

Percutaneous fixation of scaphoid.

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The technique was described in 1970 by Streli¹, in German literature.

Scaphoid fracture is an injury of a young population with an average age of about 25 years.

Why it was propounded? It was noted that the average plaster immobilization was 6 to 8 weeks or more, leading to stiffness, wasting of the muscles, loss of earning, absence from athletics or inability to write examinations. Though these limitations were temporary issues in the short term, but for a certain group of patients, these are *the* key issues. Restoration of movements after getting a stiff wrist further prolonged the treatment and prevented resumption of normal activities of daily living.

It was further argued that open surgery is too extensive; leads to avoidable dissection and stripping of volar radio carpal ligament, the scar may potentially hypertrophy and occasionally lead to reflex sympathetic dystrophy. Dissection of volar ligaments may lead to carpal instability.

Indications for Percutaneous fixation .

1. Undisplaced transverse fracture of the mid third scaphoid.
2. Minimally displaced fracture which can be manipulated to perfect reduction.
3. Displacement of over a mm but can be manipulated to perfect reduction.

Having mentioned the indications for percutaneous fixation, properly molded, snug fitting, uninterrupted cast immobilization still remains the first and preferred method of treatment. It is noteworthy that percutaneous fixation is an alternative to casting. It may permit early mobilization and high rate of union but it does not guarantee union⁶.

Contraindications:

1. Nonunion with sclerotic edges with cystic changes⁴.
2. Nonunion with hump back deformity requires volar wedge bone grafting.

3. Degenerative arthritis of radio carpal joint and mid carpal joint.

Goal of surgery.

1. Early return to work /athletics/ examination.

When to abandon percutaneous fixation:

Proceed with open surgery if:

1. Fracture gets further displaced during surgery.
2. Fractures cannot be reduced anatomically.

Technique of Volar approach.

Patient lies supine with the arm abducted on a sturdy radiolucent hand table.

*General or regional anesthesia.

*Uninflated tourniquet in upper arm.

*Painting /draping.

*Wrist acutely extended over one to two sterile rolled towel/s.

*The surgeon is seated on the axillary side or the shoulder side of the patient. The idea is, the drill can be pointed from the wrist side towards the forearm. So a right handed surgeon operating a right scaphoid should sit on the shoulder side and the image intensifier should approach from the axillary side or foot end side. Depending on the preference and training, the surgeon may opt for sitting on the outer edge of the hand table.⁴ In the accompanying pictures, the surgeon is seated at the edge of the hand table.

Dorsiflexion of the wrist will potentially displace the trapezium away and expose the distal pole of the scaphoid. The scaphoid tubercle is marked (Picture1).

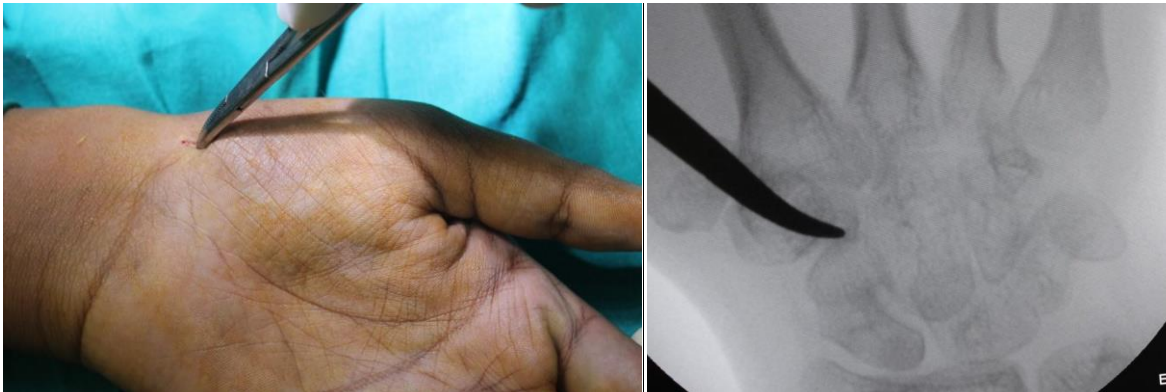


Picture 1 shows palpating the scaphoid tubercle. The surgeon is seated on the edge of the hand table.



Picture 2 showing the surgeon's thumb on the scaphoid tubercle and artery forceps is radial and distal to it to, mark the entry point.

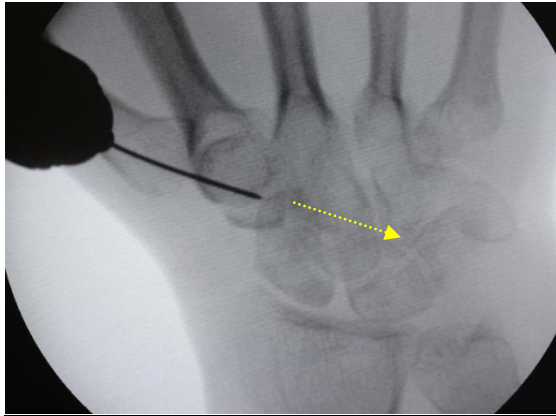
A 5mm long incision is made radial and distal to the scaphoid tubercle(Picture 2).Using a hemostat, this incision is deepened, so as to create a track to scaphotrapezial joint(Picture 3and 4).



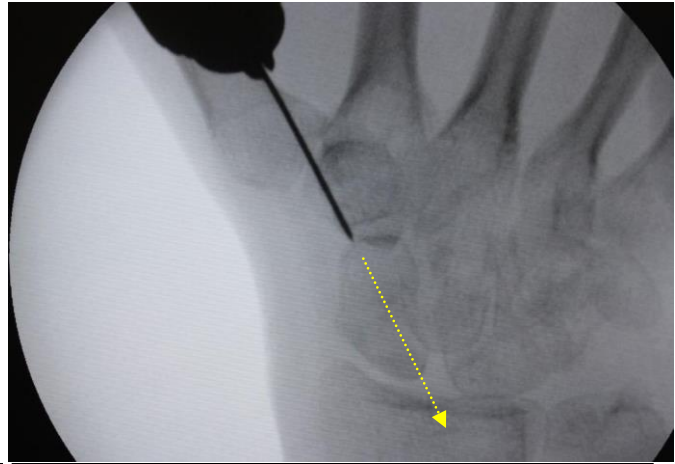
Picture 3 and 4.After a stab incision, the artery forceps is used to dilate the incision up to the scaphoid .

Number 14 gauge IV needle may be used as a cannula and locate the entry point into the scaphotrapezial joint. In the current case, the IV cannula has not been used. It is an option. The IV needle if used , is pointed proximally, ulnarly towards the proximal pole of scaphoid. Try to get as central as possible in the scaphoid distal pole.

Under image intensifier, a 1 mm Kirschner wire or the guide wire is introduced through the IV needle in the scaphotrapezial joint. As we know, the scaphoid is oriented about 45 degrees to AP and lateral plane. So the guide wire within the 14 gauge needle should follow this orientation. The wire which is mounted on a drill is pointed proximally towards the forearm, dorsally and ulnarly. Picture 5a and 5b.



Picture 5a. A guide wire is being introduced. The direction is not appropriate though. The wire is not along the central axis of scaphoid. Yellow arrow indicates the trajectory of the wire.

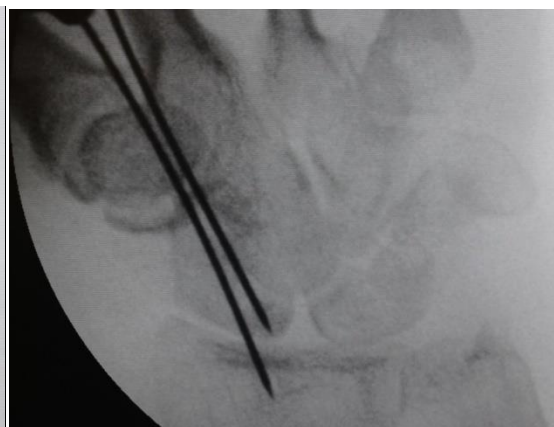


Picture 5b. The guide wire is now aligned along the central axis of scaphoid. This is good alignment. Yellow arrow indicates the trajectory which is along the central axis of the scaphoid.

On the lateral view, the wire should be pointing towards the dorsal rim of the lower end of the radius. Picture 5c.



Picture 5c. On the lateral view, the guide wire should be aimed such that, it is just distal to the dorsal rim of the distal radius.



Picture 6. Second guide wire is parallel to the first and acts as anti rotation wire.

Further, the wire should traverse the central axis of the scaphoid and exit just radial to scapho lunate joint. Another simple technique for the direction of the guide wire is to locate the scaphoid tubercle with the thumb and the index finger of the same hand is placed over the Lister's tubercle. The guide wire is aimed towards the index finger.

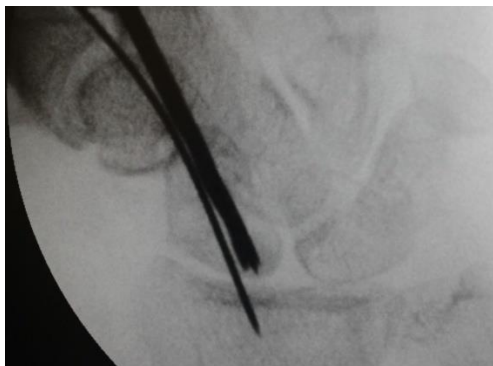
The wire is advanced under C arm dorsally .The advancement of the wire ceases when its leading edge touches the proximal edge of the scaphoid bone.

The IV needle is withdrawn, once the guide wire has been placed. Using another K wire of equal size, which is placed juxtaposed to the first wire, resting adjacent to the first wire, the size of the wire within the scaphoid is calculated. About 4 mm is subtracted from the measured length. Usually the approximate size of the screw is 20 mm +/- 2mm.

A second wire is passed parallel to this wire. It should be sufficiently away from the first wire, to avoid both the wires entwining around each other. The second wire acts as an anti rotation wire. Picture 6.

Drill bit provided with the screw set is passed over the guide wire up to the proximal pole but not across the proximal pole (Picture7). The drill bit is withdrawn and a tap is passed over the guide wire. Throughout the procedure, one should ensure that the guide wire does not disengage and comes out with the drill bit or the tap. It is safe to engage the leading edge of the guide wire to the dorsal lip of distal radius or let the guide wire emerge dorsally where it is held with a hemostat. If the wire has exit dorsally, engaging the dorsal rim of radius, it is absolutely mandatory that the wrist remains stationary, the way it is while the wire is being driven in. If the wrist moves even slightly, the guide wire will bend and possibly break.

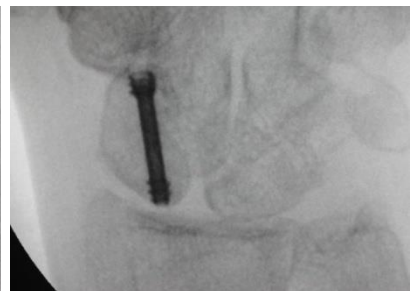
The cannulated headless screw is passed over the guide wire. Make sure, that it is buried within the bone at both the ends of the scaphoid.Picture8a and 8b.



Picture7. Drill bit is passed over the guide wire up to the subchondral bone.



Picture8a. Screw being driven in.



Picture8b. Screw in place. Both wires are withdrawn.

The anti rotation wire and the guide wires are now removed .The wound is sutured and POP scaphoid cast applied.

If the fracture is somewhat displaced, the accuracy of the reduction can be enhanced by introducing a K wire in each fragment and using them as joysticks to manipulate the fracture fragments.

The procedure described above is with the forearm horizontal. The procedure has also been described keeping the forearm vertical and the thumb suspended with traction. The C arm is then kept horizontal. It is a matter of individual training and preference.

POST OP Course. The hand is elevated above the heart level. Finger, elbow and shoulder ROM is started. Cast is replaced with a thumb spica splint after 2 weeks .The thumb spica splint is worn for 3 to 4 weeks. They can resume computer operation. Heavy manual work, lifting weight and in our country pushing the mobike on and off the stand is prohibited till the tenderness has not fully disappeared. The splint is removed every few hours for ROM and reapplied.

Dorsal approach indication.

1. Fracture proximal pole.
2. Mid1/3 fracture scaphoid , with over1 mm displacement / comminution/ angulation of over 15⁰.
3. Undisplaced fracture and pts does not want/cannot immobilize in a plaster immobilization.
Example: exam next week or both hand fracture.

Technique of surgery dorsal:

Anesthesia. Hand is abducted on an arm board as mentioned above .The surgeon is seated on the head end.

There are two methods to approach the dorsal or the proximal pole of the scaphoid.

Method1.The wrist is acutely flexed, pronated and ulnar deviated. On C arm, this will show an ‘end on’ view of a cylinder i.e. the scaphoid will appear like a ring .The guide wire is passed in the dead centre of the *ring* of the scaphoid.

Method 2 . Acutely flex the wrist and introduce the guide wire from the scaphoid side of the Scapholunate space. Through a 5 mm incision, the wire is advanced along the fully abducted thumb.

The wire is advanced till it exits on the palmar aspect. It is withdrawn anteriorly till the wire has freed the dorsal surface of the scaphoid. This will allow the wrist to be brought

back to neutral extension .Do not extend the wrist with the wire still projecting dorsally lest the wire bends or breaks.

A second wire is passed parallel to the first wire .This is anti rotation wire.

Once a guide wire is confirmed to be in the central axis of the scaphoid, the wire which is now totally volar , is drilled back out of the scaphoid for about 5 cms. The drill is passed over it .The drill is advanced till the subchondral region of the distal pole and then withdrawn. The drill is replaced with a tap. Screw is passed. Both the ends should be buried within the bone.

For the proximal pole fracture, it is however, preferable to do vascular bone grafting and fixation. This is a open surgery ofcourse.

Avoidable Technical Errors:

1. K wire bending and breaking if the wrist is moved inadvertently.
2. The drill bit breaks within the scaphoid for the same reason.
3. Guide wire and the anti rotation wires entwine.
4. The screw is too long.

Bibliography:

- 1.Streli R. Perkutane versraubung des handkahnbeines mit bohrdrahtkompressionsschraube. *Zentralbl Chir* 1 970;95: 1060-7 8.
2. Bond CD, Shin AY. Percutaneous cannulated screw fixation of acute scaphoid fractures. *Tech Hand Up Extrem Surg.* 2000;4(2):81-87.2000
3. Acutrak Percutaneous Scaphoid Fixation. Fares . Haddad,Nicholajs. Goddard,. *Techniques in Hand aid Upper Extremity Surg* 4(2):78-80, 2000
4. Miriam Mu'ller, MD and Gu'nter Germann, Michael Sauerbier.Minimal Invasive Screw Fixation and Early Mobilization of Acute Scaphoid Fractures in the Middle Third: Operative Technique and Early Functional Outcome. *Techniques in Hand & Upper Extremity Surg* 12(2):107-113, 2008.
- 5 Alexander Y. Shin, Eric P. Hofmeister, Percutaneous Fixation of Stable Scaphoid Fractures. *Techniques in Hand and Upper Extremity Surgery* 9(4):202-206, 2005.
6. David Slutsky .The scaphoid..Thieme publication 2011. Page86.