

# Use of Arthroscopy for the Treatment of Scaphoid Fractures

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## KEYWORDS

• Scaphoid • Arthroscopy • Fracture • Nonunion

## KEY POINTS

- An arthroscopic assist for scaphoid fixation is useful to assess the quality of the reduction, the stability of fixation, and to assess hardware position.
- Arthroscopy allows one to evaluate and treat any associated ligament injuries.
- Scaphoid waist fractures can be treated with either a volar or dorsal approach. Distal scaphoid fractures are managed with a retrograde screw insertion, whereas proximal pole fractures are treated with an antegrade screw insertion.
- Specialized training in wrist arthroscopy is desirable before attempting an arthroscopic assisted screw fixation.

## INTRODUCTION: NATURE OF THE PROBLEM

Minimally invasive approaches are increasingly popular in the treatment of hand fractures. For scaphoid fractures, decreasing the incision size and limiting the dissection have led to the adoption of percutaneous approaches. Most scaphoid screws are well positioned using a percutaneous or mini-open approach. However, these small incisions can limit the surgeon's ability to fully understand the anatomy and assess the reduction. In these instances, arthroscopic assist can be advantageous ensuring better implant placement and a more predictable result. Specifically, arthroscopy can aid optimal guidewire positioning. Arthroscopy allows direct visualization of the fracture even with minimal skin incisions, which allows assessment of the quality of fracture reduction, especially for comminuted fractures. Arthroscopy provides evaluation of the rigidity of fixation, because seemingly good screw purchase may not adequately stabilize a comminuted segment. One can use arthroscopic techniques to assess screw length and ensure there is no radiocarpal

penetration with retrograde (volar) insertion or conversely to check that the screw threads are well buried in the proximal pole with dorsal (antegrade) insertion. Finally, scaphoid fractures can have associated ligamentous injuries, and arthroscopy allows the surgeon to evaluate for other potential soft tissue injuries.<sup>1</sup>

## INDICATIONS/CONTRAINDICATIONS

### *Indications*

The indications for percutaneous screw fixation parallel those for an open reduction. These indications include any acute proximal pole fracture or any reducible scaphoid waist fracture with more than 1 mm of displacement or translation. Angulated fractures and fractures with significant comminution as well as combined injuries can also be managed with percutaneous reduction and fixation, but these are the type of cases that would benefit from an arthroscopic assist. Nondisplaced fibrous scaphoid nonunions without evidence of avascular necrosis are also suitable candidates for percutaneous fixation. Acute

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nondisplaced scaphoid waist fractures can be effectively treated with cast immobilization; however, there are some instances where screw fixation is considered such as high performance athlete, economic hardship with prolonged casting, or patients who cannot tolerate immobilization for psychological reasons. An arthroscopic assist allows the surgeon to use the percutaneous approach for more complex cases such as comminuted scaphoid fractures and when there is a suspicion of an associated ligament injury.

### ***Contraindications***

There are cases in which percutaneous approaches even with arthroscopic assist are not appropriate. Partial or complete avascular necrosis of the scaphoid is a relative contraindication, although Slade described healing of avascular proximal using percutaneous methods.<sup>2</sup> A very small proximal pole fragment does not allow adequate screw purchase and needs an alternative approach. Nonunions with a humpback deformity and a secondary dorsal intercalated segmental instability (DISI) pattern usually require an open volar wedge graft, which requires wide exposure. An alternative approach is required in the presence of significant radiocarpal and/or midcarpal degenerative changes. Finally, arthroscopy is contraindicated in the presence of active infection, bleeding disorders, or a poor skin envelope.

## **SURGICAL TECHNIQUE**

### ***Preoperative Planning***

#### ***Approach***

After the decision for surgical intervention, the next step is to decide what is the best approach as the implant can be placed through either dorsally or volarly. The dorsal technique has the disadvantage of creating a hole in the weight-bearing surface of the proximal scaphoid pole but it allows more direct access to the central axis of the scaphoid. Dorsal screw insertion is the recommended approach for proximal pole fractures because this provides maximum fracture compression of the smaller proximal fragment. The volar approach is best for distal pole fractures. Volar implantation often requires eccentric screw placement through the distal pole, and there is limited area for screw insertion. To place the screw using the volar approach, the surgeon often has to ream through the trapezium to gain access to the central scaphoid axis. However, with careful planning, the volar approach allows the screw to be placed centrally through the waist and proximal pole.<sup>3</sup> An advantage of the volar technique is that the articular defect from the entry site is limited to

the radial edge of the scaphotrapezial joint. Either dorsal or volar approach is used for a scaphoid waist fracture. A recent comparison of the volar and dorsal percutaneous screw fixation showed no difference in the ultimate union rates, although dorsal screw fixation tended to be closer to the central axis and more perpendicular to the fracture line with waist fractures.<sup>4</sup> In the end, the surgeon must evaluate the fracture and decide which approach best fits the patient and the fracture.

#### ***Imaging***

Imaging is a necessary adjunct in both the preoperative planning and post-operative assessments of scaphoid fractures. Preoperatively the position of the fracture or the nonunion is assessed with anteroposterior (AP), lateral, and semipronated oblique wrist radiographs. A preoperative computed tomographic (CT) scan is helpful in difficult cases and has become the gold standard in assessing the degree of bony union post-operatively. With a longstanding nonunion, the author practices to perform a preoperative magnetic resonance imaging (MRI) in all cases to rule out avascular necrosis of the proximal fragment.

#### ***Screw placement***

An essential component to success in the operative scaphoid fracture treatment is proper placement of the screw. The implant should be placed down the central axis of the scaphoid as this position provides the greatest rigidity.<sup>5</sup> Correct positioning results in faster union rates and allows longer screw insertion, which better distributes the bending forces.<sup>6</sup> Because guidewire insertion and screw placement are the critical steps of the procedure, several researchers have attempted to quantify the optimum starting position for screw insertion so that the screw ends up in the central one-third of the proximal pole.<sup>7</sup> Menapace and colleagues<sup>8</sup> defined a safe zone for volar k-wire insertion for placement of a Herbert-Whipple screw based on radiograph, CT, and anatomic dissections. To limit the risk of damaging the scaphoid blood supply, they recommended avoidance of the radiodorsal portion of the scaphoid (provides 70%–80% of the blood supply) and the volar surface of the scaphoid tuberosity (provides 20%–30% of the blood supply). They also eschewed the ulnar one-third of the scaphoid so that the scaphocapitate articulation was not compromised. They also noted that paired scaphoids had no significant radiographic differences in the lengths and widths, allowing the contralateral scaphoid to be a measuring template for screw placement planning. After reviewing their results, they defined the safe starting point to be 4 to 5 mm dorsal and distal to

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