

Scaphoid Wrist Fracture

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Introduction

Scaphoid fractures are the most common of the carpal fractures and tend to occur in younger, active individuals. They account for 2-7% of all fractures and 60-70% of carpal bone fractures.[1][2] Scaphoid fractures are not uncommonly missed initially on clinical and radiographic examination. These injuries can be misdiagnosed initially as a simple wrist sprain.

This misdiagnosis can lead to increased morbidity for the patient as the risks of non-union can be high (14-50% if displaced). If left untreated, arthritis, deformity, and instability invariably develop within five years which can lead to significant disability. As these injuries often happen in young, active patients, the associated morbidity and cost implications secondary to disability are significant.

Etiology

Patients typically present with wrist pain following a fall onto an outstretched hand. Axial loading of the wrist with it in forced hyperextension and radial deviation can cause the fracture as the scaphoid impacts on the dorsal rim of the radius. Contact sports and road traffic accidents are also common causes.

Epidemiology

Scaphoid fractures predominantly affect young adults, with a mean age of 29 years.[2] There is a higher incidence in males. They are unusual in the pediatric population and the elderly population where the physis or distal radius, respectively, are more likely to fracture first. Scaphoid fractures account for 15% of acute wrist injuries.

Pathophysiology

The scaphoid is one of, and the largest of, the eight carpal bones.[3] Anatomically, the scaphoid has proximal and distal poles with a waist between the two. Blood supply to the scaphoid bone is predominantly from branches of the radial artery (dorsal carpal branch). These enter the dorsal ridge and supply the 80% of proximal pole via retrograde flow. The second source is from the superficial palmar arch, a branch of the volar radial artery, which enters at the distal tubercle and supplies the distal pole. The retrograde nature of the blood supply means that fractures at the waist of the scaphoid leave the proximal pole at high risk of avascular necrosis.[4]

The majority of fractures (approximately 65%) occur at the waist, with a quarter at the proximal third and 10% the distal third.

The incidence of avascular necrosis carries a strong association with the location of the fracture; the proximal segment has a 100% rate of AVN, reducing to 33% at the distal segment of the scaphoid.

History and Physical

Scaphoid fractures most commonly cause pain and swelling at the base of the thumb in the anatomic snuffbox.

Patients will typically present with wrist pain with a recent history of trauma. Pain is often centered on the radial side of the wrist and is worse with movement. There may be associated swelling and reduced range of motion. It is important to ascertain if the patient is a smoker as this increases the risk of non-union by approximately 20%.^[5]

Examination of the wrist should follow the “look, feel, move” pattern. Deformity is unlikely unless there is associated carpus dislocation, for example, perilunate dislocations. It is important to palpate over the distal radius and ulna and metacarpals to assess for any associated injury. Classically, there is tenderness in the anatomic snuffbox dorsally, especially with waist fractures). The snuffbox is the area between the first and third extensor compartments. Radially lies abductor pollicis longus and extensor pollicis brevis. To the ulnar side is the extensor pollicis longus. There may also be tenderness over the scaphoid tubercle on the volar aspect, which can be felt as the bony prominence radial to flexor carpi radialis at the level of the distal palmar crease. Tenderness usually presents in one of three locations:

1. The volar prominence at the distal wrist for distal pole fractures
2. Anatomic snuffbox for waist or mid-body fractures
3. Distal to Lister's tubercle for proximal pole fractures

The scaphoid compression test is a more sensitive test and involves placing the examining index finger and thumb over each pole of the scaphoid and compressing. This maneuver is likely to elicit pain in the presence of a fracture. Pain in the anatomical snuff box on ulnar deviation of the wrist suggests scaphoid fracture.

Evaluation

There are no particular laboratory tests but if surgery is to be done then routine blood work, including full blood count, urea, and electrolytes, clotting screen and group and save, may be of benefit.

Initially, it is necessary to obtain AP and lateral views of the wrist alongside scaphoid views, taken with the wrist at approximately 30 degrees of extension and 20 degrees of ulnar deviation. Estimates are that up to 25% of scaphoid fractures are not evident on initial plain radiographs. If a high clinical suspicion exists, the wrist should undergo immobilization in a splint or cast for 7-14 days and plain radiographs repeated. If early confirmation is needed, bone scans can be done to diagnose occult fractures at 72 hours post-injury.

Persisting clinical suspicion with negative repeat radiographs warrants Magnetic Resonance Imaging (MRI) or Computed Tomography (CT).^[6] MRI is the most sensitive means of diagnosis and can also identify any associated ligamentous injury or bone edema/contusions.^[7] A recent meta-analysis estimated 97.7% sensitivity and 99.8% specificity.^[8]

CT scan, although it has high sensitivity and specificity, fractures with less than 1 mm displacement can be missed.

Treatment / Management

Suspected fractures in those with positive clinical findings on examination but negative radiographs should have a followup with films repeated in 7-14 days. If pain persists and radiographs are still normal, then further imaging in the form of MRI or CT should be undertaken. Pain management with assistance of pharmacist should be considered.

Nonoperative management

Fractures which are non-displaced and within the distal third of the bone can be managed non-operatively with

immobilization in a cast.[9] There is active debate as to whether a long or short arm cast is optimal and whether a thumb spica should be included to immobilize the thumb, but there is no evidence currently to suggest one option is better than the other.[10]

The cast usually needs to remain on for six weeks with repeat radiographs taken at this time to assess for union. Time to union varies depending on the location of the fracture. The distal-third would be expected to heal within 6-8 weeks, middle-third within 8-12 weeks and proximal third within 12-24 weeks. The relative increase in time to healing while moving from distal to proximal is secondary to the tenuous blood supply and retrograde arterial flow.

Surgical fixation

Indications for operative management include:

- Displacement greater than 1mm
- An intrascaphoid angle greater than 35 degrees (humpback deformity)
- A radiolunate angle of more than 15 degrees
- Transcaphoid perilunate dislocation
- Proximal pole fractures
- Comminuted fractures
- Non displaced waist fractures in individuals that need to return quickly to work/sport
- Nonunion or avascular necrosis

Surgical fixation involves the insertion of a single or multiple screws and can be done percutaneously or via an open procedure. The latter is preferable for non-unions and those fractures that exhibit gross displacement with the former for acute, minimally displaced fractures.

Technique

Positioning of the screw is crucial and should be in the middle third of the central axis of the scaphoid; this provides the most stability, reduces time to union and improves alignment.

Access to the scaphoid can be via a dorsal or volar approach. The decision is made based on surgeon preference and location of the fracture. The volar approach uses the interval between flexor carpi radialis and the radial artery and is the optimal approach for waist and distal pole fractures. It has the benefits of allowing exposure of the entire scaphoid and radioscapulunate ligament and is least damaging to the vascular supply. The dorsal approach is preferred for proximal pole fractures but places the vascular supply at greater risk of injury.

Nonunion

Treatment of scaphoid non-union is approachable in a variety of ways.[10] Early on in its course, open reduction and internal fixation with bone grafting can be an option. Bone graft can be sourced from the distal radius or the iliac crest.

Alternative treatments include excision of the proximal fragment, total or partial arthrodesis (fusion), radial styloidectomy or proximal row carpectomy. These are salvage procedures and usually considered when there is evidence of arthritis of the radio-carpal joint.

Differential Diagnosis

- Distal radius fracture
- Other carpal bone fractures
- Scapholunate dissociation
- Dequervain's tenosynovitis
- Osteoarthritis
- Tendonitis

Pertinent Studies and Ongoing Trials

There remains much debate within the literature regarding the management of undisplaced scaphoid waist fracture; whether early operative intervention has better outcomes compared to conservative management in a cast. There have been numerous systemic reviews exploring this question, but insufficient evidence exists to inform management of waist fractures adequately.[11][12][13][14][15] Several studies reported earlier return to function following surgery although there was a higher incidence of complications, albeit minor ones. There is currently a pragmatic multi-center randomized controlled trial underway in the UK evaluating whether early fixation of nondisplaced scaphoid waist fractures leads to improved patient outcome compared to later fixation of those initially managed conservatively.

Toxicity and Side Effect Management

Pain can usually be managed according to the WHO pain ladder with paracetamol (acetaminophen) initially alongside non-steroidal anti-inflammatory drugs (NSAIDs) provided there are no contra-indications. If this fails to control the pain, then weak opioids such as codeine can be introduced before progressing to stronger opioids such as morphine. These may be indicated in the initial post-operative period.

Prognosis

Scaphoid fracture with displacement <1 mm has a union rate of 90%. The prognosis is worse if the fracture is displaced, with a missed diagnosis, or if the fracture is in the proximal pole. If left untreated, the risk of chronic pain with associated reduced range of motion and grip strength is more likely to occur.

Complications

- **Nonunion** - This is the most likely complication arising from missed scaphoid fractures. The risk is higher in those that are very displaced or have associated carpal fractures. These will generally require operative intervention with screw fixation. There are three stages:

1 – Radioscaphoid arthritis

2 – Scaphocapitate arthritis

3 – Lunocapitate arthritis

Scaphoid non-union advanced collapse (SNAC) is the end stage and is managed with wrist fusion or proximal row carpectomy.

- **Avascular necrosis** - The incidence of this is approximately 30-40%. This is most likely to affect the proximal pole

- **Scapholunate dissociation**

- **Delayed union** - typically 90-95% if operatively managed fracture unites, but if there is doubt, CT scan may be needed to confirm union.

Postoperative and Rehabilitation Care

Physiotherapy is a requirement whether the fracture undergoes operative or non-operative management. Physical therapy helps the patient to regain range of motion and wrist strength. In the early stages, swelling predominates, and it is important to keep the hand elevated with active finger, elbow, and shoulder movements encouraged to avoid stiffness. After immobilization (for conservatively managed fractures or post-operatively), the wrist stiffens, and physiotherapy is vital for safely increasing the range of movement. Active range of motion alongside pronation and supination exercises are encouraged once the cast comes off.

Post-operatively, the wrist is usually immobilized initially in a below elbow back slab and then converted to a full cast at two weeks after wound review and repeating plain film radiographs. They remain in the full cast until six weeks postoperatively when plain radiographs will be repeated, and the cast removed if there are radiological signs of bone healing. A wrist splint for a further six weeks may be indicated to protect the wrist.

Return to sport and driving can usually safely take place from 3 months.

Deterrence and Patient Education

Wrist protection in the form of a removable splint may be of benefit if the patient takes part in high-risk activities where a fall on an outstretched hand may be more likely. Smoking cessation is recommended to optimize fracture healing both for those managed operatively and non-operatively. Where fractures have occurred, patients should be informed of the risk of degenerative arthritis.

Pearls and Other Issues

General practitioners and emergency medicine doctors should be vigilant to scaphoid fractures to ensure that they are not missed and referred appropriately to the orthopedic team. Neglect of injury for over four weeks increases nonunion rates almost tenfold.

Enhancing Healthcare Team Outcomes

Emergency department doctors and general practitioners should work in conjunction with radiologists and orthopedic doctors to minimize the chances of missing these fractures. A multi-disciplinary team approach is vital in managing these fractures, and early physiotherapy and hand therapy involvement will help improve outcome. The patient should have direct involvement at all stages of discussion, and the risks and receive proper education regarding the benefits of conservative versus operative management.

Questions

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References

1. Hove LM. Epidemiology of scaphoid fractures in Bergen, Norway. Scand J Plast Reconstr Surg Hand Surg. 1999 Dec;33(4):423-6. [PubMed: 10614752]
2. Dinah AF, Vickers RH. Smoking increases failure rate of operation for established non-union of the scaphoid

- bone. *Int Orthop*. 2007 Aug;31(4):503-5. [PMC free article: PMC2267625] [PubMed: 16947049]
3. Yin ZG, Zhang JB, Kan SL, Wang XG. Diagnostic accuracy of imaging modalities for suspected scaphoid fractures: meta-analysis combined with latent class analysis. *J Bone Joint Surg Br*. 2012 Aug;94(8):1077-85. [PubMed: 22844049]
 4. Dias J, Brealey S, Choudhary S, Cook L, Costa M, Fairhurst C, Hewitt C, Hodgson S, Jefferson L, Jeyapalan K, Keding A, Leighton P, Rangan A, Richardson G, Rothery C, Taub N, Thompson J, Torgerson D. Scaphoid Waist Internal Fixation for Fractures Trial (SWIFFT) protocol: a pragmatic multi-centre randomised controlled trial of cast treatment versus surgical fixation for the treatment of bi-cortical, minimally displaced fractures of the scaphoid waist in adults. *BMC Musculoskelet Disord*. 2016 Jun 04;17:248. [PMC free article: PMC4893284] [PubMed: 27260639]
 5. Tang A, Varacallo M. StatPearls [Internet]. StatPearls Publishing; Treasure Island (FL): Dec 13, 2018. Anatomy, Shoulder and Upper Limb, Hand Carpal Bones. [PubMed: 30571003]
 6. Erwin J, Varacallo M. StatPearls [Internet]. StatPearls Publishing; Treasure Island (FL): Dec 2, 2018. Anatomy, Shoulder and Upper Limb, Wrist Joint. [PubMed: 30521200]
 7. Mallee WH, Wang J, Poolman RW, Kloen P, Maas M, de Vet HC, Doornberg JN. Computed tomography versus magnetic resonance imaging versus bone scintigraphy for clinically suspected scaphoid fractures in patients with negative plain radiographs. *Cochrane Database Syst Rev*. 2015 Jun 05;(6):CD010023. [PubMed: 26045406]
 8. Karantanas A, Dailiana Z, Malizos K. The role of MR imaging in scaphoid disorders. *Eur Radiol*. 2007 Nov;17(11):2860-71. [PubMed: 17351778]
 9. Dias JJ, Wildin CJ, Bhowal B, Thompson JR. Should acute scaphoid fractures be fixed? A randomized controlled trial. *J Bone Joint Surg Am*. 2005 Oct;87(10):2160-8. [PubMed: 16203878]
 10. Cooney WP, Dobyns JH, Linscheid RL. Nonunion of the scaphoid: analysis of the results from bone grafting. *J Hand Surg Am*. 1980 Jul;5(4):343-54. [PubMed: 6999072]
 11. Doornberg JN, Buijze GA, Ham SJ, Ring D, Bhandari M, Poolman RW. Nonoperative treatment for acute scaphoid fractures: a systematic review and meta-analysis of randomized controlled trials. *J Trauma*. 2011 Oct;71(4):1073-81. [PubMed: 21986747]
 12. Yin ZG, Zhang JB, Kan SL, Wang P. Treatment of acute scaphoid fractures: systematic review and meta-analysis. *Clin. Orthop. Relat. Res*. 2007 Jul;460:142-51. [PubMed: 17310931]
 13. Buijze GA, Doornberg JN, Ham JS, Ring D, Bhandari M, Poolman RW. Surgical compared with conservative treatment for acute nondisplaced or minimally displaced scaphoid fractures: a systematic review and meta-analysis of randomized controlled trials. *J Bone Joint Surg Am*. 2010 Jun;92(6):1534-44. [PubMed: 20516332]
 14. Symes TH, Stothard J. A systematic review of the treatment of acute fractures of the scaphoid. *J Hand Surg Eur Vol*. 2011 Nov;36(9):802-10. [PubMed: 21700649]
 15. Modi CS, Nancoo T, Powers D, Ho K, Boer R, Turner SM. Operative versus nonoperative treatment of acute undisplaced and minimally displaced scaphoid waist fractures--a systematic review. *Injury*. 2009 Mar;40(3):268-73. [PubMed: 19195652]



Wrist Radiograph Scaphoid Fracture. Contributed by Scott Dulebohn, MD

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