Section: Orthopaedic

Original Research Article

COMPARISON OF ORIF AND PERCUTANEOUS FIXATION OF SCAPHOID FRACTURES

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ABSTRACT

Background: Scaphoid fracture is the most common carpal fracture and the most challenging. Hence clinical effects of closed reduction and percutaneous cannulated screw internal fixation under fluoroscopy and arthroscopy assisted percutaneous was compared so that early healing will start functional exercise so that patient can return to his daily activities. **Materials and Methods:** 54 scaphoids with fractures were treated and studied. The radiographs were taken from different perspectives. The screw fractures were treated with Herbert screws. The injuries were graded as per Herbert and Fisher's classification. All the factures were first tried for percutaneous fixation using the volar approach. If adequate reduction was not achieved, then opt for ORIF and bone grafting through a volar approach, with a minimum follow-up of up to 12 months. **Result:** Out of 54 scaphoid fractures, 36 belonged to the right wrist and 18 to the left wrist. As per Heart Bean: 23 B2, 25=A2, 6-C. Per cutaneous fixation, 17 (31.4%) had excellent results. In Orif, 14 (25.9%) patients had excellent results, 9 (16.6%) had good results, and 5 (9.2%) had fair results. Various motions or movements, like wrist flexion, wrist extension, mean range of motion, mean grip strength score, activity score, and mean MMWS score per cutaneous, have increased scores and motions as compared to ORIF. **Conclusion:** It is concluded that the percutaneous fixation technique in scaphoid fractures is an ideal method to treat because fractures unite early and return to normal functional activity with fewer complications than ORIF.

INTRODUCTION

Scaphoid fracture is the most common carpal fracture, accounting for 60% to 70% of carpal fractures and 2% of total body fractures, which is only second to distal radius fracture.[1] The blood supply system of scaphoid fracture is unique, and improper treatment in the early stage may lead to delayed healing or nonhealing of the fracture, thus affecting wrist function. Traditional plaster fixation can be used for non-displaced scaphoid fractures,[2] but nonunion occurs in 15% of cases. It is suggested that the risk of nonunion caused by nonsurgical treatment is four times higher than that of non-displaced fractures. Hence, surgical treatment is advised for displaced fractures; however, open reduction and internal fixation can aggravate structural damage to the wrist ligament, affecting normal function of the wrist.[3]

Percutaneous internal fixation has been widely used in the clinical treatment of scaphoid fractures. As percutaneous internal fixation, or minimally invasive screw fixation, is the mainstream surgical treatment that can help to compress the broken end of the fracture, promote fracture healing, and start functional exercise early and has achieved satisfactory results.[4] Hence, an attempt is made to compare both techniques, and their pros and cons are evaluated.

MATERIALS AND METHODS

54 (fifty-four) patients with fractures of the scaphoid bone visited the orthopaedic department of MNR Medical College and Hospital, Sangareddy-502294, Telangana, India, were studied.

Inclusive Criteria

The age group between 18 and 50 years is patients with acute scaphoid fractures, patients with delayed unions or fractures that showed no healing after 12 weeks of wearing plaster casts, and patients with fractures that presented late (4 weeks to 3 months

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after injury). The patients who gave their consent in writing were selected for study.

Exclusion Criteria

Patients having tuberosity fractures and trans-scaphoid perilunate dislocations. DISI (dorsal intercalated segmental instability), deformity, osteonecrosis of the scaphoid, and patients with a previous history of wrist injury or pathological fractures were excluded from the study.

Method: Various views of scaphoid radiographs taken, postero-anterior, lateral, semipronation oblique and antero-posterior views with wrist. The scaphoid fractures were treated with a Herbert screw for scaphoid fractures. The injuries were graded according to Herbert ad Fisher classification.

Table 1: Herbert and Fisher classification

No	Type	Description
(A)	Acute stable	A1 fracture of tubercle A2 Non-displaced incomplete fracture in the wrist
(B)	Acute instable	B1 – Oblique fracture in the distal third B2 – Displaced or mobile fracture in the wrist B3 – facture of the proximal pole B4 – Fracture with dislocation B5 – Comminuted fracture
(C)	Delayed	6 weeks
(D)	Established	D1 : Fibrous D2 : Sclerotic

All the fractures were first tried for percutaneous fixation using the volar approach; if adequate reduction was not achieved, we opted for ORIF, except for the patient with a time of admission of 150 days after injury, who was treated directly with ORIF, and the bone grafting volar approach was for the ORIF of a scaphoid fracture. For purcutaneous fixation, a volar approach was also used.

For every patient, a scaphoid cast was applied postoperatively, sutures were removed, and the cast continued for another 4 weeks. At the 6th week, the cast was removed and replaced with a removable wrist immobilizer brace for another four weeks, along with physiotherapy. Hand grip strengthening exercises for the wrist were started. Every patient was evaluated at a two-week interval until the fracture was united. In every follow-up, patients were subjected to clinical and radiological examinations with a scaphoid profile. Union was considered when there was no tenderness at the anatomical snuff box or at the scaphoid tubercle and if there was any evidence of tubercle crossing fracture on at least two views. On the final follow-up, clinical assessments were performed as per the modified Mayo wrist score (MMWS). The minimum follow-up was 12 (twelve months).

Grip strength was measured by asking the patient to squeeze the examiner's index finger, and strength was compared on the contralateral side. Grip strength was graded according to MRC grading. The range of motion was measured by gonometry.

Table 2: Modified Mayo wrist score (MMWS)

No	Category	Points
A	Pain (25 points)	
	None ----------	25
	Mild Occasional ----------	20
	Moderate (with normal use, not at rest) ----------	10
	Severe, constant ----------	0
B	Range of motion (25 points) Flexion, Extension degrees	
	>140	25
	100 – 140	20
	70 – 99	15
	40 – 69	10
	< 40	0
C	Grip strength (25 points)	
	- Normal - ----------	25
	- Diminished but > 50% of normal ----------	15
	- less than 50% of normal ----------	0
D	Activity (25 points)	
	Same activities ----------	25
	Restricted activities caused by injured wrist ----------	15
	Change of work or sports caused by injured wrist---	0

All 54 (fifty-four) scaphoid fractures treated by both methods united successfully. Radiological union was confirmed postoperatively in every patient treated with percutaneous fixation at 8–9 weeks (7–12 weeks) and ORIF 12.2 weeks (8–16 weeks), respectively. In patients with delayed union with cast treatment, fracture union was seen at 12.9 weeks (range 11–14 weeks) postoperatively.

In case of percutaneous fixation, wrist flexion averaged 635 (range 40 to 7500) and wrist extension averaged 625 (range 40 to 700). In orif wrist flexion,

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averaged 585 (range 30 to 700), and wrist extension 565 (range 30 to 650).

According to the Modified Mayo wrist score (MMWS), the mean pain score was 21.5 (range 10 to 25) with percutaneous and 20.5 (range 10 to 25) with ORIF. The mean range of motion was 24.01 (range 15 to 25) with percutaneous and 23.2 (range 15 to 25) with ORIF.

The mean grip strength score was 24.8 (range 15 to 25) with percutaneous and 23.8 (range 15 to 25) with ORIF.

Activity: The activity was 22.2 (range 15 to 25) with percutaneous and 21 (range 15 to 25) with ORIF.

The mean MMWS score was 96 (range 90 to 100) for percutaneous and 836.9 (range 70 to 95) for ORIF.

Accordingly, 17 (31.4) patients had excellent results with percutaneous fixation, while with ORIF, 14 (25.9) patients had excellent results, 9 (16.6) had good results, and 5 (9.2%) patients had fair results.

There were no post-surgical complications like malunion, and I did not show signs of posttraumatic osteoarthritis of the scaphoid or wrist at the final follow-up.

The duration of the study was February 2025 to March 2026.

Statistical Analysis:

The various parameter findings were classified by percentage. The statistical analysis was carried out in SPSS software. The ratio of males and females was 1:1.

RESULTS

Out of 54 scaphoid fractures, 36 fractures belonged to the right hand and 18 belonged to the left wrist. Herbert type 13=B2 (displaced or mobile fracture), 14=A2 (non-displaced in complete fracture), and 3=C (delayed union > 6 weeks).

- With ORIF 17 (31.4%), patients had an excellent result with percutaneous fixation.
- 14 (25.9%) had excellent results,
- 9 (16.67%) had good results
- 5 (9.2%) had a fair result

In both techniques, no post-surgical complications were observed.

A. In ORIF, wrist flexion averaged 585 (range 30 to 700 score).

- 20.5 – wrist score (as per MMWS)
- 23.2 – Mean range motion (15 to 25)
- 23.8 – Mean grip strength score (15 to 25)
- 21 – Activity score (range 15 to 25)
- 86.9 – Mean MMWS score (range 70 to 95)

B. In percutaneous fixation, there were 635 wrist fixations (degree range 40 to 700).

- 21.5 wrist score (mean pain score) (range 10 to 25)
- 24.1 Mean range of motion
- 24.8 Mean grip strength score (range 15 to 25)
- 22.2 Activity score (range 15 to 25)
- 96 Mean MMWS score (range 90 to 100).

Table 3: Study of patients with different score and classifications

Sl No.	Side	Herbert type	Time to surgery (Days)	Approach	Time to Union	MMWS point	Remarks
1	R	B2	6	Orif	12	85	Bone Grafting was done cast failure
2	R	B2	17	Volor	8	100	
3	L	C	151	Percut	15	80	
4	R	C	45	Volor	12	70	
5	L	A2	21	ORIF	9	95	
6	R	B2	4	Volor	9	90	
7	L	A2	14	ORIF	8	95	
8	R	A2	4	Volor	8	85	
9	R	B2	2	Percut	8	95	
10	R	B2	8	Volor	11	95	
11	L	A2	10	ORIF	12	80	
12	R	B2	8	Volor	16	95	
13	L	A2	5	ORIF	14	100	
14	R	A2	2	Volor	10	90	
15	L	B2	12	Percut	8	95	
16	R	B2	5	ORIF	12	85	
17	R	A2	15	Percut	8	90	
18	L	A2	5	ORIF	14	85	
19	L	B2	8	ORIF	10	90	
20	R	A2	7	Percut	9	90	
21	L	B2	6	Percut	14	85	
22	R	A2	16	ORIF	10	90	
23	R	B2	4	Percut	12	90	
24	L	A2	5	ORIF	14	85	
25	L	A2	5	Volor	11	90	
26	R	B2	5	Percut	8	85	
27	L	A2	16	Percut	8	90	
28	L	A2	8	Percut	10	95	
29	R	B2	5	ORIF	9	100	
30	L	A2	8	ORIF	8	95	

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B2=23, A2=25, C=6

DISCUSSION

In the present comparative study of ORIF versus percutaneous fixation of scaphoid fractures in the Telangana population, out of 54 scaphoid fractures, 36 belonged to the right and 18 belonged to the left wrists. The classification of Herbert type 13-B2 (displaced or mobile fractures), 14-A2 (non-displaced incomplete fractures), and 3-C (delayed union of fractures > 6 weeks).

Per cutaneous fixation, 17 (31.4%) had excellent results. In ORIF fixation, 14 (25.9%) had excellent results, 9 (16.6%) had good results, and 5 (9.2%) had fair results. Both techniques had no postsurgical complications.

(A) In Orif, wrist flexion averaged 585 (range 30 to 700), 20.5 wrist score, 565 wrist extension, and 636 to 650 (mean pain score), as per MMWS.

- 23.5 – Mean range motion (range 15 to 25)
- 23.8 – Mean grip strength score (15 to 25)
- 21 – Activity score (range 15 to 25)
- 86.9 – Mean MMWS score (range 70 to 95)

(B) In percutaneous fixation

- 635 – Wrist flexion (300 to 750)
- 625 – Wrist extension (30 to 650)
- 21.5 – Wrist score (mean pain score) (10 to 25)
- 24.1 – Mean range of motion (15 to 25)
- 24.8 – Mean grip strength score (15 to 25)
- 22.2 Activity score (range 15 to 25)
- 96 – Mean MMWS score (range 90 to 100)

These findings were more or less in agreement with previous studies.[5-7]

One can operate all scaphoids with a Herbert screw only, which will give better results. The only problem is that if it uses open reduction, then complications of ORIF may occur. Immobilization of the wrist using a plaster cast is a very safe treatment for non-displaced scaphoid fractures.[8] Between 90% and 95% of fractures will heal following treatment with a cast only. However, patients must be able to accept the long length of immobilisation that requires prolonged rehabilitation because prolonged immobilisation can also cause muscle wasting. However, surgery does not require prolonged casting; it will still require protection of the wound site with bandages for 4 to 6 weeks.[9] However, during this time, the patient is encouraged to mobilize the wrist to prevent stiffness. Open reduction and internal fixation (ORIF) of an acute fracture of the scaphoid using a compression lag screw was recommended and allowed early mobilization of the wrist.[10] The benefit of percutaneous Herbert screw fixation lies in the fact that it does not injure the blood supply to the scaphoid and stabilizes the ligament of the wrist, which was confirmed radiologically.[11] Hence, range of motion is greater per cutaneous fixation, and patients feel less pain with increased range of motion and grip strength as compared to ORIF patients.

Although both ORIF and percutaneous fixation reliably diminish the incidence of non-union and malunion with residual carpal instability that occurs with cast immobilization in scaphoid fractures, percutaneous fixation leads to early union and an early return to functional activity with fewer complications as compared to ORIF.

CONCLUSION

In the comparative study of ORIF and percutaneous fixation of scaphoid fractures, both ORIF and percutaneous fixation reliably diminish the incidence of non-union and malunion with residual carpal instability that occurs with cast immobilisation in scaphoid fractures. But percutaneous fixation leads to early union, and patients can early return to their activities with fewer complications as compared to ORIF. But this study demands further biomechanical, patho-physiological, nutritional, and genetic study because the factors or mechanisms acting on the union of fractured bones are still unclear.

Limitation of study: Due to the remote location of the research centre, the small number of patients, and the lack of the latest technologies, we have limited results.

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