Chapter 18 Arthroscopically Assisted Scaphoid Fracture Fixation

Introduction

Scaphoid fractures represent 2% of all fractures, 11% of hand fractures, and 60% of wrist fractures. Luckily, these fractures are becoming easier to diagnose due to a better understanding of the clinical signs, physician training, and modern imaging methods such as X-rays, but especially magnetic resonance imaging and computed tomographic scans.

These fractures have typically been treated by cast immobilization, but internal fixation is increasingly used. In the mid-1980s, Herbert and Fisher[1] transformed the indications for fracture fixation by developing a scaphoid-specific screw. More recently, the use of cannulated screws has led to the development of percutaneous techniques, which simplify postoperative recovery and, more importantly, preserve vascularization. Nevertheless, it is not unheard of to have minor rotational problems that can lead to delayed union or nonunion. Wrist arthroscopy allows for evaluation and reduction of scaphoid fractures, while limiting incisions and therefore preserving the scaphoid's vascularity.

Operative Technique

Patient Preparation and Positioning

Surgery is generally performed on an outpatient basis under regional anesthesia. The patient is placed supine, with the arm resting on an arm board with an attached tourniquet. A standard traction tower is used during the arthroscopic procedures.

First Phase: K-wire Insertion into the Scaphoid

A small (2 mm) anterior volar incision is made through which a 1 mm K-wire is inserted into the scaphoid under fluoroscopic control (**Fig. 18.1a–c**). This can be the most difficult step of the entire procedure. It is important to know how the scaphoid is shaped and oriented. If a rolled drape is placed under the wrist to extend it to 60°, the K-wire will be about 45° to horizontal. The K-wire is angled from the distal tubercle toward the middle of the carpus.

The scaphoid's position can be determined by placing a thumb on the distal tubercle and the index finger on

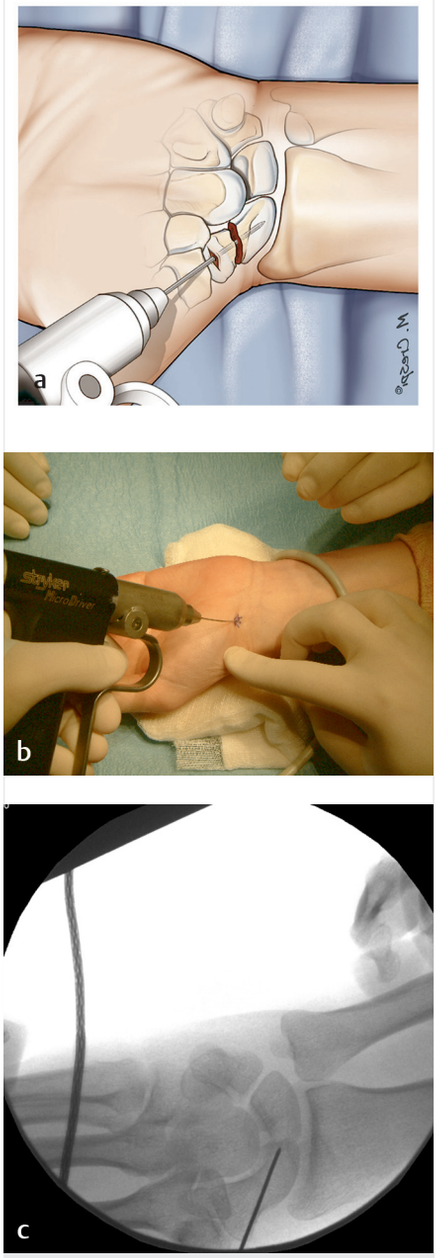

Fig. 18.1a–c Drawing (**a**), intraoperative view (**b**), and X-ray (**c**) of the retrograde percutaneous insertion of a K-wire into the scaphoid.

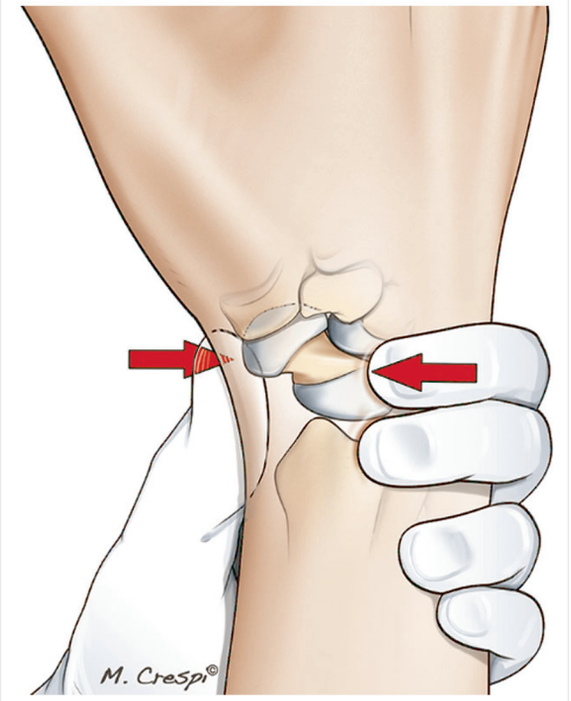

Fig. 18.2 Drawing of bony landmarks on the scaphoid being palpated to determine the scaphoid's position. After performing small wrist flexion movements, the thumb is placed on the distal tubercle and the index on the proximal pole (red arrows).

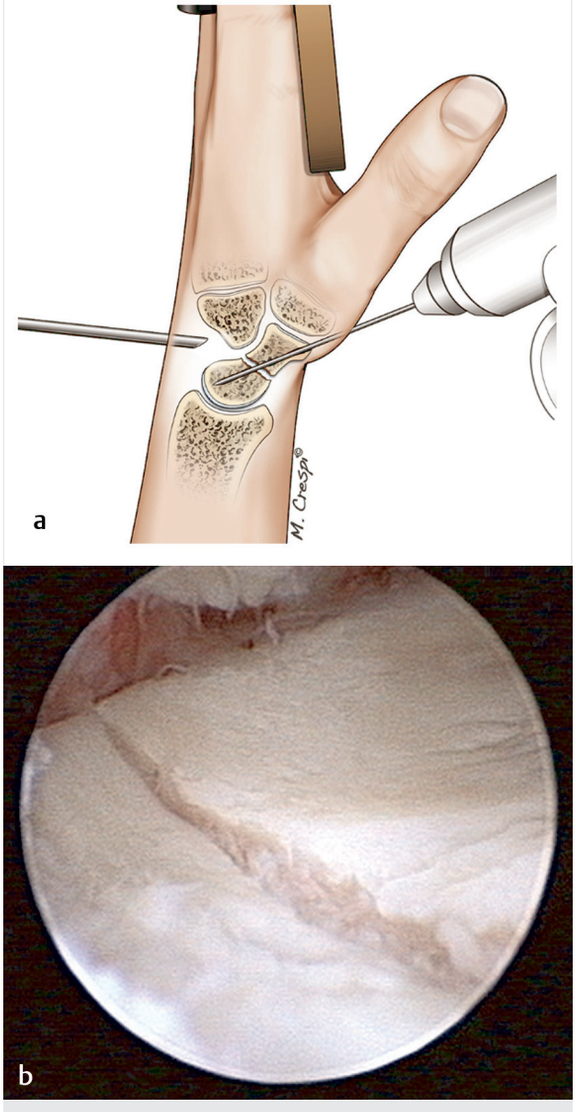

Fig. 18.3a, b Drawing (**a**) and arthroscopic view (**b**) of the midcarpal evaluation of a nonreduced scaphoid fracture.

the proximal pole of the scaphoid on the dorsal side of the wrist (**Fig. 18.2**). It then becomes obvious that the distal tubercle is in line with the flexor carpi radialis (FCR), closer to the midline than to the lateral side of the wrist, and that the proximal pole is located in the middle of the wrist. If the wrist is extended without moving the thumb and index from their positions, the scaphoid will feel nearly horizontal. These maneuvers can provide the surgeon with a spatial reference when inserting the K-wire.

Arthroscopic Checking

Traction is placed along the wrist's main axis, and the K-wire position is checked in the radiocarpal and midcarpal joints. The radiocarpal inspection is carried out through either or both the 6R and 3–4 portals. When properly positioned, the K-wire tip will be visible as it emerges from the scaphoid. The K-wire will be located above the posterior margin of the radius when the wrist is pulled along its axis.

The quality of the reduction is evaluated through the midcarpal joint, typically using the ulnar midcarpal (MCU) portal. One may be surprised to find that, although the reduction appears complete on X-rays, there is a rotational misalignment with a small step-off in the fracture area (**Fig. 18.3a, b**).

If the reduction is not satisfactory, the K-wire is removed from the proximal pole but left flush with the distal part of the scaphoid (**Fig. 18.4**). The assistant pulls on the thumb along its main axis (**Fig. 18.5**). External maneuvers and a hook probe are used to reduce the proximal pole back into the correct position. The K-wire is reinserted up to the proximal pole, and the reduction is checked again (**Fig. 18.6**).

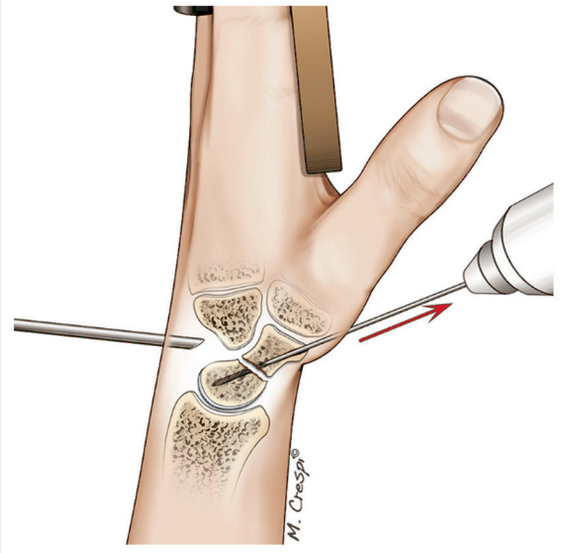

Fig. 18.4 Drawing of the K-wire being removed from the proximal pole with the wrist still in traction.

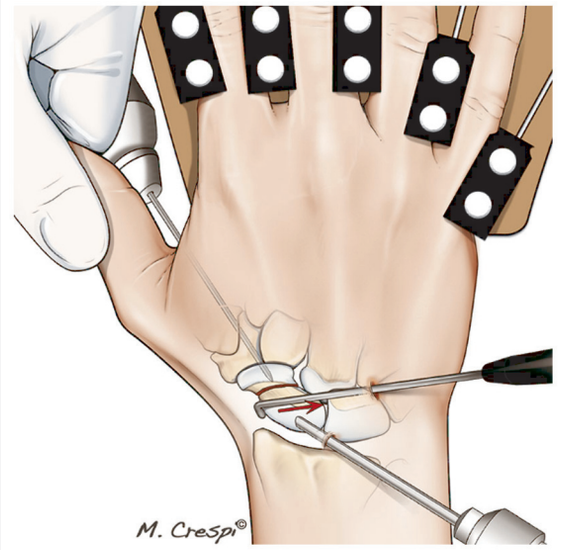

Fig. 18.5 Drawing of the arthroscopic reduction method used with a displaced scaphoid fracture: the assistant pulls on the thumb, and a probe is used to reduce the proximal pole onto the distal tubercle under midcarpal and radiocarpal arthroscopic control.

Third Phase: Screw Insertion

The hand is released from the traction tower and placed flat on the table (**Fig. 18.7a, b**). Self-tapping cannulated screws make internal fixation of the scaphoid easier. Obviously, the screw length must be measured precisely.

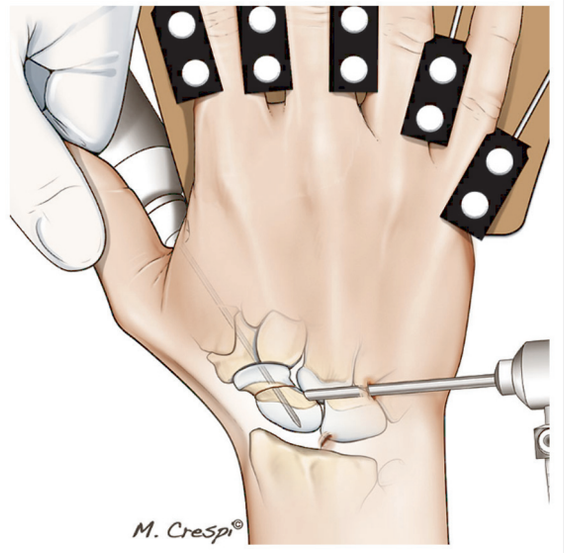

Fig. 18.6 Drawing of the scaphoid after it has been reduced and temporarily secured with the K-wire reinserted into the proximal pole.

Fluoroscopy is used continuously throughout this surgical phase.

Final Arthroscopic Checking

Traction is placed on the hand again for the final arthroscopic verification steps. First, the quality of the reduction is checked through the midcarpal portal. A few turns can be added to the screw as needed to achieve the desired compression (**Figs. 18.8** and **18.9a, b**).

The intraosseous positioning of the screw is verified through the radiocarpal portal. This will be easier to do if the K-wire is left in place as a reference. In some patients, despite X-rays not revealing any problems, a few of the screw threads jut out through the cartilage. The screw must be removed and another midcarpal check performed to make sure the compression is still correct. If a problem is found, a smaller screw should be inserted (**Fig. 18.10**).

The small incisions are left open for healing by second intention. There are no wound healing sequelae.

Postoperative Care

If the construct is stable and there are no associated injuries, range of motion exercises can be initiated right away. A small removable anterior splint can be used to reduce pain, especially during the first few postoperative days. X-rays are performed regularly until union is complete.

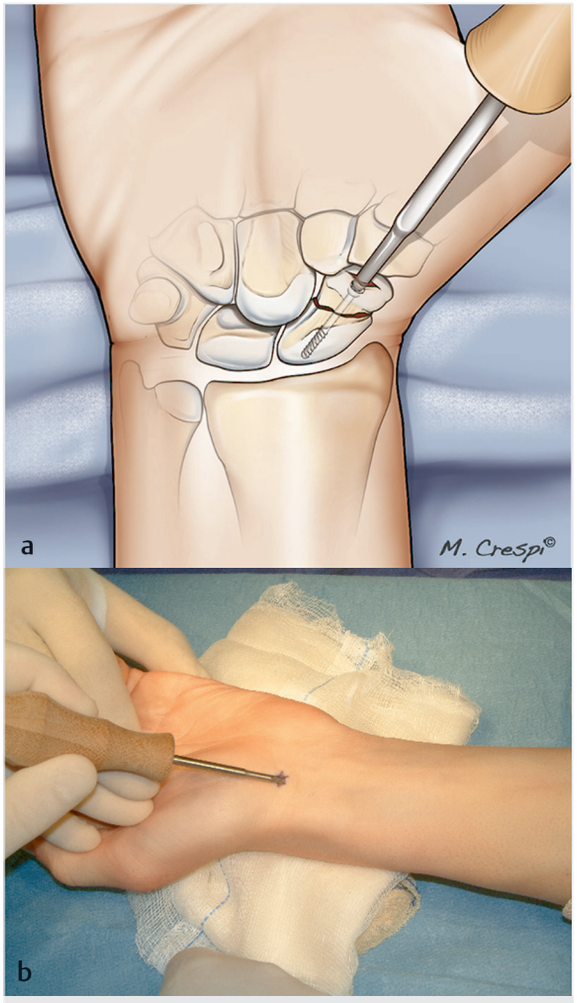

Fig. 18.7a, b Drawing (**a**) and intraoperative view (**b**) of a cannulated screw being inserted into the reduced scaphoid, which is being held by the K-wire.

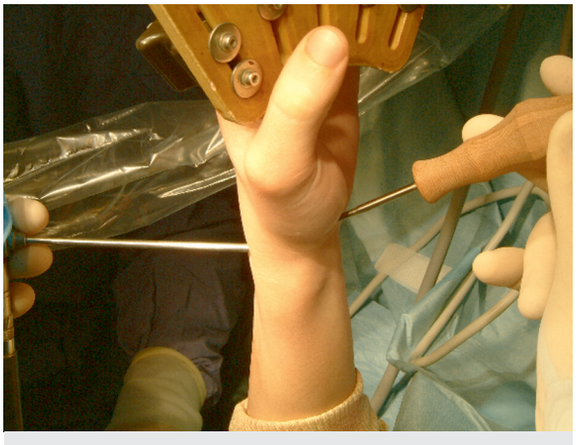

Fig. 18.8 Intraoperative view of the final screw fixation under arthroscopic control.

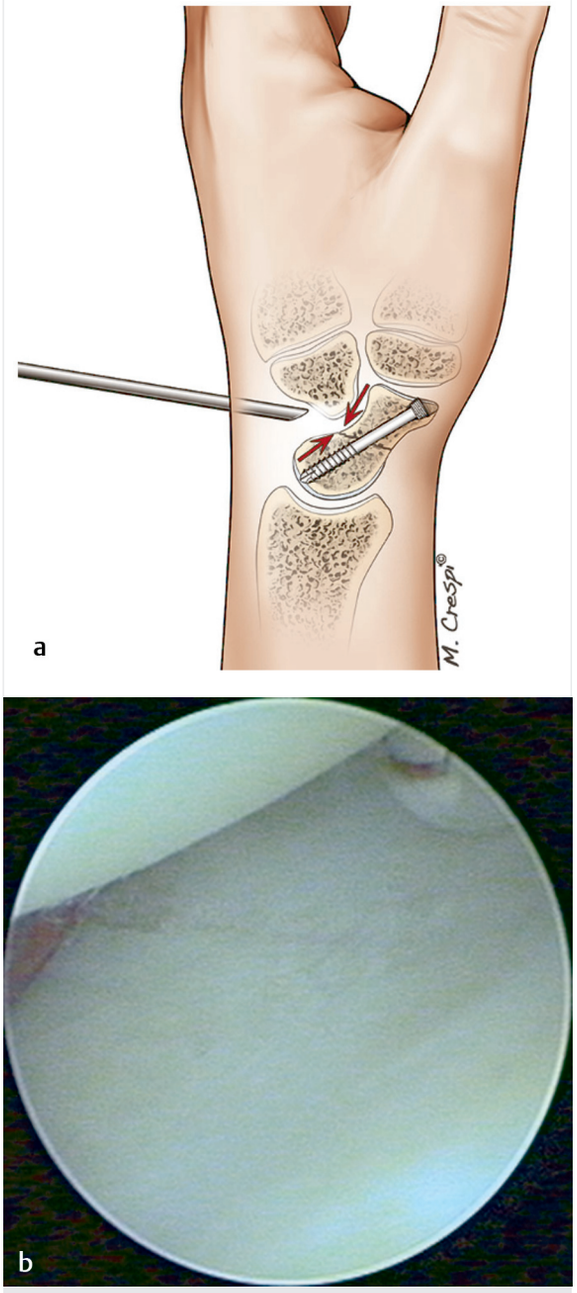

Fig. 18.9a, b Drawing (**a**) and arthroscopic view (**b**) showing the midcarpal evaluation of a completely reduced scaphoid fracture. The red arrows show the compression effect.

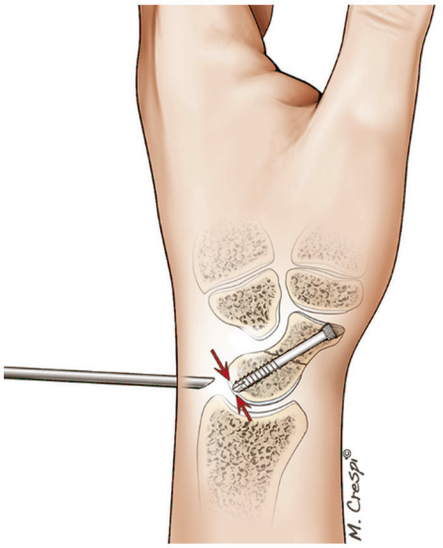

Fig. 18.10 Drawing of the radiocarpal inspection performed to ensure that the distal end of the screw does not jut out into the joint space. The red arrows point the area where a part of the screw could jut out of the scaphoid.

Conclusion

Even for fractures that are not displaced, internal fixation of scaphoid fractures is commonly used in patients who don't accept immobilization by cast and who understand the advantages and disadvantages of this method. Arthroscopy enables the surgeon to avoid some of the usual pitfalls associated with internal fixation by ensuring that the screw is perfectly positioned and the fracture is completely reduced.

Reference

1. Herbert TJ, Fisher WE. Management of the fractured scaphoid using a new bone screw. J Bone Joint Surg Br 1984;66(1):114–123