Ministry of Defence

Synopsis of Causation

Clavicle Fractures

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Disclaimer

This synopsis has been completed by medical practitioners. It is based on a literature search at the standard of a textbook of medicine and generalist review articles. It is not intended to be a meta-analysis of the literature on the condition specified.

Every effort has been taken to ensure that the information contained in the synopsis is accurate and consistent with current knowledge and practice and to do this the synopsis has been subject to an external validation process by consultants in a relevant specialty nominated by the Royal Society of Medicine.

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1. Definition

1.1. A fracture is defined as a loss of continuity (breakage), usually sudden, of any structure resulting when internal stresses, produced by load, exceed the limits of its strength. The complexity and displacement of the fracture depend largely on the energy build up in the structure prior to fracture. The shape of the fracture planes (transverse fracture, split fracture, avulsion, impaction etc.) is related to the nature of the load, which may be compressive, bending, torsional, shear, or any combination of these.[1]

1.2. The clavicle is the only bone strut connecting the trunk to the shoulder and arm.

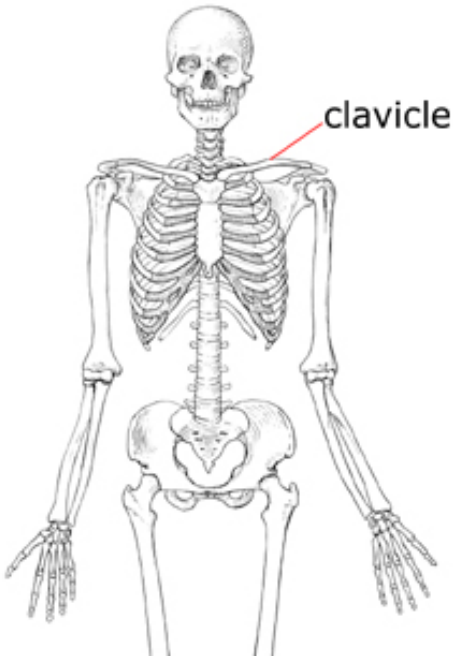

Figure 1: Position of the clavicle in relation to the shoulder and arm

2. Anatomy

2.1. The clavicle is the first bone in the body to ossify. The sternal end is the last ossification centre to fuse at 22 to 25 years of age.

2.2. The clavicle is the only long bone to ossify by intramembranous ossification without a cartilaginous stage.

2.3. The outer third of the clavicle is flat and is the insertion site for 2 important muscles, the trapezius (back) and deltoid (shoulder). Two important ligaments, the acromioclavicular and coracoclavicular also attach to this area of bone.

2.4. The middle third is tubular and provides protection for important structures such as the brachial plexus, subclavian and axillary vessels and the apex of the lung.

2.5. The clavicle is thought to be strongest in axial load. The junction between the flat and tubular areas of bone occurs in the middle third and it is this area that is vulnerable to fracture.

3. Clinical Features

3.1. It has not proved possible to predict the position of a clavicle fracture from the mechanism of injury alone.

3.2. The patient with a fracture of the clavicle will usually give a good history of trauma to lead the physician to suspect the injury. It is uncommon for the clavicle to develop stress fractures or to fracture through pathological deposits.

3.3. The patient will typically present with pain and decreased movement of the affected limb. The arm will usually be held across the chest with the opposite limb used to support the weight of the injured limb. There is usually a visible deformity.

3.4. It is imperative to perform a full neurovascular examination of the injured limb to identify any associated neurological or vascular injuries.[2]

3.5. The clavicle lies subcutaneously and being so close to the skin usually makes the fracture very easily palpable. If the fracture is significantly displaced, it may cause pressure on the overlying skin. Such pressure can lead to the eventual death of the skin over the fracture. If on clinical examination, a significant soft tissue injury or indeed a "degloving" type injury is found, then the examiner should suspect and look for any other associated injuries.

3.6. The chest should be auscultated and the presence of a pneumothorax excluded.

3.7. Patients may also have sustained bony injuries to head, neck, and upper torso and these should be excluded.

3.8. **Diagnosis**

3.8.1. Although clinical examination will provide much information, good quality radiographs (x-rays) will confirm the diagnosis.

3.8.2. Two x-rays taken from different angles (anteroposterior and 45° cephalic tilt) are needed to fully investigate multifragmentary fractures.

3.8.3. A plain chest x-ray should also be taken. This allows exclusion of a pneumothorax and, in addition, allows any shortening of the clavicle to be seen, as well as the relative relationships of the scapulae to be appreciated.

4. Aetiology

4.1. Fractures of the clavicle comprise 4% of all fractures and about 35% of fractures of the upper limb girdle.[3]

4.2. Allman described a trimodal distribution of clavicle fractures. In a Swedish study of over 2000 cases, Allman Group 1 fractures (middle one third of the clavicle - the shaft) accounted for 76% of clavicle fractures with a median age of 13 years. Group 2 (lateral one third - the acromial end) accounted for 21% with a median age of 47 years. Group 3 (medial one third - the sternal end) accounted for 3% with a median age of 59 years. All 3 groups were characterised by a preponderance of men, and there was a significant increase in the incidence of clavicular fracture between 1952 and 1987, both overall and sports-related.[4,5]

4.3. One thousand fractures of the adult clavicle were reviewed in a Scottish study. In males, the annual incidence was highest under 20 years of age, decreasing in each subsequent cohort until the seventh decade. In females, the incidence was more constant, but relatively frequent in teenagers and the elderly. In young patients, fractures usually resulted from road-traffic accidents or sport, and most were diaphyseal. Fractures in the outer fifth were produced by simple domestic falls and were more common in the elderly.[6]

4.4. It was widely believed that a fall onto the outstretched hand was the most common mechanism of injury. More recent research however has shown little evidence to support this. Falls onto the affected shoulder are now believed to cause up to 87% of clavicle fractures, whereas direct impact (accounting for 7%) and falls onto the outstretched hand (6%) are less common.[7]

4.5. Very rarely, the clavicle can fracture due to violent muscle contraction. This has been reported after seizures and the first reported case of clavicle fracture related to the violent muscle contractions associated with bench pressing highlighted the risks of heavy weight training and the need for proper supervision.[8]

4.6. Stress fractures of the clavicle are rare.[9] The patient typically presents with a history of pain over the clavicle sometimes associated with swelling. There is no definite history of trauma.[10-13]

4.7. Pathological fractures of the clavicle are also rare.[14-16]

4.8. There has been documented evidence that patients with a high alcohol intake have a higher incidence of clavicle fracture. A Swedish study looked at all adult cases of clavicle fracture treated in Malmö during one year. The patient database was cross-referenced with the Department of Alcohol Diseases. Twelve percent of all patients with a shoulder injury were recorded as alcohol abusers. One third of mid-clavicular fractures and two thirds of all lateral clavicle fractures were sustained by alcohol abusers.[17]

4.9. Fractures of the clavicle can occur following gunshot or other penetrating injuries.[18]

5. Treatment

5.1. The treatment of clavicle fractures can be divided into conservative (no operation) or operative.

5.2. The goal of management is to provide support for the shoulder girdle with sling immobilisation for 4 to 6 weeks to ensure adequate reduction while allowing for the use of the opposite arm, elbow, wrist and hand.

5.3. Closed treatment is successful in most cases with no need for reduction.

5.4. Comfort and pain relief are the main goals.

5.5. A sling has been shown to give the same results as a figure of eight bandage, with less patient discomfort and fewer skin problems.

5.6. Surgical intervention in the acute setting should be considered in certain circumstances:

- Open fractures, or fractures with overlying tenting of the skin
- Fractures with an associated injury to nearby nerves and blood vessels
- Fractures in the patient who has other severe injuries, such as multiple rib fractures leading to a flail chest segment, associated upper-limb fractures (a 'floating shoulder')

5.7. The details of surgical techniques are not described in this article, however broadly speaking, stable fixation can be achieved using 4 main techniques:

- Plate fixation is widely used but the subcutaneous location of the plate may result in patient dissatisfaction due to prominent painful metalwork
- Intramedullary devices may be used. These devices which are positioned inside the bone are prone to migration and can cause significant post-operative problems
- Cerclage (loop) suturing or wiring of the fracture
- External fixation devices have been used in the treatment of patients with multiple injuries

5.8. **Complications**

5.8.1. Neurovascular complications can occur either at the time of injury as the sharp bone ends lacerate the subclavian vessels or brachial plexus, or later as excessive callus forms around the healing fracture and compression of the above structures may become symptomatic.

5.8.2. Healing of the fracture in an abnormal position (malunion) may cause an unacceptable cosmetic deformity. Malunion may also lead to diminished function of the upper limb girdle and chronic pain.

5.8.3. The incidence of clavicle fracture nonunion is reported to be between 0.1 and 13%. The following factors are felt to predispose to nonunion:

- Inadequate immobilisation
- Operative treatment

- Certain types of distal clavicle fracture
- Fractures with soft tissues interposed between the bone ends

5.8.4. Post-traumatic arthritis may occur after intra-articular injuries to the sternoclavicular or acromioclavicular joints. However, the literature does not support the supposition that proximal clavicle fractures have a higher rate of post-traumatic arthritis than other forms of clavicular fracture even with the intra-articular extension.

6. Prognosis

6.1. The prognosis for patients following clavicle fracture is highly dependent on the mechanism of injury, age of patient, degree of fracture displacement, position of fracture and any underlying pathology.[20]

6.2. Clavicle fractures are among the most common acute shoulder injuries. Some authors report that 80% of fractures can be managed conservatively with good results.[21] The debate over operative versus nonoperative treatment is outside the remit of this synopsis of causation; the literature suggests that long-term outcome of more severe injury is variable.

6.2.1. Two hundred and twenty five patients with closed mid-clavicle fractures were reviewed in a Swedish study. All were treated conservatively. At follow up, 185 shoulders were asymptomatic. Thirty-nine patients had moderate pain and were rated as fair, and one patient was rated as poor. Fifty-three fractures were malunited with persistent fracture displacement, and 7 were nonunions. Nonunion was significantly more prevalent in cases with displaced fractures. The authors concluded that few patients with fractures of the mid-part of the clavicle required operative treatment.[22]

6.2.2. Evidence shows that the more displaced (>15mm) or shortened (>20mm) the fracture is, the higher the incidence of complications.[23,24] To avoid the poor prognosis of this pattern of injury, some authors recommend open reduction and internal fixation of severely displaced fractures of the middle third of the clavicle in adult patients.

6.2.3. Lateral clavicle fractures have also been studied. One hundred and ten patients with lateral clavicle fractures managed conservatively were reviewed at 15 years following injury. Ninety-five shoulders were asymptomatic. Fifteen shoulders had moderate pain and dysfunction and were rated as fair. No patient had severe residual shoulder disability. The authors concluded that fractures of the lateral end of the clavicle did not need an operation.[25]

6.3. A short case series of 5 servicemen who had sustained closed clavicular fractures has been reported. Four of these patients had presented with a painful nonunion and one with tenting of the skin. All patients were managed operatively. The results were excellent with all 5 men returning to duties with pain free shoulder girdles within 6 months.

6.3.1. One case was complicated by a prominent plate, which rubbed on straps and had to be removed. The patient returned to full duties.

6.3.2. The military surgeons involved advocated early orthopaedic referral in cases of painful clavicular nonunion and, where appropriate, open reduction and internal fixation with the expectation of an early return to full duties with a pain free shoulder girdle. [26]

6.4. The role of the intact clavicle in the closed-chain linkage system of the shoulder girdle has been investigated in biomechanical terms. The functional loss of clavicular length and malrotation has yet to be fully understood.[3]

6.5. The role of disturbed blood supply and perfusion in clavicular nonunion is assumed, the intra- and extraosseus clavicular blood supply has yet to be characterised.[3]

6.6. Three-dimensional imaging of the periclavicular spaces after injury and identification of loss of volume would further establish criteria for consideration of clavicular fixation following fracture.[3]

7. Related synopses

Fracture Long Bones, Upper Limb

8. Glossary

anteroposterior	The x-ray beam is directed through the subject from front to back.
asymptomatic	Not causing the patient pain or dysfunction.
auscultate	The use of a stethoscope to listen to the chest.
avulsion	The pulling off of a bony fragment by stronger ligament and muscle attachments.
axillary	Pertaining to the cavity beneath the junction of the arm and the body, better known as the armpit.
brachial plexus	A vulnerable structure of important nerves running from the neck to the upper limb.
cartilaginous	Predominantly made up of cartilage.
cephalic	Directed towards the head.
degloving	When skin and soft tissue is torn from its underlying attachments.
median	The observation closest to the middle when looking at data in a normal distribution.
ossification	The production of bone.
pathological fracture	A fracture, usually caused by an abnormally low energy, which occurs through diseased bone. Tumour deposits or congenital abnormalities can make bone susceptible to pathological fracture.
pneumothorax	A pneumothorax occurs when air enters the plural cavity, collapsing the lung. If pressure builds up within the chest cavity a tension pneumothorax can develop which compresses the heart and great vessels.
subclavian	Under the clavicle (the collar bone), as the subclavian artery or the subclavian vein.
subcutaneously	Running just under the skin (cutaneous) layer.
tenting of the skin	If bone fragments are displaced sufficiently, they can put the overlying skin under pressure. This can lead to skin breakdown and the uncovering of the fracture. This is a serious complication.

transverse	Across. Transverse bisection of the body in the anatomical position would divide it into upper and lower halves. Not the same as horizontal, which means parallel with the horizon. Horizontal is always related to the horizon, whereas the anatomical planes (coronal, frontal, sagittal, transverse) always relate to the anatomical position.[1]

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