

Comparison of ORIF and Percutaneous Fixation of Scaphoid Fractures in Maharashtra Population**Vinod Chandrashekar Nair¹, Omkar Rohidas Shinde², Swaroop Solunke³, Satyam Jawa⁴**¹Associate Professor, Department of Orthopaedics, Dr. DY Patil Medical College and Research Centre Santtukaram Nagar Pimpri – 411018, Maharashtra²Resident, Department of Orthopaedics, Dr. DY Patil Medical College and Research Centre Sant Tukaram Nagar Pimpri – 411018, Maharashtra³Associate Professor, Department of Orthopaedics, Dr. DY Patil Medical College and Research Centre Sant Tukaram Nagar Pimpri – 411018, Maharashtra⁴Resident, Department of Orthopaedics, Dr. DY Patil Medical College and Research Centre Sant Tukaram Nagar Pimpri – 411018, Maharashtra

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Abstract:**Background:** Fractures of the distal radius, including scaphoid bone, are the most common among orthopaedic injuries and impose a significant financial burden on patients; hence, early union of fractures is a clinical challenge for orthopaedic surgeons.**Method:** 30 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 fractures 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.**Results:** Out of 30 scaphoid fractures, 20 belonged to the right wrist and 10 to the left wrist. As per Heart Bean: 13 B2, 14=A2, 3-C. Per cutaneous fixation, 15 (26.6%) had excellent results. In Orif – 8 (26.6%) patients had excellent results, 5 (16.6%) had good results, and 2 (6.6%) had fair results. Various motions or movements, like wrist flexion, wrist extension, Mean range motion, mean grip strength score, activity score, and mean MMWS score Per cutaneous has increased score and motions as compared to ORIF.**Conclusion:** In the present pragmatic study, it is concluded that, percutaneous fixation technique in scaphoid fractures is an ideal method to treat, because fractures unite early and return to normal functional activity with less complications than ORIF.**Keywords:** Percutaneous, ORIF, Hear beart and Fisher, Gonometre, Maharashtra.This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.**Introduction**

The fracture of the distal radius has comprised approximately one-sixth of all fractures for several decades, but the definite treatment of these fractures remains a subject of debate. The indication of surgical management is obvious, but selecting the right method for fixation of distal radius fractures has been an issue of controversy [1].

It can occur at any age in both sexes. It is more common in females than males [2]. The mechanism of injury results from low-energy trauma more frequently than high energy injuries. Displaced intra articular fractures are usually caused by the shearing and impaction forces that occur in high-

energy injuries and are usually seen in young and active elderly patients [3].

The scaphoid is a carpal bone that forms the floor of anatomical snuff boxes. In the olden days, these fractures were treated non-operatively with a prolonged period of immobilisation [4]. Non-union rates of scaphoid fractures greater than 1 mm displacement were reported as high as 53 to 92. Non-union risk was 17 times higher in non-surgical (operative) treatment than operative fixation. Hence, many surgeons recommended open reduction and internal fixation (ORIF) for displaced unstable scaphoid fractures. Percutaneous placement of a headless compression screw is an alternate approach to open treatment of scaphoid

fractures and has been shown to be highly effective. Hence, an attempt is made to evaluate and compare techniques, their time for union, and various scores of movements.

Material and Method

30 patients with fractures of the scaphoid bone visited the orthopaedic department of Dr. DY Patil Medical College, and the research centre in Sant Tukaram Nagar, Pimpri, Maharashtra- 411018 was studied.

Inclusive Criteria

The age group between 18 to 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 after injury).

Exclusion Criteria

Patients having tuberosity fractures, 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-anteriorly, lateral view, semipronation oblique and antero posterior view with wrist. The scaphoid fractures were treated with Herbert screw for scaphoid fractures. The injuries were graded according to Herbert and 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 – fracture 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 immobiliser 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 goniometry..

Table 2: Modified Mayo wrist score (MMWS)

No	Category	Points
A	Pain (25 points)	25 20 10 0
	None -----	
	Mild Occasional -----	
	Moderate (with normal use, not at rest) -----	
B	Severe, constant -----	25 20
	Range of motion (25 points) Flexion, Extension degrees >140	
	100 – 140 70 – 99	

	40 – 69 < 40	15 10 0
C	Grip strength (25 points) - Normal - ----- - Diminished but > 50% of normal ----- - less than 50% of normal -----	25 15 0
D	Activity (25 points) Same activities ----- Restricted activities caused by injured wrist ----- Change of work or sports caused by injured wrist---	25 15 0

All 30 (thirty) 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, 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.

Mean grip strength score was 24.8 (range 15 to 25) with percutaneous, 23.8 (range 15 to 25) with ORIF. Activity score was 22.2 (range 15 to 25) with percutaneous, 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, 15 (50) patients had excellent results with percutaneous fixation, while with ORIF, 8 (26.6) patients had excellent results, 5 (16.6) had good results, and 2 (6.6) patients had fair results. There were no post-surgical complications like malunion, and I did not show signs of post-traumatic osteoarthritis of the scaphoid or wrist at the final follow-up.

The duration of the study was May 2020 to June 2023.

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.

Observation and Results

Out of 30 scaphoid fractures 20 fractures belonged to right hand and 10 belonged to left wrist. Herbert type 13=B2 (displaced or Mobile fracture) 14=A2 (Non-displaced in complete fracture) 3=C (delayed union > 6 weeks).

With ORIF 15 (30%) patients had excellent result with per cutaneous fixation.

8 (16.6%) had excellent results,
5 (16.67%) had good results
2 (6.6%) had fair result

In both technique no any 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 had 635 wrist fixa- tions (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)

Discussion

In the present comparative study of ORIF versus percutaneous fixation of scaphoid fractures in the Maharashtra population, Out of 30 scaphoid fractures, 20 belonged to the right and 10 belonged to the left wrists. The classification of Herbert type 13-B2 (displaced or mobile fractures) 14-A2 (non-displaced incomplete fractures) 3-C (delayed union of fractures > 6 weeks)

Per cutaneous fixation, 15 (30%) had excellent results. In ORIF fixation, 8 (26.6%) had excellent results, 5 (16.6%) had good results, and 2 (6.6%) had fair results. Both techniques had no post-surgical complications.

- In Orif, wrist flexion averaged 585 (range 30 to 700), 20.5 wrist score, 565 wrist extension, 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 per cutaneous 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 [5,6,7]

One can operate all scaphoids with Herbert screw only, which will give better results. The only problem is that if it uses open reduction, then complications of ORIF may occur. Immobilisation of the wrist using a plaster cast is a very safe treatment for non-displaced scaphoid fractures [8]. Between 90-95% 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 mobilise 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 mobilisation 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 stabilises 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 mal-union with residual carpal instability that occur with cast immobilisation in scaphoid fractures, But percutaneous fixation leads to early union and an early return to functional activity with fewer complications as compared to ORIF.

Summary and 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, mal-union with residual carpal instability that occur 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 bio-mechanical, pathophysiological, 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 tertiary location of the present institution, the small number of patients, and the lack of the latest technologies, we have limited results.

- This study was approved by the Ethical Committee of Dr. DY Patil Medical College and Research Centre Sant Tukaram Nagar Pimpri, Maharashtra – 411018,
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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

B2 = 13, A2=14, C=3

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