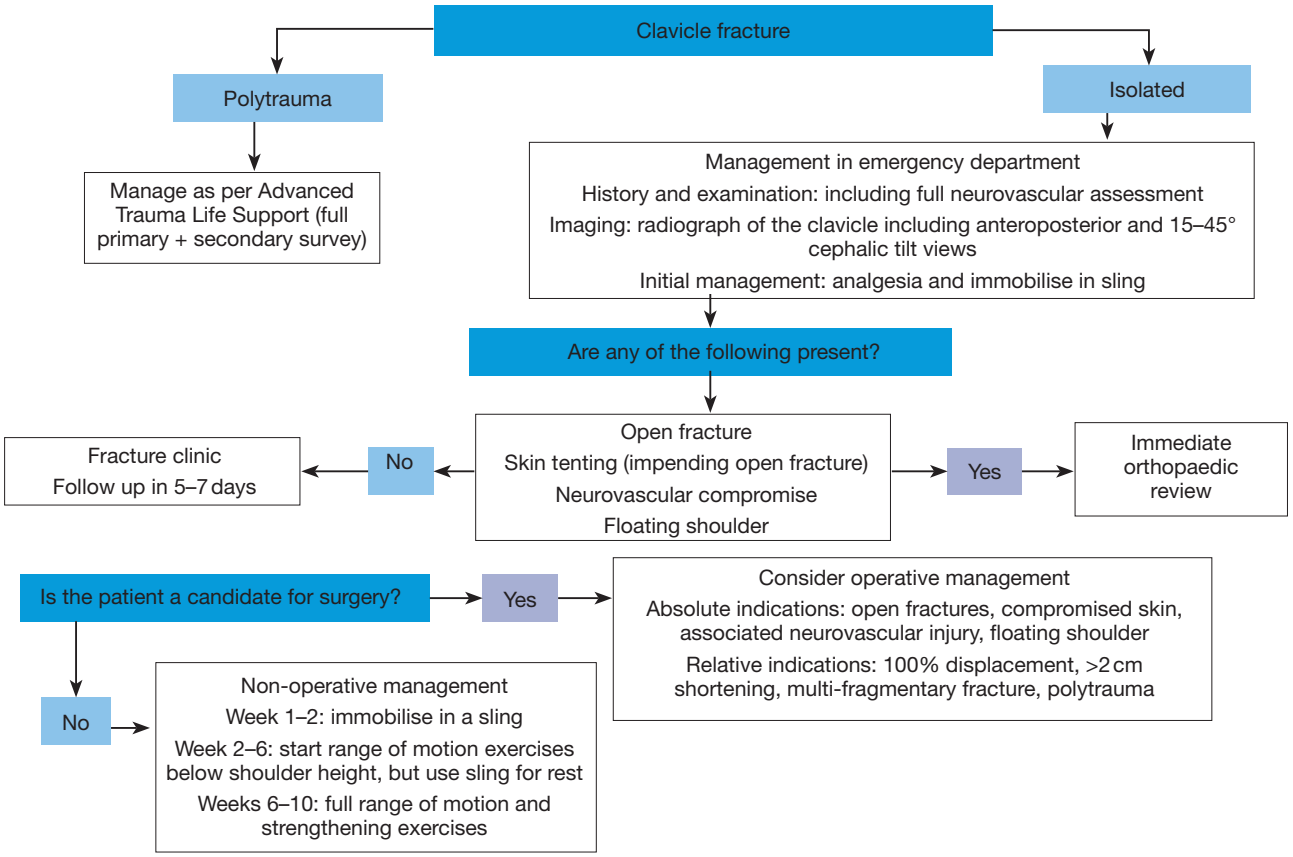


**Figure 5.** Assessment and management of adult clavicle fractures.

Surgical treatment aims to provide anatomical reduction of the fracture, with a shorter period of immobilisation and faster return to activities (Khan et al, 2009; Donnelly et al, 2013; King et al 2015). Although a number of different surgical techniques have been described, the most common method of fixation is open reduction and internal fixation with a plate and screws (Figure 6).

The absolute indications for surgical treatment are outlined in Table 4. Some fracture patterns have a high rate of non-union and form the basis of relative indications for surgery (Table 4).

Ultimately, the treatment option should be made on an individual patient basis with careful consideration of the relative benefits and risks of each intervention and patient preferences.

## Management of lateral third clavicle fractures (group 2)

Lateral clavicle fractures occur more commonly in patients older than 65 years of age. Undisplaced and minimally displaced lateral clavicle fractures can be treated non-operatively with good results. Displaced lateral clavicle fractures have a high rate of non-union (28–44%) (Robinson et al, 2004) and are often treated with early surgical fixation (Banerjee et al, 2011). In patients over 65 years of age and/or in patients with

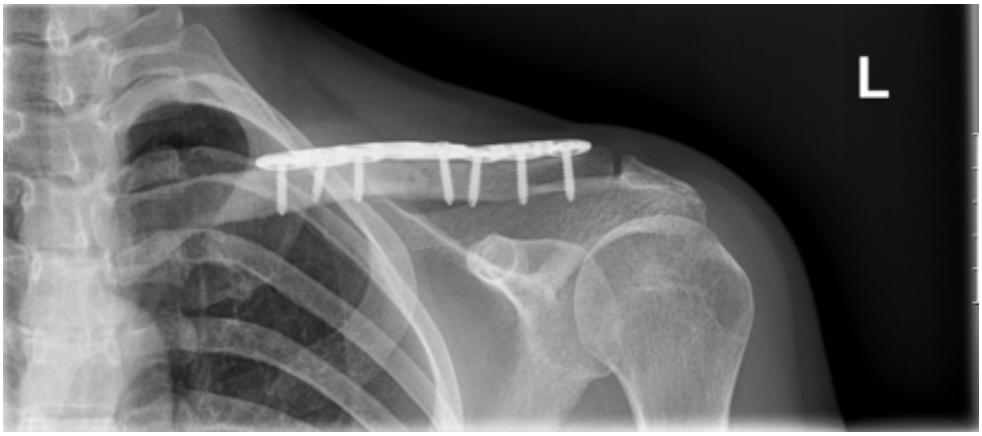


**Figure 6.** Radiograph demonstrating left clavicle open reduction internal fixation with plate and screws.

**Table 4. Absolute and relative indications for surgical fixation of middle third clavicle fractures**

| | |
|---|---|
| Absolute indications | Open fracture |
| | Skin tenting |
| | Associated neurovascular injury |
| | Floating shoulder |
| Relative indications | Shortening >2 cm |
| | Displacement >100% |
| | Multifragmentary fracture |
| | Polytrauma |

low physical demands, non-operative treatment remains an option, as the prevalence of symptomatic non-union is lower than midshaft fractures.

## Management of medial third clavicle fractures (group 3)

Medial clavicle fractures are rare and most often occur in middle-aged men. They are most commonly extra-articular fractures with minimal or no displacement, but may be associated with a fracture-dislocation of the sternoclavicular joint (Asadollahi and Bucknill, 2019). Radiographs are often unclear, and computed tomography may be beneficial for defining the fracture anatomy in further detail. In the majority of cases, these fractures can be treated non-operatively with a high union rate and overall good functional outcome (Asadollahi and Bucknill, 2019). Surgery is reserved for displaced fractures, particularly if nearby vascular structures are compressed.

## Management of paediatric clavicle fractures

Clavicle fractures are the most common childhood bony injury, accounting for 7–15% of all paediatric fractures (Rennie et al, 2007) (Figure 7). The majority of paediatric clavicle fractures are secondary to trauma. The possibility of non-accidental injury should always be considered, particularly in non-ambulatory children, where there is no clear mechanism of injury and if there is a delay in presentation. Most paediatric clavicle fractures can be treated conservatively with immobilisation in a broad arm sling to support the limb for 2 weeks or until the child is comfortable. Owing to the high remodelling potential in children, these injuries have an excellent prognosis, with most children returning back to normal activities within 8 weeks. The management of paediatric clavicle fracture in the emergency department is summarised in Table 5.

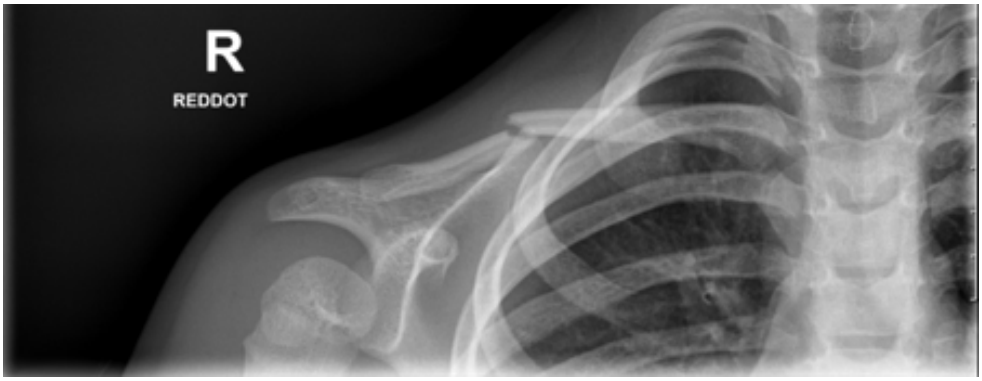


**Figure 7.** Radiograph demonstrating a right paediatric clavicle fracture.

**Table 5. Immediate management of paediatric clavicle fractures**

| Fracture type | Management | Referral |
|---|---|---|
| Middle third | Non operative<br>Polysling | ■ No need for follow up if undisplaced<br>■ If displaced, refer to fracture clinic |
| Lateral third | Non operative<br>Polysling | ■ Refer to fracture clinic if undisplaced<br>■ Refer to orthopaedics if displaced or fracture extends into acromioclavicular joint |
| Medial third | Non operative<br>Polysling | ■ Refer to orthopaedics |

## Conclusions

Clavicle fractures are common injuries in both adults and children. A thorough assessment of associated injuries is mandatory. A good proportion of clavicle fractures can be managed conservatively with good functional outcome, but some fractures do need operative intervention.

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## Key points

- Clavicle fractures are common injuries in both adults and children.
- Most clavicle fractures are caused by a fall onto the shoulder and most commonly affect active and healthy people during sporting activities or road traffic collisions.
- On assessment in the emergency department, it is important to examine for associated injuries and document a full neurovascular assessment.
- A good proportion of fractures can be managed conservatively in a sling; however, it is important to be able to recognise those fractures that require immediate orthopaedic assessment and consideration of operative management.
- Surgical fixation most commonly involves open reduction and internal fixation with a plate and screws.
- Surgical management decisions should be made on an individual patient basis, with careful consideration of the relative benefits and harm of each intervention and patient preferences.

## Curriculum checklist

This article covers the following areas from the Acute Care Common Stem (ACCS) and Core Surgical Training (CST) curricula:

- Know the anatomy of the axial skeleton and joints (ACCS/CST)
- Common fracture patterns of upper limb – presentation, management and complications (ACCS/CST)
- Be able to recognise which fractures need an orthopaedic opinion and those that cannot be treated in ED (ACCS)

**Conflicts of interests**
The authors declare no conflicts of interest.

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