International Journal of Orthopaedics Research
www.orthopaedicsjournal.in
E-ISSN: 2663-0923, P-ISSN: 2663-0915
Received: 06-10-2020; Accepted: 21-10-2020; Published: 09-11-2020
Volume 2; Issue 4; 2020; Page No. 12-16

Comparison of ORIF and percutaneous fixation of scaphoid fractures in Telangana population: Retrospective study

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Abstract
Background: Scaphoid is the most frequently fractured carpal bone - accounting for 60% of all carpal fractures. Stable, un-displaced fractures can be treated non operatively, whereas unstable, displaced fractures or proximal pole fractures require operative procedures for early and proper healing.
Method: 35 scaphoid fractures were treated and studied. The fractures were evaluated with different radiographic views which are routinely used in diagnosing scaphoid fractures. Fractures which are appropriate for operative treatment were treated with Herbert screws. The injuries were graded as per Herbert and fisher classification. All the factures were first tried for percutaneous fixation using volar approach. If adequate reduction was not achieved or fracture is thought appropriate for open reduction were subjected to ORIF and bone grafting through volar or dorsal approach depending on the location of the fracture and both these groups were followed for a minimum period of 12 months.
Results: Out of 35 scaphoid fractures, 20 were on right side and 15 were on left side. As per Heartben – 15-B2, 16-A2, 4-C. In percutaneous fixation 14 (32%) had excellent results. In ORIF – 10 (28%) had excellent results, 9 (25.7%) had good results and 2 (5.7%) had fair results. Results were evaluated with various motion or movements score like wrist flexion and extension, mean range motion, mean grip strength score, activity score, mean MMWS score. The percutaneous technique group has increased score and motions as compared to ORIF group.
Conclusion: Percutaneous fixation in scaphoid fractures is an ideal method to treat these difficult fractures. It has proved that percutaneous group needed less duration of time for union and early return to functional activity. Lesser complications were noted in this group as compared to the ORIF group.

Keywords: Orif, percutaneous technique, goniometer, herbert and fisher, modified mayo score, Telangana

Introduction
Scaphoid is the carpal bone that forms the floor of the anatomical snuff box. The name scaphoid is derived from Greek word 'skapos' means boat [1]. Scaphoid fractures account for 60% of the all carpal fractures [2]. In Olden days most of these fractures were treated non-operatively with prolonged periods of immobilisation; Non-union rates for scaphoid fracture with greater than 1 mm displacement have been reported to be as high as 53 to 92% [3]. The non-union risk was 17 times higher with non-operative treatment compared to operative fixation. Hence many authors recommend open reduction and internal fixation (ORIF) for displaced, unstable scaphoid fractures [4]. Percutaneous placement of headless compression of screw is an alternative technique to open treatment of scaphoid fractures and has been shown to be highly effective. Hence attempt was made to evaluate both of these techniques and the time taken for union by these two different techniques and to evaluate the outcomes with various scores for movements.

Materials and Methods
35 patients with fracture of scaphoid bone, who visited to orthopaedic department of Surabhi Institute of Medical Sciences, Siddipet, Telangana-502375, India between January, 2016 to December, 2018 were studied.

Inclusive Criteria
Patients aged between 18 to 50 years with acute scaphoid fracture, patients with delayed union or fractures which showed no healing even after 12 weeks of non-operative treatment and fractures which presented late (4 weeks to 3 months after injury) were included in the study.

Exclusion Criteria
Patients having tuberosity fracture, trans-scaphoid peri lunate dislocation. DISI (Dorsal intercalated segmental instability) deformity, Osteonecrosis of scaphoid, patients having previous history of wrist injury and pathological fractures were excluded from the study.

Method
Patients with suspected scaphoid fractures were evaluated with

various radiographic views- posteroanterior, lateral view, semi pronation oblique view, clenched fist PA view and scaphoid view of the wrist. The scaphoid fractures were treated with Herbert screws in both the groups. 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 unstable	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 – Communited fracture
(C)	Delayed	6 weeks
(D)	Established	D1: Fibrous D2: Sclerotic

All the fractures were first tried for percutaneous fixation using volar or dorsal approach depending on the location of the fracture. If adequate reduction was not achieved, we opted for ORIF except in fractures older than 150 days at the time of admission which were treated directly with ORIF and bone grafting through appropriate approach. For percutaneous fixation volar approach was commonly used, whereas dorsal approach was preferred in proximal pole fractures.

For all the patients scaphoid cast was applied post operatively. Sutures were removed around 10th day and cast were continued for another 4 weeks. At the 6th week cast was removed and replaced with removable wrist brace for another four weeks along with physiotherapy. Hand grip and other strengthening exercises of wrist were started. All the patients were evaluated at two weeks interval until fracture united. During follow up every patient was subjected to clinical and radiological examination with scaphoid profile. Union was considered effective when there was no tenderness at the anatomical snuff box or at scaphoid tubercle and if there was any evidence of trabeculae crossing fracture in at least two views. On the final follow up clinical assessment was performed as per the Modified Mayo Wrist Score (MMWS). The minimum follow-up was 12 (twelve) months.

Grip strength was measured asking the patient to squeeze the examiners index finger and strength was compared with contra-lateral side. Grip strength was graded according to MRC grading. Range of motion was measured by goniometer. Duration of study was from January, 2016 to December, 2018.

Table 2: Modified Mayo wrist score (MMWS)

No	Category	Points
A	Pain (25 points) None ---------- Mild Occasional ---------- Moderate (with normal use, not at rest) ---------- Severe, constant ----------	 25 20 10 0
B	Range of motion (25 points) Flexion, Extension degrees > 140 100 – 140 70 – 99 40 – 69 < 40	 25 20 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---	 2 5 15 0

All 35 (thirty-five) scaphoid fractures treated by both methods united successfully. Radiological union was confirmed post operatively in all the patients treated with percutaneous fixation at 9.5 weeks (range 7-12 weeks) and ORIF 12.2 weeks (range 8-16 weeks) respectively. In patients with delayed union with cast treatment, fracture union was seen at 12.9 weeks (range 11-14 weeks) post operatively.

In case with percutaneous fixation: wrist flexion averaged 63.5 (range 40 to 75) and wrist extension averaged 62.5 (range 40 to 70). In ORIF group wrist flexion, averaged 58.5 (range 30 to 70) and wrist extension 56.5 (range 30 to 65).

According to 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. 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 83.9 (range 70 to 95) for ORIF.

Accordingly, 14 (32) patients had excellent results with

percutaneous fixation while with ORIF 10 (28.5) patients had excellent results, 9 (25.7) had good results and 2 (5.71) patients had fair results.
There were no post-surgical complications like mal union or any signs of post-traumatic osteoarthritis of wrist or carpals at final follow up.

Statistical analysis
The various parameters and findings were classified with percentage. The statistical analysis was carried out in SPSS software. The ratio between male and females was 2:1.

Observation and results
Out of 35 scaphoid fractures 20 fractures belonged to right side and 15 belonged to left side. Herbert type 15-B2 (displaced or Mobile fracture) 16-A2 (Non-displaced in complete fracture) 4-C (delayed union > 6 weeks).
With ORIF 14 (32%) patients had excellent result with percutaneous fixation.
10 (28.5%) had excellent results,
9 (25.7%0 had good results
2 (5.7%) had fair result
In both the techniques there were no significant post-surgical complications observed.
(A) In ORIF – wrist flexion averaged 58.5 (range 30 to 70 score)
20.5 – wrist score (As per MMWS)
23.2 – Mean range of 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 63.5 wrist fixations (range 40 to 70)
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 Telangana Population, out of 35 scaphoid fractures 20 fractures belonged to right and 15 belonged to left wrists. The classification of Herbert type 15-B2 (displaced or Mobile fractures) 16-A2 (Non-displaced incomplete fractures) 4-C (delayed union of fractures > 6 weeks) was used.
In percutaneous fixation 14 (32%) had excellent results. In ORIF fixation – 10 (28%) had excellent results, 9 (23.7%) had good results, 2 (5.7%) had fair results. In both techniques had no significant post-surgical complications were noted.

In ORIF – Wrist flexion averaged was 58.5 (range 30 to 70), 20.5 wrist score
56.5 wrist extension 63.6 (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)

In percutaneous fixation
63.5 – Wrist flexion (30 to 75)
62.5 – Wrist extension (30 to 65)
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 scaphoid fractures with Herbert screws only. Most of the times it will gives good results with percutaneous techniques. But sometimes, especially when it is used as a part of open reduction and internal fixation then complications may occur.
Immobilisation of the wrist using plaster cast is very safe treatment for non-displaced scaphoid fractures [8]. Between 90-95% of fractures will heal following the treatment with cast only. However, patients must be able to accept the prolonged period of immobilisation and rehabilitation needed because of muscle wasting with non-operative measures. However, surgery does not require prolonged casting, but it will still require protection of wound site with bandages for 4 to 6 weeks [9]. However, during this time patient is encouraged to mobilise the wrist to prevent stiffness.
Open reduction and internal fixation (ORIF) of acute fractures of the scaphoid using compression lag screw was recommended for allowing early mobilisation of wrist [10]. The benefit of per cutaneous Herbert screw fixation lies in the fact that, it does not injure the blood supply to scaphoid or the stabilizing ligaments of the wrist [11]. Hence in percutaneous group of patients range of motion is more, have less pain with increased range of motion and grip strength as compared to ORIF group of 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 early return to functional activity with lesser complication rates as compared to group of patients treated with ORIF.

Summary and Conclusion
In the comparative study of ORIF and percutaneous fixation of scaphoid fractures although 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, percutaneous fixation leads to early union and early return to activities with lesser complications as compared to ORIF. But this study demands further bio-mechanical, patho-physiological, nutritional, genetic studies because the factors or mechanisms which act on union of fractured bone are still unclear.
This study was approved by Ethical Committee of Surabhi Institute of Medical Sciences, Siddipet, Telangana-502375, India

Conflict of Interest

Funding

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	Volar	8	100	
3	L	C	151	Percut	15	80	
4	R	C	45	Volar	12	70	
5	L	A2	21	ORIF	9	95	
6	R	B2	4	Volar	9	90	
7	L	A2	14	ORIF	8	95	
8	R	A2	4	Volar	8	85	
9	R	B2	2	Percut	8	95	
10	R	B2	8	Volar	11	95	
11	L	A2	10	ORIF	12	80	
12	R	B2	8	Volar	16	95	
13	L	A2	5	ORIF	14	100	
14	R	A2	2	Volar	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	Volar	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	
31	R	B2	7	Percut	11	90	
32	L	A2	6	Percut	12	90	
33	R	B2	4	Percut	9	95	
34	R	A2	7	ORIF	16	90	
35	R	B2	5	Percut	11	95	

B2 = 15, A2=16, C=4

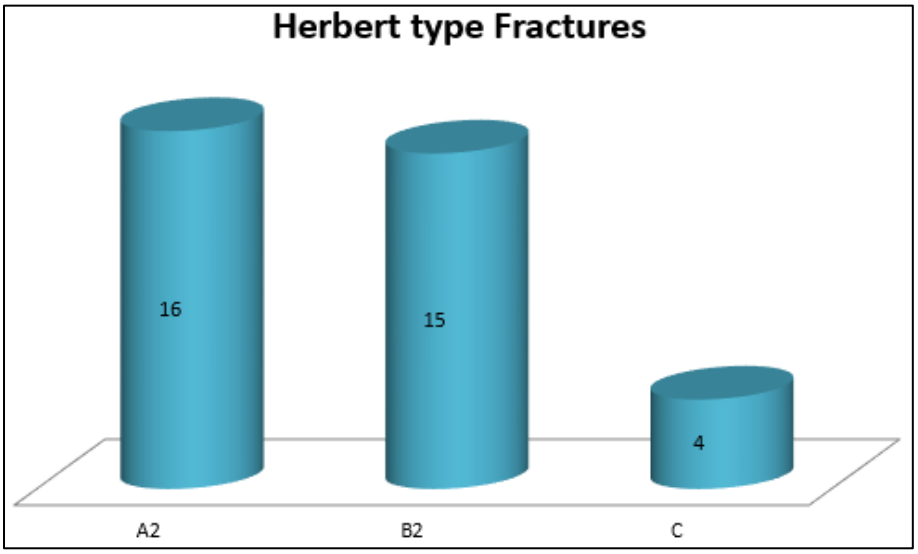

Fig 1

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