



# PANORAMIC REVIEW OF ACUTE SCAPHOID FRACTURES: DESCRIPTION, EPIDEMIOLOGY, ETIOLOGY, PRESENTATION, DIAGNOSIS, TREATMENT AND PROGNOSIS

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**Article DOI:** <https://doi.org/10.36713/epra16993>

**DOI No:** 10.36713/epra16993

## SUMMARY

**Introduction:** Scaphoid fractures are the most common fractures of the carpal bone and commonly occur in young males. Inadequate treatment of these fractures commonly leads to pseudarthrosis, resulting in pain and significant disability. Tenderness to palpation and/or pain with axial loading of the thumb should be managed as if it were a scaphoid fracture until proven otherwise.

**Objective:** to detail current information related to scaphoid fractures, description, epidemiology, etiology, presentation, diagnosis, treatment and prognosis.

**Methodology:** a total of 37 articles were analyzed in this review, including review and original articles, as well as clinical cases, of which 20 bibliographies were used because the other articles were not relevant to this study. The sources of information were PubMed, Google Scholar and Cochrane; the terms used to search for information in Spanish, Portuguese and English were: fracture, scaphoid, carpal bones, trauma, surgery.

**Results:** Scaphoid fractures account for 2% to 7% of all fractures and 60% to 70% of carpal bone fractures. They are infrequent in children with approximately 3% of all pediatric hand and wrist fractures. Non-displaced fractures have high healing rates with cast treatment. Radiographs may miss fractures up to 25% of the time. Physical therapy is important in both operative and nonoperative treatment.



**Conclusions:** Knowledge of the clinical presentation, diagnosis and treatment of scaphoid fractures is of utmost importance, because sometimes this type of fracture can go undetected on radiographs, which can lead to complications such as pseudarthrosis. The diagnosis of scaphoid fractures is sometimes complicated, so when there is clinical suspicion, appropriate complementary examinations should be performed to better determine the pathological condition, as is the case of computed tomography. Conservative or surgical management will depend on the type of fracture. Smoking cessation is recommended to improve fracture healing and physiotherapy both after surgical and non-surgical treatment.

**KEY WORDS:** fracture, scaphoid, carpal bones, trauma, surgery.

## INTRODUCTION

Scaphoid fractures are the most common fractures of the carpal bone and commonly occur in young men; however, the incidence in women has increased in recent years. Studies show that about 2.4% of all wrist fractures are scaphoid fractures, with an incidence rate of 1.47 per 100,000 people per year. They are infrequent in children with approximately 3% of all pediatric hand and wrist fractures. Tenderness to palpation and/or pain with axial loading of the thumb should be managed as if it were a scaphoid fracture until proven otherwise or the diagnosis is evidenced by serial radiographs or more advanced imaging. Inadequate treatment commonly leads to pseudarthrosis, resulting in pain and significant disability. The diagnosis of fracture may be more difficult at times, mostly when presenting with apparently normal radiographs at the time of diagnosis. Clinical intuition may be augmented by physical examination and complementary tests available at the time, such as ultrasound, in the emergency department, however, definitive diagnosis should be made with CT and MRI to verify the presence of displacement. The vast majority of displaced scaphoid fractures will require surgical treatment to reduce the risk of pseudarthrosis. Non-displaced fractures have high healing rates with cast treatment, however, they require prolonged periods of immobilization(1-7).

## METHODOLOGY

A total of 37 articles were analyzed in this review, including review and original articles, as well as cases and clinical trials, of which 20 bibliographies were used because the information collected was not important enough to be included in this study. The sources of information were Cochrane, PubMed and Google Scholar; the terms used to search for information in Spanish, Portuguese and English were: fracture, scaphoid, carpal bones, trauma, surgery.

The choice of the bibliography exposes elements related to scaphoid fractures; in addition to this factor, the description, epidemiology, etiology, presentation, diagnosis, treatment and prognosis of the disease are presented.

## DEVELOPMENT

Anatomically, the scaphoid has 2 poles, proximal and distal, and a waist between them. The blood supply to the scaphoid comes mostly from branches of the radial artery, mainly the dorsal carpal branch. These penetrate to the dorsal crest and supply up to 80% of the proximal pole by retrograde flow. The second site of blood supply comes from the superficial palmar arch, a branch of the volar radial artery, which penetrates to the distal tubercle and irrigates the distal pole. The retrograde behavior of the blood supply implies that fractures at the waist

of the scaphoid leave the proximal pole at greater risk of avascular necrosis. Ligamentous insertions of the scaphoid include the radioscaphoid ligament, which variably inserts on the ulnar aspect of the scaphoid waist, and the dorsal intercarpal ligament, which provides the main vascularization to the scaphoid(8,9).

The scaphoid, the largest bone of the proximal carpal row, plays an important role in the transfer of compressive loads from the hand to the forearm, as well as being vital in maintaining carpal stability. Scaphoid fractures can be divided according to the main mechanisms and can be traumatic or stress-induced. The origin is usually due to a fall on the outstretched hand, which generates a forceful hyperextension of the wrist(1,10-12).

Scaphoid fractures account for 2% to 7% of all fractures and 60% to 70% of carpal bone fractures. Individuals may have wrist pain following a fall on the outstretched hand. Axial loading of the wrist in forced hyperextension and radial deviation may result in fracture when the scaphoid impacts the dorsal border of the radius. Contact sports and traffic accidents are also common causes. Tumors and infections are infrequent causes of pathological scaphoid fractures (12,13).

Scaphoid fractures can generate pain and swelling at the base of the thumb at the anatomic clog. Affected individuals have wrist pain following a recent history of trauma. The pain is usually located on the radial side of the wrist and is worse with mobility, and there may be decreased range of motion of the wrist. It is recommended that the wrist examination should have the "look, feel, move" pattern. Deformity is unlikely unless a related carpal dislocation is present. The distal radius, ulna and metacarpals should be palpated to assess for associated injury. Occasionally it may also be accompanied by pain on palpation over the scaphoid tubercle on the volar aspect, feeling a bony prominence radial to the radial carpal flexor at the level of the distal palmar crease. The scaphoid compression test is the most sensitive and involves placing the examiner's index finger and thumb on each pole of the scaphoid and compressing, usually this maneuver generates pain in the presence of a fracture. Pain at the anatomical snuffbox with ulnar deviation of the wrist also provides a signal suggestive of a scaphoid fracture(12,14).

The diagnosis of scaphoid fractures is sometimes complicated. X-rays can miss fractures up to 25% of the time, resulting in unnecessary delays and immobilization. Computed tomography, magnetic resonance imaging, bone scintigraphy and ultrasound provide greater accuracy and faster results. Ultrasound is promising because of its availability and accuracy. MRI is considered the best for occult fractures and

related injuries. MRI or computed tomography (CT) scans may be important for individuals with positive clinical findings. Repeat radiographs can be performed if necessary. CT scans and the use of 3D printing may have an impact on diagnosis and surgical planning(5,15).

### Classification

Based on fracture pattern (Russe):

- Horizontal oblique.
- Transverse.
- Vertical oblique.

Displacement based:

- **Stable:** nondisplaced fractures that do not exhibit any steps in any plane.
- **Unstable:** joint step displaced 1 mm or more, scapho-semilunate angulation  $> 60^\circ$  or radiosemilunate  $> 15^\circ$ .

Based on location:

- Tuberosity: 17% to 20%.
- Distal pole: 10% to 12%.
- Waist: 66% to 70%.
  - Horizontal oblique: 13% to 14%.
  - Vertical oblique: 8% to 9%.
  - Transverse: 45% to 48%.
- Proximal pole: 5% to 7%(9).

The differential diagnosis can be made with distal radius fracture, other carpal bone fractures, scapholunate dissociation, De Quervain's tenosynovitis, osteoarthritis, tendinitis, lunate dislocation, carpal radial flexor tendon rupture, carpometacarpal joint arthrosis and Kienböck's disease(9,12,16-18).

**Figure1. Anteroposterior, profile and oblique radiograph of the wrist, after surgical treatment of scaphoid fracture with Hebert screw.**



Source: The Authors.

### Conservative Management

Fractures that are not displaced and are within the distal third of the bone can be managed conservatively with cast immobilization. There is divergence of opinion on whether a long or short arm cast is optimal and whether a thumb spica should be made to immobilize the thumb. However, at present there is insufficient evidence to clarify which alternative is better. Commonly, the cast is worn for six weeks and at this time repeated radiographs are taken to assess healing. The time to heal is different according to the specific location of the fracture. The distal third would be expected to heal within 6 to 8 weeks, the middle third between 8 to 12 weeks and the proximal third between 12 to 24 weeks. The relative increase in time to recovery when moving from distal to proximal is secondary to subdued blood supply and retrograde arterial flow(19,20).

### Surgical Treatment

The indications for surgical fixation are:

- Transcaphoid perilunate dislocation.
- Fractures of the proximal pole
- Comminuted fractures.
- Displacement greater than 1 mm.
- An intrascaphoid angle greater than 35 degrees.
- A radiolunate angle of more than 15 degrees.
- Non-displaced waist fractures in people who need to return quickly to work/sport.
- Pseudoarthrosis or avascular necrosis.

Surgical fixation involves the placement of screws or K-wires and can be done percutaneously or through an open procedure. Open fixation is preferred in pseudoarthrosis, as well as fractures that have significant displacement.





## Technique

Screw placement is important and should be in the middle third of the central axis of the scaphoid, generating greater stability, as well as decreasing union time and improving alignment. Access to the scaphoid can be done through a dorsal or volar approach, depending on the approach, the surgeon's preference, type and location of the fracture. The volar approach goes in the interval between the radial carpal flexor and radial artery and is the effective approach for waist and distal pole fractures. It has benefits such as allowing exposure of the entire scaphoid and radioscapholunate ligament, as well as being less detrimental to the vascular supply. As for the dorsal approach, it is preferred for fractures of the proximal pole, but it places the vascular supply at greater risk of injury, compared to the other access(12).

Treatment of scaphoid pseudarthrosis can be managed in several ways. Initially open reduction and internal fixation with bone grafting may be an alternative. A bone graft can come from the distal radius or the iliac crest. It is important to know that failure of surgical treatment of established pseudarthrosis of the scaphoid bone is more associated with smoking. Alternative treatments include total or partial arthrodesis, excision of the proximal fragment and radial styloidectomy or carpectomy of the proximal row. The latter are considered rescue procedures and are usually considered when there is arthritis compromising the radiocarpal joint(12,14).

Scaphoid fractures with a displacement of less than 1 mm have a healing rate of about 90%. The prognosis is worse when the fracture is displaced, undiagnosed or if the fracture is in the proximal pole. If left untreated, it is possible to generate chronic pain, in addition to a decrease in range of motion and grip strength. Physical therapy is important in both surgical and non-surgical treatment. Physical therapy allows the affected individual to regain range of motion and wrist strength(12).

## CONCLUSIONS

Knowledge of the clinical presentation, diagnosis and treatment of scaphoid fractures is of utmost importance, because sometimes this type of fracture can go unnoticed in radiographs, which can lead to complications such as pseudarthrosis. The diagnosis of scaphoid fractures is sometimes complicated, so when there is clinical suspicion, appropriate complementary examinations should be performed to better determine the pathological condition, as is the case of computed tomography. Conservative or surgical management will depend on the type of fracture. Smoking cessation is recommended to improve fracture healing and physiotherapy both after surgical and non-surgical treatment.

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**Conflict of Interest Statement**

The authors report no conflicts of interest.

**Funding**

The authors report no funding by any organization or company.