

## Case Series

# Surgical management of middle and distal third fractures of scaphoid fixed with Herbert screw by volar approach

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### ABSTRACT

Surgical treatment of scaphoid fractures has evolved over the years to include variety of procedures and techniques. However scaphoid middle and distal third fractures fixation with Herbert screw by means of volar approach is a safe and effective method with good functional outcome and union rates. Our study concluded that management of middle and distal third scaphoid fractures with Herbert screw by volar approach gives excellent results in terms of union and recovery to daily activities. The wrist function improvement is more satisfactory, and the incidence of complications is low with this modality of treatment.

**Keywords:** Fracture, Scaphoid, Volar approach

## INTRODUCTION

The scaphoid bone is the most commonly fractured carpal bone, accounting for approximately 60% of carpal fractures. Approximately 80% of these scaphoid fractures occur at the waist region. Scaphoid fractures result from fall on out stretched hand with wrist in extension. These fractures were classified according to Herbert classification.<sup>1</sup> There is relatively poor blood supply to proximal pole which receives blood flow in a retrograde manner from branches of radial artery. So middle and distal third fractures of scaphoid may disrupt this tenuous blood supply, leading to delayed union, non-union, and avascular necrosis of scaphoid which results in secondary osteoarthritis and carpal collapse.

Early treatment of scaphoid fractures is important in preventing these complications. The aim of this study is to evaluate the results of middle and distal third scaphoid fractures fixed with Herbert screw by volar approach.<sup>2</sup>

## CASE SERIES

We performed all cases through volar approach. Firstly under General or regional anaesthesia, patient was placed supine on the operating table with the shoulder abducted, forearm supinated and the wrist is extended over a roll.

**Table 1: Demographic details in the study.**

Demographic data	Number of cases	Percentage
<b>Age in years</b>		
10-20	7	43.75
21-40	9	56.25
<b>Gender</b>		
Males	12	75
Females	4	25
<b>Side of injury</b>		
Right	10	62.5
Left	6	37.5

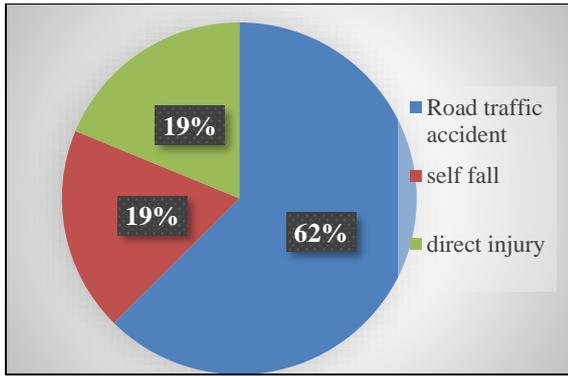


Figure 1: Mode of injury in the study.

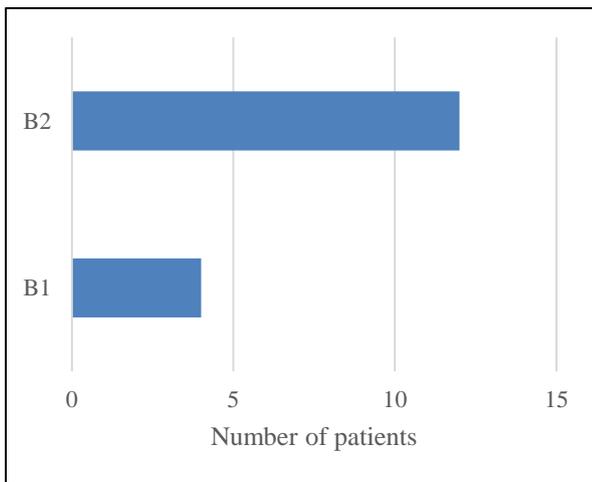


Figure 2: Distribution of fracture in study.

Table 2: Screw length distribution in present study.

Screw length	Number of cases	Percentage
14 mm	2	12.5
16 mm	9	56.25
18 mm	2	12.5
20 mm	3	18.75

Make a straight incision on the distal forearm about 2-3 cm long, base it on the tubercle of the scaphoid and extend it proximally between the tendon of the flexor carpi radialis and the radial artery. Carry the incision across the distal crease using a hockey stick incision towards the base of the thumb. FCR tendon retracted ulnarly and then through capsule splitting approach the entry point is made on the radial side of scaphoid tubercle with 1 mm k-wire.

Guide wire of size 1.0 mm is passed through the entry point, then AP and lateral radiographs are taken to confirm the correct position of guide wire. The length of the guide wire was measured to determine the appropriate screw length.

Later 2.0 mm cannulated drill bit was placed over the guide wire and the scaphoid was drilled under the C-arm

guidance. Reaming is done. Both fragments were reduced and were held with pointed forceps. A cannulated differential pitch headless screw (Herbert screw) of size 2.5 mm was inserted over guide wire and tightened with two fingers tightness, compression achieved.

After 12 months of follow up, all the cases were excellently good, no carpal instability present no AVN changes reported in any of these 16 cases. The duration when patients presented to us after injury ranged from immediate post injury to 17 days. The average duration at which the patient was operated post injury ranged from 10 days to 21 days at an average of 15.25 days.

In our study we analysed the functional results of scaphoid fractures managed by Herbert screw fixation in 16 patients. The age of the study population ranged from 21-40 years with a mean age of 27.1 years.

All 12 patients were male 4 females showing a male preponderance in the injury. All the patients were right hand dominant and the injury occurred in both right and left scaphoid at a ratio of 5:3.

The mode of injury in the patients that resulted in these fractures when analysed showed that 10 patients sustained their injury from road traffic accident with fall on an outstretched hand with axial load and hyperextension injury. 3 patients had accidental fall on floor with outstretched hyperextended hand while 3 patient sustained injury from assault by direct injury over the wrist.

All the fractures were classified by Herbert Fischer classification and out of 16 cases, 4 case of B1 type and 12 cases of B2 type was found showing a predominance of complete displaced waist fracture of the scaphoid as the predominant type involved in the study.

We used Herbert screws of length 14 mm in 2 case, 16 mm in 9 of the cases and 18 mm in 2 case and 20 mm in 3 case.

Results were analysed both clinically and radiologically. Time of clinical union was defined as the period between operation and full weight bearing without external support along with radiographically healed fracture. Union was achieved in all the cases at a mean duration of 7.2 weeks with a range of 6-10 weeks.

There was a no statistically significant relationship between the duration of union and the functional results at 1 year, and it was noted that all cases that united had better comparable functional results at 1 year follow-up irrespective of the rate of union of individual fractures types.

Average duration of follow-up obtained in our study was 12 months with a range from 6-18 months. Wrist flexion averaged 66.81 (range 50 to 75) and wrist extension averaged 57.5 (range 40 to 65). According to Modified Mayo wrist score (MMWS); the mean pain score was 21.3

(range 15 to 25), mean range of motion score was 23.3 (range 15 to 25), mean grip strength score was 24.6 (range

20 to 25) and satisfaction score was 23.3 (range 15 to 25). The mean MMWS score was 87.5 (range 75 to 95).

**Table 3: Fracture type and final outcome.**

Fracture type	Number of cases	Excellent	%	Good	%	Fair	%
<b>B1</b>	4	2	12.5	1	6.25	0	0
<b>B2</b>	12	12	75	0	0		6.25
<b>Total</b>	16	14	87.5	1	6.25	1	6.25



**Figure 3: X-ray after Herbert screw fixation of the scaphoid.**



**Figure 4: Distal pole fracture of scaphoid on X-ray AP view and volar approach of scaphoid fracture.**

Accordingly, 14 patients (87.5%) had excellent results, 1 patients (6.25%) had good results and one patient (6.25%) had fair result and none of the patient had poor result.

Complications noted in our study were stiffness of the wrist in the initial post-operative period in 5 cases which later subsided with wax bath mobilisation and wrist pain in 4 cases due to arthritic changes in the scaphoid-trapezoid articulation being violated for screw placement in the volar approach on one case and due to screw protrusion in one case.

None of the patient had non-union. 3 patients had scar sensitivity which subsided with physiotherapy.

**DISCUSSION**

Fractures of scaphoid are common, and many times are difficult to diagnose and treat. Fracture scaphoid can cause prolonged morbidity and absences from work in young male adults in which they are most common.<sup>5</sup> In our series The age of the study population ranged from 21-40 years with a mean age of 27.1 years. This finding suggests that scaphoid fracture is common in young adults. All 12 patients were male 4 females showing a male preponderance in the injury.

Herbert screw can be inserted through both palmar and dorsal approach. Palmar approach is useful in waist as well as distal pole fractures and preserves the important dorsal blood supply; however, it disrupts the volar carpal ligaments and gives poor exposure of proximal pole. Dorsal approach provides exposure of the proximal pole but can disrupt the tenuous blood supply.<sup>6,7</sup>

In our study we have used open volar approaches in all cases We did not encounter any complications or difficulties pre-operatively using those approaches. Filan and Herbert achieved 88% union rate with displaced or mobile fracture of scaphoid waist that had early surgical intervention with screw fixation.<sup>8</sup>

In our series we achieved 100% union rate, minimal complication and an early return of wrist function with open reduction and internal fixation with Herbert screw irrespective of type of fracture. Though significant complications have been reported with open technique, it is mainly due to significant soft tissue dissection and violation of the extrinsic volar and dorsal ligaments.<sup>9</sup>

From our study we found that the average size of the screw used in our population was 16 mm. Scaphoid fixation is best accomplished with the longest screw placed in the distal scaphoid poles. The bone density is greatest in the scaphoid poles providing the best fixation. The longer the screw the more rigid the fixation because forces are reduced along the screw, reducing the forces at the fracture site.<sup>10</sup>

In our study most of the patients had Excellent functional outcome and none of the patient had poor result. Mohamed I Rakha et al had good functional results both at 6 weeks postoperatively and at final visit, which may be attributed to several factors: first, the early mobilization of the wrist joint (after 2 weeks) postoperatively; second, the near-perfect screw positioning in our cases.<sup>11</sup> The importance of screw position in the scaphoid, especially the central placement of the screw in the proximal pole of the scaphoid, has been emphasized by various authors, who found that the perfect screw placement is directly related to good scaphoid alignment, which resulted in excellent radiological and functional outcome in terms of decreases in the time to union and improvement in the range of motion.<sup>12,13</sup>

The most common complication seen in various studies were; problem with scar (Hypertrophied scar), screw protrusion, osteoarthritic changes in scaphotrapezium joint after volar approach and post-operative instability.<sup>14</sup> Another common complication following Herbert screw fixation is non-union. In our study we faced with complications like sensitive scar, stiffness and pain. Review of literature, however, shows that the most common reason for failure in Herbert screw procedure is improper screw placement.

## CONCLUSION

We found Herbert screw fixation for middle and distal third fractures of scaphoid using a volar approach was a reliable method for patients to achieve bony union with excellent functions and without major complications.

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