Current management of midshaft clavicle fractures

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Most midshaft clavicle fractures can be managed conservatively, but surgical fixation is indicated in certain situations and can be expected to deliver excellent results.

Fractures of the clavicle are common, occurring most often in males aged 13 to 20 years.[1] The mechanism of injury is usually a direct blow to the point of the shoulder or a fall onto an outstretched hand. It is most frequently seen in people who participate in sports such as rugby, skiing and cycling. Generally, the fracture occurs in isolation, but it is imperative for the examining clinician to ascertain that there has not been any associated injury involving the sternoclavicular or acromioclavicular joints, first rib fractures or injuries to the lung, pleura or neurovascular structures.

Management

Nonoperative treatment

Most midshaft clavicle fractures can be treated nonoperatively. They always heal in pre- and peripubertal patients, and most mild or undisplaced fractures in adults will also unite.

Elbow support to minimise the weight of the arm should be provided using a sling, because the weight of the arm tends to drag the lateral fragment inferiorly, causing displacement (Figure 1). A figure-of-eight clavicle support will further stabilise the scapula, reduce movement at the fracture site and provide better analgesia; any such added support should be applied firmly but not too tightly. Use of a collar 'n' cuff support is inappropriate because it will not reduce the weight of the arm and will accentuate the fracture deformity.

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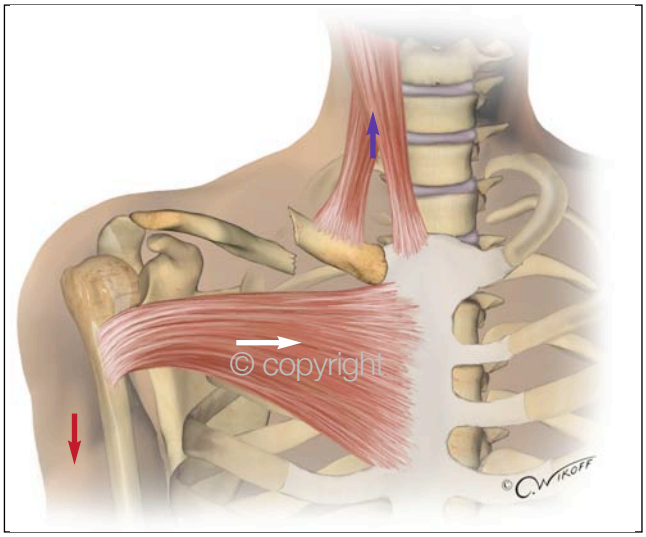


Figure 1. Deforming forces acting on a midshaft clavicle fracture. The weight of the arm tends to drag the lateral fragment inferiorly (red arrow), causing displacement of the fracture. The trapezius tends to pull the medial fragment upwards (blue arrow) while the pectoralis major tends to pull the arm medially (white arrow), shortening the fracture.

Figure 2. Obvious deformity from a displaced clavicle fracture.

The fracture is immobilised in a sling for three to four weeks. A graded mobilisation program with range of motion and strengthening exercises is then introduced, provided that x-rays show union to be progressing. Contact sport may be allowed after eight to 12 weeks, depending on the consolidation of the fracture and the amount of pre-existing deformity that needs to remodel.

Even though clavicle fractures may heal with deformity, overlap and shortening, symptoms may be minimal. However, some patients complain of a lump at the site of the fracture being uncomfortable, with the shoulder sitting forward and shortened (Figure 2). Other symptoms include rotator cuff irritation,

continued

Table. Midshaft clavicle fracture: indications for open reduction

Skin compromise
Compound fracture
Soft tissue interposition
Neurovascular compromise
Wide separation and displacement of fragments
Shortening of fracture of more than 2.0 cm
Altered scapulothoracic posture (scapular winging)

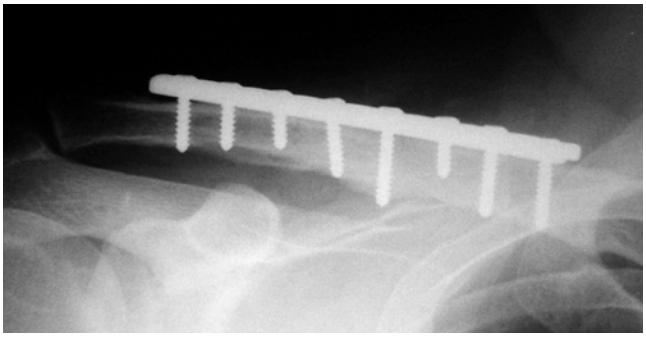


Figure 3. A clavicle fracture fixed with plate and screws.

winging of the scapula, fatigue pain and, rarely, thoracic outlet symptoms.[2] These are more likely to occur when the shortening is greater than 2.0 cm.[3]

Nonunion is a concern when there is wide separation of fragments, with or without comminution. The probability of nonunion of a widely displaced diaphyseal fracture at 24 weeks in males aged 25 years or older is at least 20%; in females, the probability is 33%. In general, displaced and comminuted fractures have a higher rate of nonunion in females and older patients.[4]

For these reasons, surgery may be recommended.

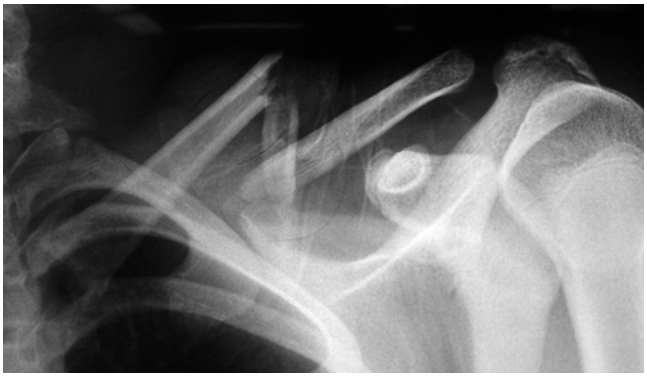
Surgical treatment

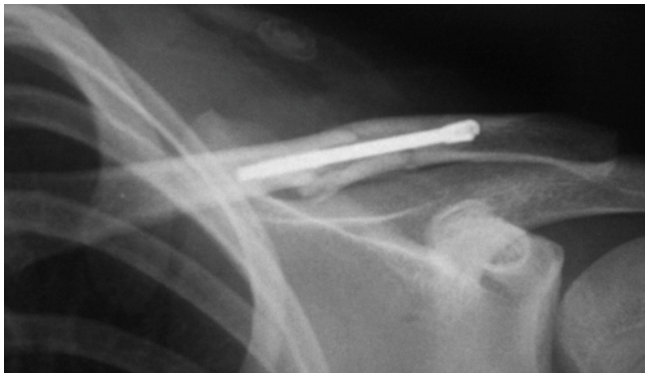
The clinical indications for internal fixation of a displaced midshaft fracture are listed in the Table. Secondary benefits include rapid analgesia as the fracture is stabilised and a quicker return to function, work and sport.

Internal fixation can be performed using two basic principles: a plate and screws, or a intramedullary screw or pin. A variety of products are available, and the choice is often surgeon dependent. Traditionally, fixation devices were made of stainless steel but recently there has been a shift to using titanium, which is stronger yet has a modulus of elasticity closer to that of bone. Stainless steel usually needs to be removed whereas titanium can be left *in situ* if it does not irritate the patient.

Plate and screw fixation is a more rigid construct, but it does involve a large exposure with risk of damage to the infraclavicular nerve (Figure 3). In a comminuted fracture, there may be difficulty with exact reduction and the surgery can take a long time. There is very little subcutaneous fat between the clavicle and the overlying skin, so the plate can often cause irritation and require later removal. After a plate and screws are removed, there may be a stress riser through screw holes that might weaken the bone – this is significant if the patient wants to return to collision sports before the bone has had a chance to strengthen itself.

Insertion of an intramedullary device into the clavicle, which is an S-shape, is technically a lot easier than expected. The device is passed from the posterolateral side of the clavicle where it curves, through the fracture site and then into the medial fragment, along the straight central part of the bone to secure the fragments (Figures 4a and b). Since the average minimum internal diameter of the central part of the clavicle is 4 to 5 mm, any device should fill this area for better fixation.[5] Intramedullary screw or pin fixation is quick and easy, and it provides rigid fixation using a





Figures 4a and b. A displaced and comminuted midshaft fracture of the clavicle prior to surgery (a, left) and after reduction and fixation with a titanium intramedullary screw (b, right).

smaller skin incision and needing little periosteal stripping. Because of the positioning of the entry hole for the pin, no screw holes remain as an area of weakness if the device needs to be removed.

Postoperative management includes a sling for comfort in the first week. The arm and hand can be used from the first day, but overhead use is avoided for two or three weeks. It is recommended that patients avoid all heavy lifting and collision sports until the fracture is well on the way to union, which is usually around six weeks.

Conclusion

Midshaft clavicle fractures are common and most are treated nonoperatively. In some patients, however, residual symptoms occur, especially if there is marked shortening (>2.0 cm), wide displacement or comminution of the fracture. Such patients may complain of local pain from nonunion, a deformity or lump, and other symptoms related to altered scapulothoracic mechanics. Sometimes, patients cannot afford to be incapacitated for many weeks while they wait for the fracture to heal. In these situations, surgical fixation is recommended. The mode of fixation will be the surgeon's choice, but the available devices include plates and screws or intramedullary screws and pins. Excellent results can be achieved with these procedures, with rapid analgesia and a quicker return to work or sport anticipated. MT

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DECLARATION OF INTEREST: Dr Bokor has a financial interest in the development of a new intramedullary titanium screw (in co-operation with Australian Surgical Design and Manufacture Pty Ltd).