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IN BRIEF

In Brief

Fractures in Brief

Scaphoid Fractures

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Introduction

The scaphoid is the most commonly fractured carpal bone, accounting for approximately 60% of all carpal fractures [2]. The injury is commonly seen in active young adults after a fall on an outstretched hand. These fractures sometimes are missed or misdiagnosed as simple wrist sprains. Left untreated or poorly reduced, a scaphoid fracture may develop a malunion or nonunion. Malunions and nonunions may lead to altered carpal kinematics (with resultant pain), diminished ROM, grip strength, and carpal arthrosis [2]. Accordingly, displaced, nonunited, and sometimes malunited fractures are treated surgically. Furthermore, because cast immobilization may be prolonged and associated with stiffness, some surgeons and patients prefer early surgery even for nondisplaced fractures.

Structure and Function

The word "scaphoid" is derived from the Greek *skapheē* meaning skiff or boat because of the elongated shape of the bone. The scaphoid has multiple ligamentous attachments. Ulnarly, it is attached to the lunate via the scapholunate interosseous ligament, which has three distinct structures: the palmar ligament, the dorsal ligament, and the proximal fibrocartilaginous membrane. The dorsal attachment is the strongest and is most important to carpal stability. Volarly, bridging from the radial styloid to the capitate, the radioscaphocapitate ligament crosses the scaphoid at its waist, causing the bone to flex with radial deviation. This ligament, in concert with the scapholunate ligament tethering the proximal pole, may lead to fracture displacement or the characteristic "humpback deformity" with palmar flexion of the distal pole and dorsal extension of the proximal pole.

The blood supply to the scaphoid comes from two branches of the radial artery. The palmar scaphoid branch arises from the superficial palmar branch of the radial artery supplying the distal pole of the scaphoid. The dorsal scaphoid branch arises from the dorsal carpal branch of the radial artery and enters the scaphoid distally. This branch is the only blood supply to the proximal pole of the scaphoid via retrograde intraosseous flow. Accordingly, the blood supply to the proximal pole is tenuous and fractures compromising the vessels place the bone at risk for nonunion (Fig. 1).

Diagnosis and Classification

All patients who fall on an outstretched hand should be evaluated for a scaphoid fracture. This includes a physical examination of the wrist and plain radiographs, including a dedicated scaphoid view. To perform a dedicated scaphoid view, simply take a posteroanterior radiograph of the wrist with the hand in ulnar deviation; this extends the scaphoid and makes the waist more easily seen. If unable to discern a fracture on plain films, but there is clinical suspicion, other imaging modalities such as MRI or CT are useful. Thin-cut CT is superior in determining displacement but is not as sensitive as MRI for evaluating nondisplaced fractures [5].

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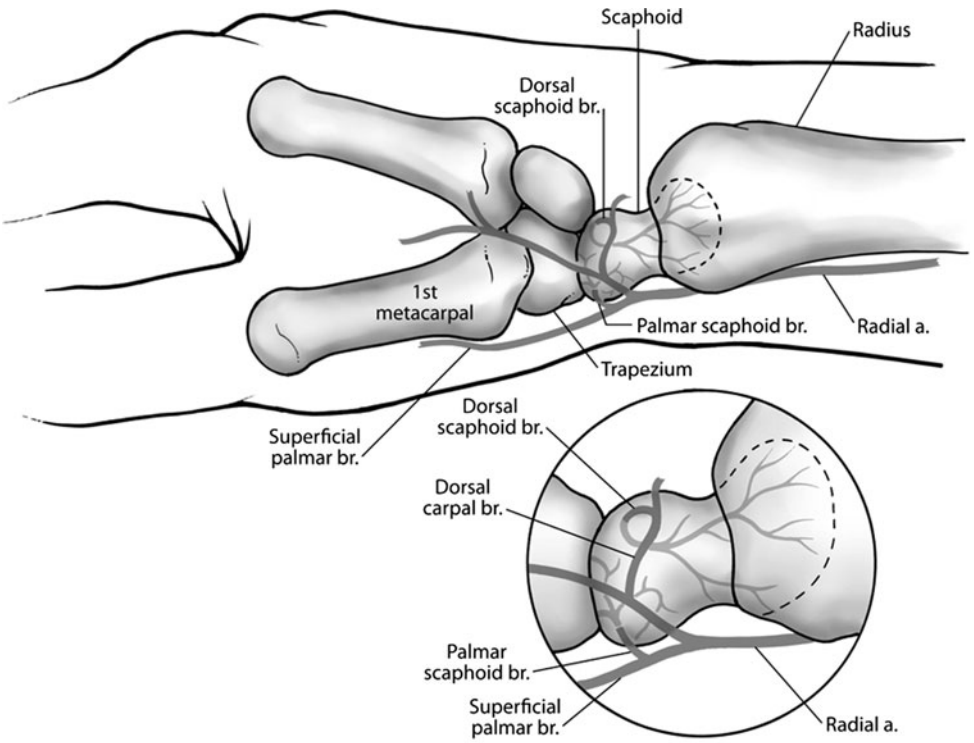

Fig. 1 The scaphoid has a palmar and dorsal blood supply. The superficial branch of the radial artery gives off a palmar scaphoid branch that only supplies the distal pole. The dorsal carpal branch of the radial artery gives off a dorsal scaphoid branch, which is the major blood supply to the scaphoid, supplying the distal and proximal poles. The proximal pole relies on retrograde interosseous flow. br. = branch; a. = artery (Reprinted with permission from Andrew Jawa).

Clinical suspicion should be guided by tenderness in the anatomic snuff box and/or pain with an axial load applied to the thumb held in abduction. Sensitivity of the clinical examination is high, but specificity for acute scaphoid fracture is low [2].

Multiple classifications of scaphoid fractures have been described including the Prosser [7], Russe [8], and Herbert [4] classification systems. However, these schemes typically are not used in clinical practice and have poor interobserver and intraobserver reliability [5]. Most surgeons describe fractures based on location (proximal, distal, waist), displacement, and chronicity.

Treatment

Scaphoid fractures fail to unite in 5% to 25% of cases [1]. Factors contributing to nonunion include displacement greater than 1 mm, delay in diagnosis/immobilization greater than 4 weeks, location at the waist or proximal pole, and a history of smoking [2].

Patients with snuff-box tenderness and no evidence of fracture on plain films should be immobilized in a short-arm thumb spica splint or cast for 2 weeks and then reexamined and reimaged [6]. Alternatively, although more expensive than plain radiographs, MRI can be ordered acutely and potentially may save lost work days and prevent stiffness that immobilization may produce [3]. The standard of care in that regard is not yet defined. A CT scan should be used if there are any concerns for displacement or carpal malalignment [5].

If a fracture is seen on imaging, it must be assessed for location (proximal pole, waist or distal pole) and displacement. Nondisplaced acute fractures may be immobilized whereas displaced fractures warrant surgical consideration. Proximal pole injuries have a higher risk of nonunion and require longer immobilization owing to the tenuous blood supply. Many surgeons favor operative treatment of these fractures.

Waist fractures that are displaced greater than 1 mm or have a scapholunate angle greater than 60° or less than 30° are considered unstable [5] and warrant surgical fixation. Additionally, fractures with associated injuries such as perilunate fracture-dislocations or sometimes distal radius fractures merit consideration for surgery given the inherent high-energy nature and associated soft tissue injury.

Additionally, because fractures treated with immobilization generally are held for 10 weeks or more, some surgeons advocate operative management even for nondisplaced fractures.

Once the decision for surgery is made, cannulated screw fixation can be performed through either a volar or dorsal approach. For percutaneous fixation, central screw placement often is easier with a dorsal approach, but there is concern for injuring the dorsal blood supply and causing articular cartilage damage with screw insertion. For displaced fractures, an open volar approach is preferred to obtain fracture reduction.

Outcomes

For nondisplaced fractures, cast immobilization or percutaneous screw fixation (to allow early ROM) can be chosen. There are no functional differences between these two groups at 2 years [1].

A recent study from Sweden shows a 100% union rate with either cast or screw fixation with no functional difference at 10 years [9]. However, there was an increase in scaphotrapezial arthritis in the operatively fixed group. In their series, all surgeries were performed through a volar approach [9].

Five Pearls

1. **The major blood supply of the scaphoid enters dorsally and distally from the dorsal scaphoid branch of the dorsal carpal branch of the radial artery. Proximal pole blood supply is tenuous, as it relies on retrograde interosseous flow.**
2. **For certain patients with a concerning physical examination, but negative plain films, either MRI should be performed or the patient must be immobilized empirically with reevaluation in 2 weeks.**
3. **Nondisplaced fractures require immobilization for 10 to 12 weeks in a thumb spica cast.**
4. **Displacement may be difficult to assess on plain films and may require a thin-cut CT scan for evaluation.**
5. **Operative indications include displacement, angulation, and associated injuries (eg, perilunate dislocations). Percutaneous screw fixation may be indicated for nondisplaced fractures in patients who want immediate ROM.**

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