



PRACTICE

EASILY MISSED?

Fractures of the scaphoid

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What you need to know

The most sensitive clinical sign of scaphoid fracture is anatomical snuffbox tenderness, but it has low specificity (ie, a high rate of false positives)

The first line investigation is a four-view scaphoid radiograph series, but negative radiography does not rule out fracture

For patients with a clinically suspected scaphoid fracture but normal radiographs, the next step is wrist immobilisation and further imaging, preferably a magnetic resonance imaging scan

Patients with scaphoid fractures that are missed are more likely to develop a non-union, and potentially post-traumatic osteoarthritis of the wrist

A 25 year old man sustains an extension injury of his right wrist while playing football as a goalkeeper, and presents to the emergency department the same day with wrist pain. Examination reveals tenderness over the radial side of the wrist, including within the "anatomical snuffbox," as well as tenderness over the tubercle of the scaphoid. However, he has no pain on longitudinal compression of his thumb. Standard posteroanterior and lateral wrist radiographs are performed (fig 1) and as no fracture is seen, he is discharged. He re-attends six weeks later with ongoing pain, and a series of scaphoid radiographs (fig 2) show a fracture of the proximal third of the scaphoid.

What is a scaphoid fracture?

It is a break in one of the carpal bones, the scaphoid, which sits between the radius proximally, and the trapezium and trapezoid distally (fig 1). The mechanism of injury is typically forced hyperextension of the wrist, such as when falling on to an outstretched hand. Less common mechanisms of injury include forced hyperextension by impact against a steering wheel in a road traffic incident or from a ball.¹ Scaphoid fractures can be classified in many ways. One method, based on the site of the fracture, is illustrated in fig 3.²

How common is it?

Estimates of the incidence of scaphoid fracture in the UK have ranged from 12.4 per 100 000 to 29 per 100 000 per year.^{3,4} Incidence is higher in young men and in people of lower socioeconomic status.³

Why is it missed?

Scaphoid fractures can be missed if patients with symptoms of wrist pain after trauma are not appropriately examined, and if appropriate imaging is then not carried out. A common clinical sign of a scaphoid fracture is tenderness in the "anatomical snuffbox" of the wrist (fig 4a), with 87-100% sensitivity but low specificity for scaphoid fracture (e.g. <40% in one meta-analysis⁵). A full series of four scaphoid radiographs should be carried out in patients with this or other relevant signs (see How is it diagnosed? below). Missed diagnoses can also occur because the sensitivity of scaphoid radiographs in the first week after injury is only 80%, meaning that negative radiographs cannot reliably rule out a fracture.⁶ Finally, patients do not always seek medical attention right away, as their wrist pain can improve after a few days, giving the impression of a resolving sprain.

Why does this matter?

Fractures of the scaphoid that are not diagnosed or treated promptly, and certainly within four weeks of injury, are more likely to progress to a non-union.⁷ Most non-unions are symptomatic and require surgical treatment, usually with screw fixation and often with bone grafting. If a non-union persists for a significant duration, either through lack of treatment or unsuccessful treatment, the risk of post-traumatic osteoarthritis of the wrist is high, with up to 75% of patients with scaphoid non-union presenting with radioscapoid degenerative changes within four years of sustaining a scaphoid fracture.⁸ Post-traumatic osteoarthritis can lead to pain, stiffness, and loss of function, and can have a broader impact on quality of life. Additionally, post-traumatic avascular necrosis (AVN) of the scaphoid is a complication that is associated with non-union. AVN occurs in the proximal fragment and is caused by interruption of the retrograde blood supply of the scaphoid. The supply is mainly from branches of the radial artery entering via a dorsal ridge on the scaphoid.⁹ Patients with osteonecrosis of the scaphoid would typically present with symptoms related to their non-union.

A recent review of NHS Litigation Authority data from 1995 to 2012 revealed that wrist and scaphoid fractures together made

up 36% of all claims pertaining to hand and wrist surgery, and that the leading reason for claims was “incorrect, missed, or delayed diagnosis.”¹⁰ A similar study looking specifically at the cost of successful claims related to scaphoid fractures between 1995 and 2010 showed that, of 85 settled cases within the NHS over that period, 57 claims were brought for reasons of missed diagnosis.¹¹

How is it diagnosed?

The timely diagnosis of a scaphoid fracture in a patient with an injured wrist is achieved through careful physical examination and accurate interpretation of the appropriate imaging tests. Common clinical examination findings include anatomical snuffbox tenderness (fig 4a), scaphoid tubercle tenderness (fig 4b), and a positive thumb longitudinal compression test (fig 4c). Anatomical snuffbox tenderness is the most sensitive test but lacks specificity.⁵ Palpating the scaphoid within the anatomical snuffbox is easier with the wrist held in ulnar deviation. Combining these three clinical tests can improve diagnostic sensitivity and specificity: a prospective clinical study combining snuffbox tenderness, scaphoid tubercle tenderness, and pain on longitudinal compression of the thumb within 24 hours of the injury showed 100% sensitivity and 74% specificity for scaphoid fracture.¹² In other words, a patient without any of these signs within 24 hours of injury is very unlikely to have sustained a fracture. These clinical signs resolve quickly, however, such that they are no longer reliable 48 to 72 hours after the injury.¹² A 2014 meta-analysis found that the sensitivity and specificity of clinical tests to diagnose scaphoid fracture was variable, but also supported the combination of these three tests to improve specificity.⁵

Clinical suspicion of scaphoid fracture should prompt a four-view series of scaphoid radiographs at the earliest opportunity. The radiographic series should include a posteroanterior (PA) view, lateral wrist view, an oblique view with the wrist pronated 45°, and a “Ziter view,” which is a PA view with the wrist in ulnar deviation and the beam angulated at 20° (fig 2c). Radiographs can supplement examination findings but cannot alone rule out a fracture. In one study, the four-view series described above failed to show a fracture in 16% of cases.¹³

Further imaging is essential if radiographs are normal and clinical suspicion of scaphoid fracture remains. It has been common practice to carry out a second set of radiographs one week to 10 days after the first, which often coincides with the first fracture clinic appointment. However, negative radiographs still cannot rule out the presence of a fracture. Cross sectional imaging is then required. This is usually obtained at or just after the first fracture clinic appointment. Either a computed tomography or magnetic resonance imaging (MRI) scan can be carried out, depending on local availability. MRI wrist scans are preferable as they have a higher sensitivity and specificity of 94.2% and 97.7%, respectively (compared with 81.5% and 96.0% for computed tomography), with the added advantages of avoiding exposure to ionising radiation and of identifying other associated bone and soft tissue injuries.¹⁴ A 2019 study of patients presenting to the emergency department with clinical signs suggestive of scaphoid fracture but negative radiographs found the use of an immediate abbreviated MRI scan in the emergency department to be cost saving of £266 (€301; \$327) at six months post-injury, compared with splintage and fracture clinic follow-up.¹⁵ The UK National Institute for Health and Care Excellence (NICE) also recommends an MRI scan for investigating clinically suspected scaphoid fractures where the

initial radiographs are normal.¹⁶ The diagnosis of a scaphoid fracture in children should follow the same principles as for adults, as currently there is insufficient evidence to suggest otherwise.¹⁷

How is it managed?

Primary management of a suspected or confirmed scaphoid fracture in the emergency department setting is immobilisation with a Futuro splint or standard below-elbow backslab, and onward referral to the local fracture clinic or orthopaedic doctor. The subsequent treatment of the fracture is dependent on both patient and fracture characteristics. Undisplaced fractures of the waist of the scaphoid, and most distal pole fractures are usually treated in a cast for six to eight weeks, with high rates of union (>95%).¹⁸ Plaster immobilisation for undisplaced fractures does not need to include the thumb or elbow.¹⁹ A small cohort of patients with undisplaced or minimally displaced waist fractures—including athletes—may benefit from early surgical intervention to aid return to work.²⁰ The outcomes of early fixation compared with cast treatment for minimally displaced fractures are being further examined in the multi-centre SWIFFT study.²¹ Displaced scaphoid waist fractures (≥ 1 -2 mm) are more unstable and require fixation to avoid non-union.²² It is generally accepted that all proximal pole fractures should be treated operatively, as non-union rates for cast immobilisation can be as high as 34%.²³ The gold standard test for the assessment of fracture union is a computed tomography scan.²⁴ Fig 5 shows radiographic scans of fracture union, nine months after surgery.

A patient's perspective

I went to the emergency department seven months ago after falling off my bike and injuring my wrist. Two x rays were taken of my wrist, instead of four, and the x rays that were done did not show a fracture. I had agonising pain for the following few months and found it difficult to do basic things like getting dressed, brushing my hair, cooking, or typing. I went to see my GP to ask for an MRI scan, but was told that I had to be referred to a physiotherapist. I underwent physiotherapy treatment for around four months but my pain didn't really improve, and I was only able to continue working by using a mixture of painkillers and anti-inflammatory gels. When I finally got to see a specialist, the full set of x rays was taken and they showed an obvious fracture that had not healed. I ended up needing to have a computed tomography scan and then an operation two weeks later to encourage the fracture to heal. I can't help but feel that I should have had the full set of x rays in the first place, or an MRI when I asked for one, and if these things had been done I would not have had to experience pain and frustration over the last seven months, and maybe would not have needed an operation at all.

Education into practice

Consider the last time that a patient presented with wrist pain after a fall. What clinical signs did you seek?

How would you proceed if a set of scaphoid radiographs was reported as normal, but the patient's anatomical snuffbox tenderness persisted?

How this article was made

We undertook a focused search strategy on Pubmed, using the search term “scaphoid fracture” combined with other specific search terms including “epidemiology,” “litigation,” and “imaging.”

How patients were involved in the creation of this article

A patient had the opportunity to review and comment on the draft manuscript. She did not feel any changes to the manuscript were needed but did share her own experiences of having a delayed diagnosis of a scaphoid fracture and needing surgery to treat the injury.

Contributors: SG conceived of the manuscript and is its guarantor. OB wrote the initial draft manuscript. All authors contributed to manuscript revisions, defining the structure and content of the final draft. IA provided a generalist and sports physician's perspective. All authors approved the final draft.

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Figures

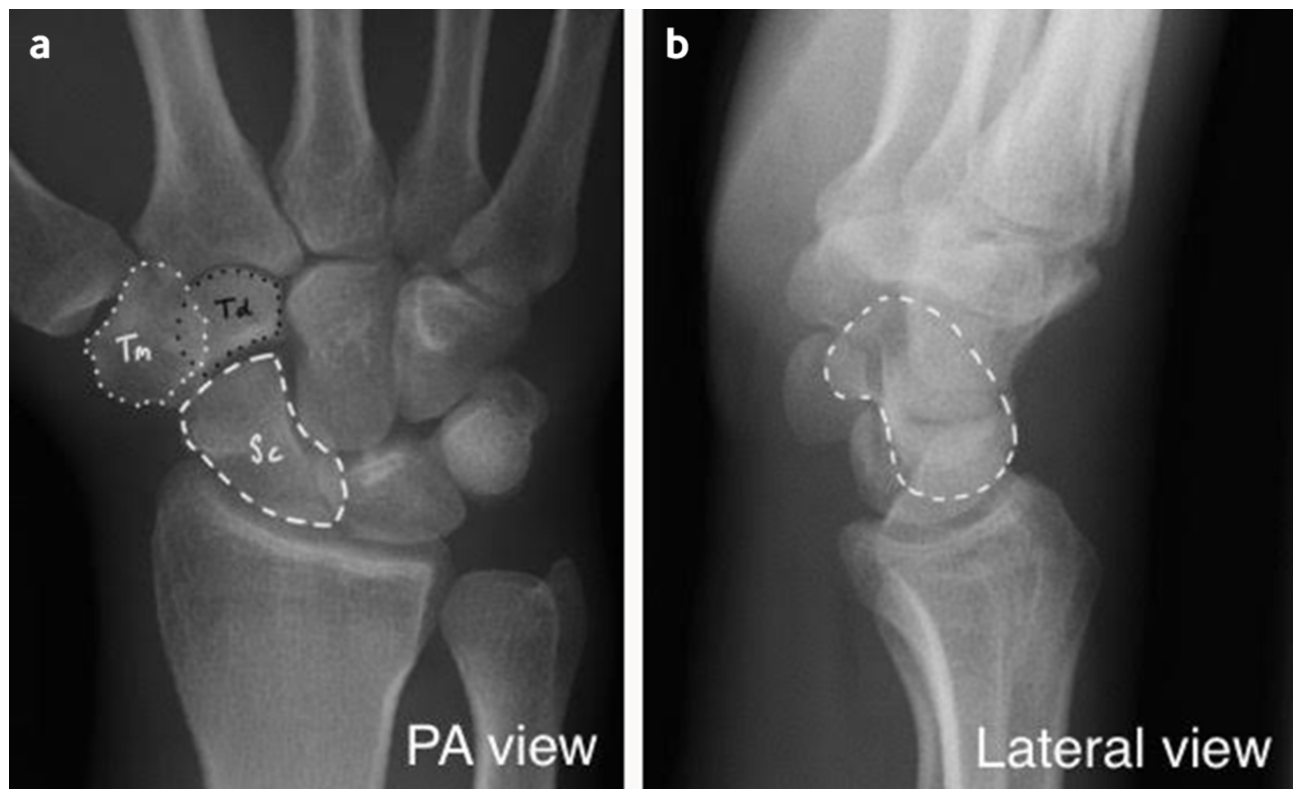


Fig 1 Initial radiographs obtained in the emergency department with and without labels. These only included standard (a) posteroanterior and (b) lateral views of the wrist. No scaphoid fracture was visible on these views. Scaphoid (Sc) marked with a dashed white line; trapezium (Tm) marked with dotted white line, and trapezoid (Td) marked with dotted black line

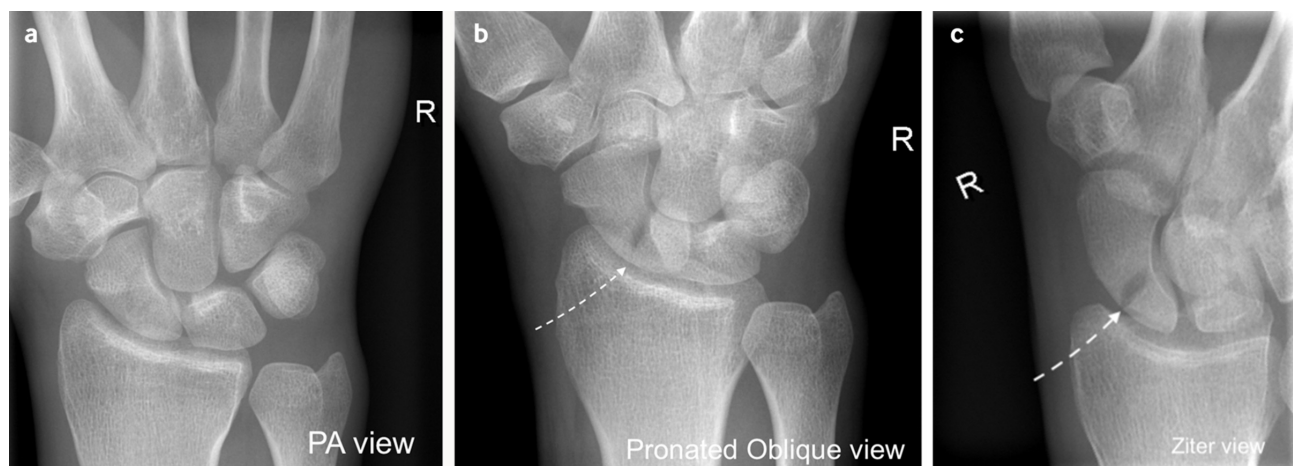


Fig 2 Scaphoid views performed six weeks after the injury. Three of the standard scaphoid series are presented including (a) posteroanterior, (b) pronated oblique, and (c) Ziter views. A proximal pole fracture is clearly seen on the pronated oblique and the Ziter views. The fracture is still not visible on the posteroanterior view, similar to the equivalent radiograph taken at day 1 (fig 1a). Arrow indicates fracture site



Fig 3 A common classification system for scaphoid fractures.² (1) scaphoid tubercle fracture, (2) distal pole, (3) waist, (4) proximal pole

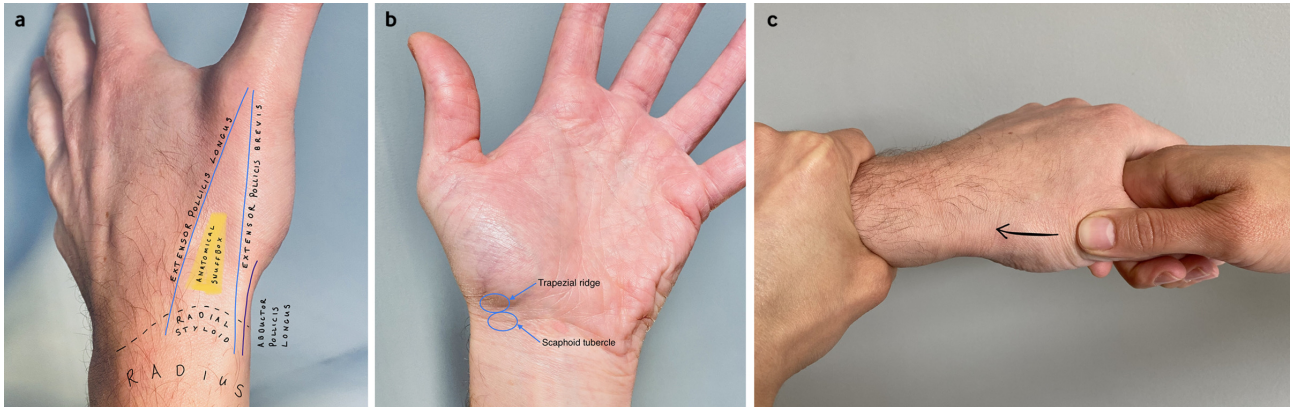


Fig 4 Surface markings of (a) the anatomical snuff box (yellow triangle) and (b) the scaphoid tubercle. The trapezial ridge is also indicated to highlight the close proximity of the two anatomical features. (c) The thumb longitudinal compression test



Fig 5 (a) Posteroanterior and (b) Zitter view radiographs, nine months after surgery, showing the scaphoid fracture union with a headless screw in situ