Al-Azhar International Medical Journal

Volume 5 | Issue 5 Article 37

5-31-2024
Section: Orthopedics

Percutaneous Fixation of Scaphoid Waist Fracture by Herbert Screw

Mahmoud Seddik
Orthopedic Surgery, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt

Mohamed Gamal Abdelkader
Orthopedic Surgery, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt

Abdelrhman Esam Hasan
Orthopedic Surgery, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt,
a.essam2001@gmail.com

How to Cite This Article

Seddik, Mahmoud; Abdelkader, Mohamed Gamal; and Hasan, Abdelrhman Esam (2024) "Percutaneous Fixation of Scaphoid Waist Fracture by Herbert Screw," *Al-Azhar International Medical Journal*: Vol. 5: Iss. 5, Article 37.
DOI: https://doi.org/10.58675/2682-339X.2439

ORIGINAL ARTICLE

Percutaneous Fixation of Scaphoid Waist Fracture by Herbert Screw

Mahmoud Seddik, Mohamed G. Abdelkader, Abdelrhman E. Hasan *

Department of Orthopedic Surgery, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt

Abstract

Background: ***The scaphoid is the carpal bone most frequently fractured among all wrist injuries. Seventy percent of all scaphoid fractures in adults occur at the waist of the scaphoid.***

Aims and objectives: ***To assess the management of scaphoid waist fracture fixation by percutaneous Herbert screw.***

Patient and methods: ***This prospective research was done on 20 patients with scaphoid waist fractures, acute, stable, no avascular necrosis consistent with the Herbert and Fisher classification, normal scapholunate angle, scaphoid waist fractures with no displacement or minimal displacement, and delayed union waist fractures with no sclerosis, gaping, cyst formation, or humpback deformity. The sample was considered comprehensive as a result of the rare attendance of cases with scaphoid waist fractures.***

Results: ***There was a highly statistically significant variance among the study population concerning time from injury to surgery and time to union. MAYO score analysis revealed that 25% of patients had an excellent score, 30% had a good score, 35% had a satisfactory score, and 10% had a poor score. In contrast, VAS pain score analysis revealed that six patients (30%) had no pain sensation, eight patients (40%) had a mild pain sensation, four patients (20%) had a moderate pain sensation, and two patients (10%) had a severe pain sensation.***

Conclusion: ***For acute displaced scaphoid fractures, percutaneous retrograde fixation with Herbert screws is a dependable method that permits patients to use their hands more quickly with minimal complications and maximum satisfaction.***

Keywords: Percutaneous Herbert Screw, Scaphoid Waist Fracture, Humpback Deformity, Kirschner Wires, Scapho-Lunate Angle

1. Introduction

Among all wrist injuries, scaphoid fractures occur with the greatest frequency among carpal bones; its incidence is second only to distal radius fractures, which account for sixty percent of carpal fractures and eleven percent of all hand fractures. [1,2]

The waist of the scaphoid is affected in 70 percent of scaphoid fractures in adults, 20 percent in the proximal pole, and 10 percent in distal pole complications. As a consequence of the distal radius's relative fragility in comparison to the scaphoid bone in young children and the elderly, fractures of this nature are rare. They typically occur when young, healthy adults between the ages of 10 and 19 forcefully extend their wrists. [3,4]

Screw fixation is now a common way to treat scaphoid fractures, whether they are acute, non-displaced, or displaced. Non-operative treatment is generally acknowledged and recommended for acute, non-displaced scaphoid waist fractures.[5] The scar produced by this procedure is much more aesthetic and avoids the devascularization of the scaphoid bone and the splitting of the carpal ligaments. [6]

The goal of treating a scaphoid waist fracture is to make sure that the bone is reduced and fixed securely without cutting off blood flow. This requires careful planning and evaluation before surgery. [7,8]

This research aimed to evaluate the management of scaphoid waist fracture fixation by percutaneous Herbert screws.

Accepted 21 May 2024.
Available online 31 May 2024

* Corresponding author at: Orthopedic Surgery, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt.
E-mail address: a.essam2001@gmail.com (A. E. Hasan).

https://doi.org/10.58675/2682-339X.2439

2. Patients and methods

This prospective research was conducted on 20 patients, following the inclusion criteria. The sample was considered comprehensive because patients with scaphoid waist fractures were rare attendees. Consent was obtained from all patients, and they underwent routine clinical evaluations and pre-operative investigations.

2.1.Inclusion criteria: scaphoid waist fracture, acute, stable, no avascular necrosis concerning the Herbert and Fisher classification, normal scapholunate angle, scaphoid waist fractures with no displacement or minimal displacement, and delayed union waist fractures with no sclerosis, gaping, cyst formation, or humpback deformity.

2.2.Exclusion criteria: tuberosity fracture, proximal pole fracture, dorsal intercalated segment instability deformity, trans-scaphoid peri-lunar dislocation, osteonecrosis of the proximal scaphoid fragment, and scaphoid non-union with sclerosis, gaping, cyst formation, and humpback deformity.

2.3.Method: Pre-operative planning: history-taking, clinical examination (inspection, palpation, and range of motion), radiological evaluation, and laboratory investigations.

2.4.Anesthesia: General anesthesia was performed in 15 cases, and regional nerve block was performed in 5 cases.

2.5.Position: Supine on the operating table

2.6.Operative Technique: This method was built on the work of Jeon and coworkers[9] with some modifications. The surgeon identified the volar scapho-trapezial joint by moving the finger across the distal wrist crease from the ulnar to radial directions. A 0.45 mm Kirschner wire was used to stabilize the fracture parallel to the thumb metacarpal and forearm in the coronal plane. The wire went from the far cortex to the middle of the proximal pole and stopped there. A 5 mm cut was made across the skin, and a hemostat was utilized to cut the bone bluntly all the way down to the distal pole of the scaphoid. A depth gauge or equal-length wires were utilized to measure the length, and the difference among them was recorded. A screw that was 4 mm shorter than the real size was utilized and the wire was moved across the proximal pole, even more, to make sure it would not move after being rammed around. A second Kirschner was utilized to prevent rotation throughout tapping. A cannulated drill was put around the wire and moved across the fracture site. A Herbert screw that was self-tapped was put in by hand without utilizing the jig method. The traction force that was previously applied to the thumb was eradicated, whereas the final rotations of the screw induce compression. Fracture site compression was determined to be present. Under the scaphoid surface, the screw's distal end was buried. The second Kirschner wire was removed if there were no issues with stability.

After fixation, the position of the screw can be verified utilizing an image intensifier. No immobilization was performed; only thumb support was advised. The patients were advised to exercise their wrists without immobilization and avoid contact sports or full loading until full union was attained. It was important to emphasize the importance of both the pronation and the supination oblique views of the scaphoid in the accurate placement of the guide wire and, subsequently, the screw centrally in the scaphoid across the fracture site. The pronation oblique view was the best view to detect the accuracy of the point of entry (just lateral to the lateral border of the trapezium), and it shows the outline of the proximal pole by removing the overlap between it and the lunate. The supination oblique view was the best way to see the humpback deformity and make sure the K wire was going in the right direction, parallel to the volar cortex and not going through the dorsal cortex.

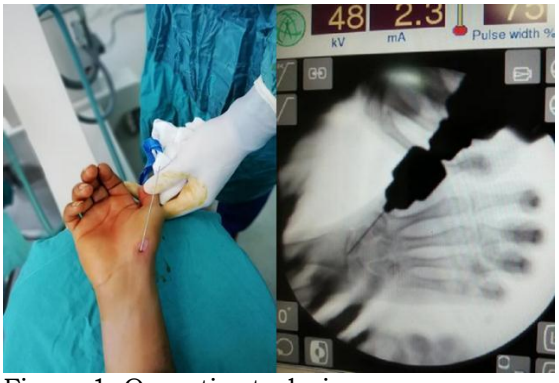
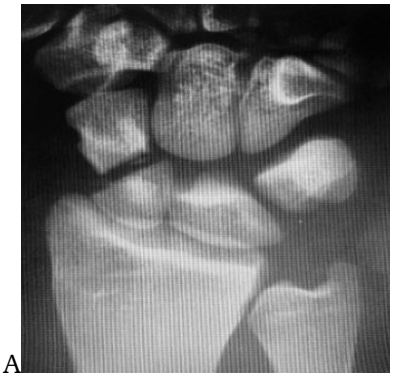


Figure 1. Operative technique



A

B

Figure 2. (A): Peri-lunate dislocation with

fracture scaphoid; and (B): The first view is the pronation view, while the second is the supination view.

Postoperative follow-up: An assessment was made of fracture site compression and screw position on early postoperative X-rays. At six and nine months of follow-up, a late radiological examination was performed to evaluate the position of the screw, carpal alignment, and the presence of complications such as arthritis or nonunion. Using the Mayo wrist score and VAS pain scale, a serial clinical examination was conducted at the time of union, at 12 months, and at the final follow-up (average, 18 months) to assess the functional outcome. The power grip was assessed utilizing a dynamometer, while the range of motion was determined utilizing a goniometer.

Assessment of union: Union was determined based on the absence of tenderness at the fracture site and the presence of trabeculae crossing the fracture site in three scaphoid views.

3. Results

Table 1. The percentage of incidence regarding sex, age, dominant hand, affected hand, and mode of trauma presented in the 20 patients.

	ITEM	NO	%
SEX	Male	11	55%
	Female	9	45%
AGE	<32	11	55%
	>32	9	45%
DOMINANT HAND	Right	15	75 %
	Left	5	25%
AFFECTED SIDE	Right	10	50%
	Left	10	50%
MODE OF TRAUMA	FALL	12	60
	RTA	5	25%
	Direct trauma	3	15

This table showed that regarding sex, 11 males (55%) and 9 females (45%) complained of scaphoid fracture. Regarding age, 11 patients (55%) were <32 and 9 (45%) were >32. Regarding the dominant hand, 15 patients were right-handed (75%), and 5 patients were left-handed (25%). Concerning the affected side, in 10 patients, the injury was on the right side (50%), and the other 10 patients were injured on the left side (50%). The mode of trauma was fall in 12 patients (60%), root traffic accident (RTA) in 5 (25%) and direct trauma in 3 (15%).

Table 2. Time from injury to surgery (weeks) and time to union (weeks)

	NO	MEAN ± SD	ONE-SAMPLE T TEST	P VALUE
TIME FROM INJURY TO SURGERY	18	2.61 ± 1.91	5.87	< 0.001
TIME TO UNION	16	7.63 ± 1.66	18.28	< 0.001

Table 2 showed that the time from injury to surgery varied from 1 to 8 weeks, with a mean of 2.61 ± 1.91. The time of union after surgery varied from 6 to 10 weeks with a mean of 7.63 ± 1.66, with a highly statistically significant difference between the study population with regard to time from injury to surgery and time to union.

Table 3. Incidence of complications recorded in the follow-up period.

	NO	%
NO COMPLICATIONS	10	50
LONG SCREW / DELAYED UNION	1	5
DELAYED UNION	4	20
NON-UNION/ OPEN SURGERY + BONE GRAFT	2	10
SCAPHO-TRAPEZIAL ARTHRITIS	3	15

As regard the evaluation of postoperative complications, 10 patients had no complications at all (50%), delayed union occurred in 4 patients (20%), 2 patients had non-union indicated open surgery and bone graft (10%), 3 patients had scapho-trapezial arthritis (15%), and one patient needed a long screw and had delayed union (5%)

Table 4. Chi Square test to detect the association between age and incidence of complications, time to union, Mayo score, and VAS pain score

	AGE ASSOCIATION TO		TIME TO RETURN TO DAILY WORK POST-OPERATIVE ASSOCIATION TO	
	Incidence of complications	Time to union	time to union	MAYO SCORE
P VALUE OF CHI SQUARE	< 0.05	<0.01	< 0.01	< 0.05
P VALUE OF EXACT FISHER	< 0.01	< 0.05	< 0.001	< 0.01

There was a significant correlation among patient age and the incidence of complications (P value of the Chi Square test < 0.05 and P value of the exact Fisher test was 0.01). Moreover, the time to union significantly longer with older age (P value of Chi Square test < 0.01 and P value of exact Fisher test was 0.05). Time to return to daily work post-operatively was significantly associated with time to union (P value of Chi Square test < 0.01 and P value of exact fisher test was 0.001) and also with MAYO SCORE (P value of Chi Square test < 0.05 and P value of exact fisher test was 0.01).

Table 5. Analysis of Mayo Score

	ITEM	NO	%
MAYO SCORE	Excellent	5	25%
	Good	6	30%
	Satisfactory	7	35%
	Poor	2	10%

The MAYO score analysis revealed that 25% of patients (5) had an excellent score, 30% of patients (6) had a good score, 35% of patients had a satisfactory score (7), and (2) 10% of patients had a poor score.

Table 6. Analysis of VAS Pain Score

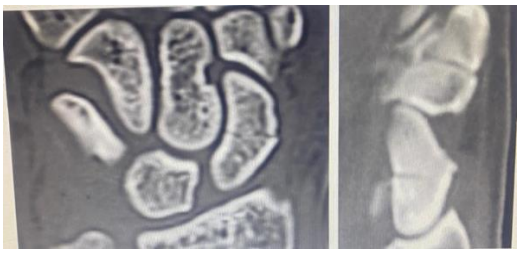
VAS PAIN SCORE	ITEM	NO	%
	No pain	6	30%
	Mild	8	40%
	Moderate	4	20%
	Sever	2	10%

VAS pain score analysis revealed that 6 patients (30%) had no pain sensation, 8 (40%) had a mild pain sensation, 4 (20%) had a moderate pain sensation, and 2 (10%) had a severe pain sensation.

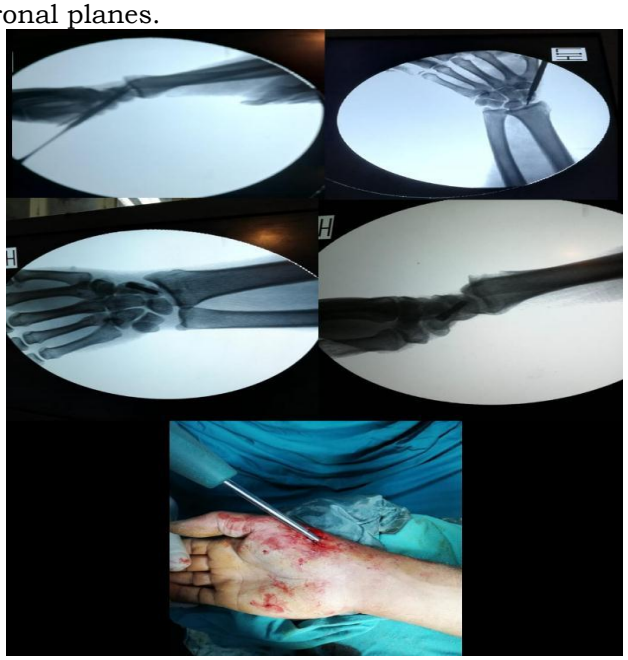
Case presentation

A male patient, 41 years old, presented to the emergency unit after falling on a stretched hand. X-rays were done on both the PA and lateral views, display a scaphoid waist fracture. A CT was done to confirm the diagnosis, and the patient was admitted for percutaneous Herbert screw fixation through a volar approach.

A. Preoperative x-ray, both PA and lateral views display a scaphoid waist fracture



B. A preoperative CT was done, showing a scaphoid waist fracture in both the sagittal and coronal planes.



C. Intraoperative imaging showing percutaneous volar fixation of a fractured scaphoid using a Herbert screw.

D. Follow-up x-rays 6 months postoperatively show union of the scaphoid waist fracture.

E. Clinical follow-up views postoperatively after 6 months

Figure 3. Photos of the case presentation

4. Discussion

Our study showed that, regarding sex, 11 males (55%) and nine females (45%) complained of scaphoid fracture. Regarding age, 11 patients (55%) were <32, and 9 patients (45%) were >32. Regarding the dominant hand, one patient (5%) was right-handed (75%), and five patients were left-handed (25%). Concerning the affected side, in 10 patients, the injury was on the right side (50%), and the other ten patients were injured on the left side (50%). The mode of trauma was fall in 12 patients (60%), root traffic accident (RTA) in 5 patients (25%), and direct trauma in 3 patients (15%).

Yip et al.[10] studied 49 patients, 46 of whom were males and 3 of whom were females. Adolfsson et al.[11] studied 53 patients, 39 of whom were males and 14 of whom were females.

Hegazy[12] study found that the ages of the cases ranged from 16 to 45, with an average of 23. Rakha et al.,[13], in their study, found that the ages of the cases ranged from 19 to 47, with an average of 27.4. Slade 3rd et al.,[14] in their study, ranged in age from 17 to 28, with an average age of 20.

In this study, all cases were operated on by percutaneous Herbert screw fixation through the volar approach. Yip et al.,[10], in their study, used percutaneous cannulated screw fixation mainly for acute scaphoid waist fractures through both volar and dorsal approaches. Adolfsson et al.[11] had a comparative study between cast immobilization and percutaneous cannulated screw fixation. Hegazy[12], in his study technique, was percutaneous cannulated screw fixation through a volar approach, and this was the same technique as ours. Rakha et al.,[13], in their study, used percutaneous cannulated screw fixation through a volar approach with bone marrow injection. Slade 3rd et al.,[14] in their study technique was arthroscopically assisted percutaneous fixation without bone grafting.

Our study showed that the time from injury to surgery varied from 1 to 8 weeks, with a mean of 2.61 ± 1.91. The time of union after surgery varied from 6 to 10 weeks, with a mean of 7.63 ± 1.66. There was a highly statistically significant variance among the study population with regard to time from injury to surgery and time to union.

As regard the evaluation of postoperative complications, ten patients had no complications at all (50%), delayed union occurred in 4 patients (20%), two patients had non-union indicated open surgery and bone graft (10%), three patients had scapho-trapezial arthritis (15%), and one patient needed a long screw and had delayed union (5%)

Adolfsson et al.,[11], in their study, found union occurred in 49 cases, and 4 cases had non-union after cast immobilization, and they were operated on later.

Slade 3rd et al.,[14], found union in 10 cases while 5 cases had non-union, and this may be due to technical problems in arthroscopic assisted fixation.

Yip et al.,[10] in their study, 16 cases had bony erosion to the trapezium due to screw heads, but they were pain-free. Adolfsson et al.,[11], in their study, found that two cases with cast immobilization had persistent radial border wrist pain even after union in radiographs.

In the current research, 20 cases with fewer than one-month fractures were fixed percutaneously by Herbert screws and followed up for a minimum of 9 months (average, 12 months). There was a significant correlation between patient age and the incidence of complications. They were furthermore, advancing age results in a significantly extended duration until union. Young men who desired to utilize their hands early incurred the majority of fractures. Patients declined prolonged wrist immobilization due to the financial implications; this would allow the patient to resume work earlier. With the exception of three patients who developed scapho-trapezial arthritis, this research demonstrated that soft tissue stripping and instability did not result in any complications throughout at least a nine-month follow-up period. This method is utilized as an alternative to open techniques. Without dissecting soft tissue, closed reduction with the aid of an image intensifier was an excellent technique for anatomic reduction.

The duration of returning to work in the current study shows that 42.9% of patients returned to their usual work after four weeks, 34.3% returned after eight weeks, and 22.8% returned after ten weeks from fixation, with a mean duration of 7.8 weeks. About half of the patients returned to their work and daily activities within four weeks, which proves that this type of fixation is a very good option for those who need no long-term immobilization in the traditional scaphoid cast.

Points of strength: The present study is prospective controlled research with appropriate power analysis, and we believe that the research

is significant because consistent results were documented in every case.

Our study had several limitations: First, the sample size is small (n = 20 patients). Second, the study did not include a control group for comparison of the results with other groups treated without bone marrow injection or treated conservatively. Nevertheless, the advantages of percutaneous screw fixation contrasted with cast immobilization have been proven by other comparative studies. Third, it is hard to get a good picture of when a scaphoid fracture has healed because it can vary from observer to observer, even though we took x-rays of all of our patients every two weeks. Fourth, the percutaneous approach is of limited capability in managing cases of severe wrist trauma, as in trans-scaphoid peri-lunate dislocation, where there is comminution of the fracture site in addition to severe soft tissue injury in need of repair or reconstruction.

4. Conclusion

The Herbert screw percutaneous retrograde fixation technique is a dependable approach for managing acute displaced scaphoid fractures. This method allows patients to use their hands more quickly, with minimal complications and maximum satisfaction. In acute scaphoid fractures, minimally invasive surgery with minimal surgical trauma to soft tissue is regarded as the key to successful outcomes, as it is effective in achieving union and has an excellent functional outcome.

Disclosure

The authors have no financial interest to declare in relation to the content of this article.

Authorship

All authors have a substantial contribution to the article

Funding

No Funds : Yes

Conflicts of interest

There are no conflicts of interest.

References

1. Meermans G, Verstreken F. Influence of screw design, sex, and approach in scaphoid fracture fixation. Clin Orthop Relat Res. 2012;470(6):1673-1681.
2. Wells ME, Nicholson TC, Macias RA, Nesti LJ, Dunn JC. Incidence of Scaphoid Fractures and Associated Injuries at US Trauma Centers. J Wrist Surg. 2021;10(2):123-128.
3. Jørgsholm P, Ossowski D, Thomsen N, Björkman A. Epidemiology of scaphoid fractures and non-unions: A systematic review. Epidemiologie von Skaphoidfrakturen und -pseudarthrosen: Eine Literaturrecherche. Handchir Mikrochir Plast Chir. 2020;52(5):374-381.
4. Dias JJ. Scaphoid fractures. InEuropean Instructional Lectures: Volume 11, 2011, 12th EFORT Congress, Copenhagen, Springer Berlin Heidelberg. Denmark 2011; (pp. 107-129).
5. Filan SL, Herbert TJ. Herbert screw fixation of scaphoid fractures. J Bone Joint Surg Br. 1996;78(4):519-529.
6. Altay T, Gunal I, Kayali C, Sener M. Dorsal percutaneous screw fixation of delayed or nonunion of scaphoid fractures: decision making with MRI. Int Orthop. 2014;38(5):1007-1010.
7. Capo JT, Orillaza NS Jr, Slade JF 3rd. Percutaneous management of scaphoid nonunions. Tech Hand Up Extrem Surg. 2009;13(1):23-29.
8. Sabbagh MD, Morsy M, Moran SL. Diagnosis and Management of Acute Scaphoid Fractures. Hand Clin. 2019;35(3):259-269.
9. Jeon IH, Micic ID, Oh CW, Park BC, Kim PT. Percutaneous screw fixation for scaphoid fracture: a comparison between the dorsal and the volar approaches. J Hand Surg Am. 2009;34(2):228-36.e1.
10. Yip HS, Wu WC, Chang RY, So TY. Percutaneous cannulated screw fixation of acute scaphoid waist fracture. J Hand Surg Br. 2002;27(1):42-46.
11. Adolfsson L, Lindau T, Arner M. Acutrak screw fixation versus cast immobilisation for undisplaced scaphoid waist fractures. J Hand Surg Br. 2001;26(3):192-195.
12. Hegazy G. Percutaneous Screw Fixation of Scaphoid Waist Fracture Non-Union Without Bone Grafting. J Hand Microsurg. 2015;7(2):250-255.
13. Rakha MI, El-Deeb MS, El-Ghandour SM. Volar percutaneous screw fixation and autogenous bone marrow injection for acute scaphoid fractures. The Egyptian Orthopaedic Journal. 2014 Apr 1;49(2):112-119.
14. Slade JF 3rd, Geissler WB, Gutow AP, Merrell GA. Percutaneous internal fixation of selected scaphoid nonunions with an arthroscopically assisted dorsal approach. J Bone Joint Surg Am. 2003;85-A Suppl 4:20-32.