

## Wrist fractures

Three quarters of wrist injuries are fractures of the distal radius and ulna. The eight carpal bones are injured less frequently. Accurate diagnosis and correct treatment help to prevent long-term loss of function.

Wrist fractures in the elderly are associated with deformity and significant and prolonged/permanent loss of dependence, especially in frail patients. [1] [2]

See also the separate article on [Carpal Fractures and Dislocations](#).

### Classification of wrist fractures [3]

As with fractures elsewhere in the body, wrist fractures can be:

- Simple
- Compound
- Comminuted
- Greenstick

For a fracture to be compound, the bone does not have to be protruding through the skin. If the bone is fractured and the overlying skin is broken this is a compound fracture and must be treated as such.

#### Common wrist fractures

- Colles' fracture (distal radius with dorsal displacement of fragments).
- Smith's fracture (distal radius with volar displacement of fragments).
- Scaphoid fracture.
- Barton's fracture (fracture dislocation of the radiocarpal joint).

- Chauffeur's fracture (fracture of the radial styloid).
- Greenstick fracture (confined to children).
- Fracture of the ulnar styloid.

High-energy injuries to the wrist may involve complex fractures of the distal radius, radiocarpal dislocations, perilunate dislocations, and other intracarpal dislocations, depending on the energy of the injury and the position of the wrist at the time of impact. The trauma is often bilateral, with proximal lesions (elbow) very often associated with contusion or compression of the median nerve.<sup>[4]</sup>

## Wrist fractures epidemiology

- Fractures of the wrist are common, representing about a quarter of all fractures of limbs.
- They are more common in children and in young adults, especially those involved in risk-taking activities.
- They also become more common with advancing age, partly because advancing age is related to an increased risk of falls and partly because of osteoporosis.<sup>[5]</sup>

## History

The history of the fall is important:

- What was the mechanism of injury? Note the degree of trauma, as fracture with a mild force suggests osteoporosis.
- Was there a sound or a feeling of something breaking on impact?
- Is there loss of function?
- Does the patient feel that it is unstable?

## Wrist fractures treatment and management<sup>[3]</sup>

- Assess Airway, Breathing and Circulation and manage as necessary.
- Assess for deformity and examine for any skin defects that might lead to a diagnosis of a compound fracture.

- Provide analgesia whilst waiting for X-ray. Temporary splinting may also help.
- If there is neurovascular compromise, urgent fracture reduction may be needed.
- Displacement of fractures, dislocation or subluxation must be reduced. In older people the cosmetic result may be subservient to the need for a good functional result.

## Reduction

- Manipulation of broken bones is very painful; some form of anaesthesia is required.
- General anaesthesia is effective but even a brief anaesthetic has risks, especially in the elderly or those with medical problems. It is also necessary to wait until at least four hours after anything was taken by mouth.
- A Cochrane review examined the main methods of anaesthesia: haematoma block, intravenous regional anaesthesia (IVRA), regional nerve blocks, conscious sedation (also known as 'moderate sedation/analgesia') and general anaesthesia. It also looked at associated physical techniques and drug adjuncts used for the management of distal radial fractures in adults. All methods were effective but regional block was probably more effective than haematoma block. However, haematoma block is quicker, easier to perform and less intensive on resources. They concluded that there was inadequate evidence of robust quality to make an adequate comparison of the various techniques.<sup>[6]</sup>
- A novel technique, which avoids the risks of local anaesthetic leakage or excess sedation, is the proximal periosteal block.<sup>[7]</sup>
- Intravenous regional anaesthesia (Bier's block) should be considered when reducing dorsally displaced distal radius fractures in adults (16 or over) in the emergency department. This should be performed by healthcare professionals trained in the technique, not necessarily anaesthetists.<sup>[8]</sup>
- The method of reduction varies depending on the fracture.

- If it is not possible to achieve satisfactory reduction of a fracture, with or without dislocation, then operative treatment is required. This is more likely to be required if there is both a fracture and a dislocation.

## **Immobilisation**

- The treatment of a fracture involves immobilisation and the general principle is that the joint above and the joint below the fracture should both be immobilised.
- The trauma of a fracture is usually associated with local swelling and so a full cast must be avoided initially, as the swelling may impede the circulation and can produce ischaemic contractures.
- The usual technique is to apply a back slab, held in place by crepe bandages. A few days later the patient is seen in the fracture clinic, the part is often X-rayed (to check that there has been no movement) and a full cast is applied.
- The management of a fractured scaphoid is an exception that will be considered below.
- After a fracture has been reduced and immobilised with a back slab, a repeat X-ray is taken to ascertain that alignment is satisfactory.

**All patients should be given an appointment for orthopaedic follow-up in a fracture clinic.**

## **Scaphoid fracture**<sup>[9]</sup> <sup>[10]</sup>

- Scaphoid fractures are the most common fractures of the carpus, accounting for 79% of all carpal fractures.<sup>[11]</sup>
- They occur most often in men aged 20–30 years. About 10% present with an associated fracture.<sup>[12]</sup>
- Scaphoid fractures can be through the waist, the proximal pole or the tubercle. They can be displaced or non-displaced.
- Due to the vulnerability of the blood supply to the scaphoid, scaphoid fractures have a high risk of non-union and avascular necrosis with subsequent osteoarthritis; early diagnosis and treatment minimise these risks.

## History and examination<sup>[13]</sup>

- Classically, the fracture occurs from a fall on to an outstretched hand (FOOSH); however, it can also be the result of injury sustained from the steering wheel during a road traffic accident.
- Rarely scaphoid stress fractures can occur in young, high-level athletes, such as gymnasts, who undertake repetitive loading of the wrist in extension.<sup>[14]</sup>
- The complaint is usually just of local pain.
- The classical sign is tenderness in the anatomical snuffbox.
- Fewer than 10% of patients with a clinically suspected scaphoid fracture have a true fracture.<sup>[15]</sup>
- The anatomical snuffbox is on the radial aspect of the dorsum of the wrist. Ask the patient to hyperextend the thumb with the wrist slightly deviated in the radial aspect. In this position, the tendons of extensor pollicis longus and extensor pollicis brevis/abductor pollicis longus that define the snuffbox become obvious. The scaphoid can be palpated proximally in the floor of the snuffbox. The trapezium can be palpated distally.
- Anatomical snuffbox tenderness on examination is a very sensitive indication of a scaphoid fracture but it is nonspecific. Causes of a false positive result can occur when the radial nerve sensory branch, which passes through the snuffbox, is pressed and causes pain.
- Pain in the scaphoid area on applying longitudinal thumb compression also suggests a scaphoid fracture.
- Another manoeuvre that suggests fracture of the scaphoid is pain in the snuffbox with pronation of the wrist followed by ulnar deviation.
- Always compare any tenderness with the unaffected side if possible.
- No single clinical test has been shown to be diagnostic of scaphoid fracture, although they all have a high negative predictive value.<sup>[16]</sup>

## Investigations<sup>[13]</sup>

- Acutely, scaphoid fractures are often difficult to identify on X-ray and may not be seen in 20% of cases.

- If a fractured scaphoid is suspected, make this clear on the X-ray request, as four specific scaphoid views will then be taken: postero-anterior, true lateral, semi-pronated oblique and postero-anterior with the wrist in ulnar deviation.
- Repeating X-rays 10–14 days after the initial injury and presumptive casting to allow time for resorption to produce a visible fracture line has a relatively low sensitivity (91.1%).<sup>[12]</sup>
- A Cochrane review of additional imaging when a scaphoid fracture is clinically suspected but the X-ray is normal found that:<sup>[13]</sup>
  - For bone scintigraphy (BS), sensitivity and specificity were 0.99 and 0.86.
  - For CT, sensitivity and specificity were 0.72 and 0.99.
  - For MRI, sensitivity and specificity were 0.88 and 1.00.
  - Although BS has the highest diagnostic accuracy, it has the worst specificity, leading to significant over-treatment. It also has the highest exposure to ionising radiation and can only be performed after a delay of 72 hours following the injury.
  - The authors concluded that either CT or MRI should be used and there was no advantage of one over the other.
- Additional imaging may also identify carpal or radial bone, or soft tissue injuries which may otherwise have been missed.

## **Scaphoid fracture treatment and management**

- To avoid undertreatment of occult fractures, patients with clinically suspected scaphoid fractures are treated with cast immobilisation followed by repeat examination and further imaging.
- Since over 90% of people with a suspected scaphoid fracture don't have a true fracture, there is significant over-treatment. This carries with it costs – both personal (from work days lost and inconvenience) and to the healthcare system.

- There is an increasing trend to treat undisplaced or minimally displaced scaphoid wrist fractures with immediate surgical fixation. [17] However, current evidence does not support routine surgical treatment: [18]
  - Surgery appears to facilitate early return of function but at the expense of a higher risk of complications (9–22%).
  - Rate of union between immediate surgical fixation and immobilisation with early fixation of those fractures that fail to unite, is similar.
- There is not enough evidence to determine the best treatment for scaphoid proximal pole fractures. There is also insufficient evidence to determine which type of cast should be used for non-displaced fractures. [19]
- A fracture of the scaphoid is an exception to the rule that a back slab be applied initially, as there is usually no associated swelling. A scaphoid cast is usually applied from the outset. This fixes the wrist in about 10° of flexion with slight radial deviation and the thumb and middle finger just able to oppose. The position is that which would be assumed when using a pen.
- The duration of immobilisation depends upon the site of the fracture and the outcome of the results of repeated radiological checks. 6–8 weeks is common but 12 weeks or longer may be necessary. [20]
- Operative treatment may be needed for displaced fractures.

## Complications

Complications can occur, especially if there is failure of diagnosis and inadequate treatment. They include:

- Avascular necrosis: the blood supply enters the scaphoid near its waist. Fractures in this area can potentially interrupt the blood supply to the proximal part of the scaphoid, leading to avascular necrosis, non-union and arthritis.
- Scaphoid non-union/delayed union; non-union occurs in approximately 5–10% of undisplaced scaphoid fractures. [21]
- Reduced grip strength and reduced range of motion.

- Osteoarthritis of the radiocarpal joint.

## Colles' fracture<sup>[22]</sup>

- The classical definition is a fracture through the distal metaphysis of the radius, within 2–3 cm of the articular surface. The term is now more loosely used for any fracture of the distal radius, with or without involvement of the ulna, with dorsal (backward) displacement of the fracture fragments.
- It is common in older people who fall and have osteoporosis. Osteoporosis should be considered in anyone with a Colles' fracture (see 'Osteoporosis and wrist fractures', below).
- It can also occur in younger people with normal bones, when it is more likely to have an intra-articular component and follow high-energy trauma.
- A systematic review found that despite worse radiographic outcomes associated with cast immobilisation, functional outcomes were no different from those of surgically treated groups for patients aged 60 and over.<sup>[23]</sup>
- A Colles' fracture is a stronger risk factor for a subsequent hip fracture in men than in women.<sup>[24]</sup>

## History and examination

- It typically occurs from a fall on to an outstretched hand that results in forced dorsiflexion of the wrist.
- The characteristic dinner fork deformity makes it easy to recognise, along with the classical history. Deviation is backwards and laterally. The fracture may be unstable.
- Physical examination of a Colles' fracture should include checking the ulnar styloid for tenderness, as well as the radial head. Both can also be fractured. The median nerve can be damaged.

## Colles' fracture treatment and management



- The fracture needs to be reduced under whatever form of anaesthesia is appropriate. The manoeuvre involves disimpaction of the fracture and a movement forwards and medially (the opposite of the deformity).
  - A back slab is applied and a repeat X-ray taken to assess the adequacy of reduction. If the position is unsatisfactory the procedure needs to be repeated. If the fracture appears unstable then orthopaedic help is required. Percutaneous pinning is sometimes necessary.
  - The optimum position for immobilising the wrist, whether the cast should be extended proximal to the elbow and how long the wrist should be immobilised are all still debated.<sup>[25]</sup>
  - Surgical reduction is recommended for intra-articular fractures if there is any articular incongruity.<sup>[25]</sup>
  - Healing usually takes about six weeks.
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## Complications

- Median and/or ulnar nerve damage can occur acutely. There can be an acute carpal tunnel syndrome.
- [Compartment syndrome](#) can occur with excessive swelling.
- Deformity can occur on healing and result in long-term loss of mobility and in functional problems.
- Chronic pain can occur.
- Malunion/non-union are possible, as with all fractures.
- Arthritis is a late complication.
- [Complex regional pain syndrome](#).

## Smith's fracture<sup>[26]</sup>

- This is sometimes called a reverse Colles' fracture.
- The definition is a fracture of the distal radius, with or without ulnar involvement, that has volar (anterior) displacement of the distal fragments.

- It is usually caused by falling backwards - a fall on to the palm of the outstretched hand with the arm above it pronating as the body falls.
- The characteristic appearance is called a 'garden spade deformity'.
- The X-ray of a Smith's fracture is very similar to a Colles' fracture except with the displacement anteriorly instead of posteriorly.
- The fracture may be extra-articular, intra-articular, or part of a fracture dislocation (called types I, II and III respectively).
- Closed reduction is usually possible except for a type III where open reduction may be needed.
- The advice about reduction is the same as for Colles' fracture except that the movement for reduction is backwards and medially instead of forwards and medially.
- Complications are similar to Colles' fractures.

## **Barton's fracture**<sup>[27]</sup>

- This is also a distal radius fracture but with an additional dislocation of the radiocarpal joint.
- It can be dorsal or volar depending on the direction of dislocation.
- Basically it is a Colles' or Smith's fracture with dislocation.
- A volar Barton's fracture is a Smith's type III fracture.
- History will be very much as for Colles' and Smith's fractures.
- There may be entrapment of tendons and/or the ulnar nerve/artery.
- Although it may be reasonable to attempt to reduce it as for a Colles' or Smith's fracture, the chance of success is substantially less and operative reduction with external or internal fixation is usually required.
- Open reduction and internal fixation of volar Barton's fracture can result in good to excellent function.<sup>[28]</sup>

## Chauffeur's fracture<sup>[29]</sup>

- Radial styloid fractures can occur in isolation or in association with other injuries, including complex intra-articular distal radius fractures, carpal fractures, carpal dislocations and radiocarpal dislocations.<sup>[30]</sup>
- It is typically caused by a direct blow to the radial aspect of the wrist.
- The term 'chauffeur's fracture' refers to its initial description in people struck by the handcrank on early cars when the engine suddenly backfired during starting.
- It can also result from forced ulnar deviation and supination of the wrist, as may occur in the sudden deceleration of a road traffic accident when the hands are on the steering wheel.
- Strong ligaments maintain the alignment of the styloid to the carpus but the styloid may be markedly displaced.
- Associated injuries include scapholunate dissociation and dorsal Barton's fracture.
- Operative fixation is required. This usually involves placement of K wires via an incision rather than percutaneously. Screws are occasionally used. Sometimes bone grafting is also required.

## Greenstick fractures of the wrist<sup>[31]</sup>

- Greenstick fracture is a fracture of children.
- The bone is broken and may be considerably distorted but the periosteum remains intact.
- Sometimes they have been present for days. If the child seems unduly protective of an injured arm there may be a greenstick fracture and it is worthy of X-ray.
- These fractures are usually either greenstick fracture of distal radius and ulna or greenstick fracture of mid-third of radius and ulna. The latter tends to occur in a child aged under 8 years who falls on an outstretched arm.
- See also the separate [Forearm Injuries and Fractures](#) article.

- When only one bone is broken, the integrity of both proximal and distal radioulnar joints should be checked.
  - If there is only a minor degree of dorsal angulation then reduction is unnecessary and remodeling will take place as the child grows.
  - Reduction involves slow, constant pressure to reduce the deformity, applied over 5-7 minutes until the intact dorsal cortex is broken. Failure to break the cortex may result in increasing deformity whilst in the cast.
  - The forearm is gently rotated into supination and a long arm cast is applied and kept on for 4-6 weeks.
  - The most common complication is recurrent deformity within the cast. This is more likely with a volar rather than a dorsal fracture and if the ulna is intact. Median nerve entrapment can also occur.
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## **Ulnar styloid process fracture**<sup>[32]</sup>

- The ulnar styloid may be fractured in an injury to the wrist.
- Suggested by local tenderness over the styloid process.
- Fracture of the ulnar styloid may be associated with a distal radius fracture.
- A fractured ulnar styloid process may not be easily apparent on X-ray if there is no displacement.
- A minimally displaced fracture can be treated by a long arm cast in mid-supination for 3 or 4 weeks.
- Fractures at the base are more likely to lead to instability of the distal radioulnar joint. Closed reduction and pinning with a K wire or screw may be needed or open reduction may be necessary to achieve stability.
- An accompanying ulnar styloid non-union in patients with distal radius malunion has no apparent adverse effect on outcome or function after corrective radial osteotomy. An accompanying non-union of the ulnar styloid can heal following corrective radial osteotomy.<sup>[33]</sup>

## Osteoporosis and wrist fractures<sup>[34]</sup>

- If a Colles' fracture, in particular, seems to have occurred with a force equivalent to a fall from a standing height or less than a fragility fracture due to osteoporosis should be suspected.
- Wrist fracture is the most common fragility fracture in perimenopausal and young postmenopausal women.<sup>[35]</sup>
- Patients experiencing a first fragility fracture are at increased risk of a second fracture within 1-2 years, if their osteoporosis remains untreated.
- Many people who sustain a fragility fracture are not tested or treated for osteoporosis. A fracture liaison service, designed to identify and treat these patients to prevent a second fracture, has been shown to reduce the risk of any re-fracture significantly. The NNT was 20 to prevent one re-fracture in three years.<sup>[36]</sup>
- In the UK the National Institute for Health and Care Excellence (NICE) recommends that:<sup>[34]</sup>
  - If the fracture is thought to be a fragility fracture, FRAX® (the World Health Organization's fracture risk assessment tool) or QFracture® should be used to assess future fracture risk.
  - If someone's risk is just above or just below the intervention threshold, to consider measuring bone mineral density using a dual-energy X-ray absorptiometry (DXA) scan and recalculate FRAX®.
  - If a fracture is assumed to be osteoporotic in origin and the patient is aged over 75, treatment can be started without a DXA scan. Bisphosphonates (plus calcium and/or vitamin D if necessary) are first-line.

See the separate [Osteoporosis](#) article.

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## Further reading

- [Whonamedit.com](#) - a biographical dictionary of medical eponyms
- [Wrist injuries](#); Wheeler's Textbook of Orthopaedics

- [Levin LS](#); Wrist Fractures in Patients 60 Years or Older–To Plate or Cast? JAMA Netw Open. 2019 Jan 4;2(1):e187078. doi: 10.1001/jamanetworkopen.2018.7078.

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