

Comparative Study of Treatment of Distal end Radius Fracture by Non-Operative Method Versus Operative Method with Joshi's External Stabilisation System

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Abstract

Background: Distal end radius fractures are the most common fracture. There are various treatment modalities, which include closed reduction and casting, closed reduction and percutaneous pinning, open reduction, and internal fixation with a variety of implants. A minimally invasive technique like JESS could be ideal technique.

Method: 30 patients with distal end radial fractures were selected. Out of 30 patients, 15 were treated with closed reduction and casting, and the remaining 15 were treated with the JESS technique approach. Patients of both techniques were studied haematologically and radiologically before undergoing these comparative technological studies, and the pros and cons of both techniques were noted. to justify the ideal method for a lower distal end fracture of the radius.

Results: The fewest post-surgical complications were observed with JESS techniques as compared to the conservative group. Excellent outcomes were observed in the JESS technique treatment, with significant statistical values in terms of good anatomical reduction and stabilisation; early mobilisation with regaining full ROM was justified.

Conclusion: From the present study, it is concluded that closed reduction with JESS fixation under the C arm is a simple, minimally invasive, and cost-effective technique that provides better stability in the treatment of distal end radius fractures with not only a good clinical and radiological outcome but also minimal complications as compared to conservative treatment.

Keywords: JESS technique, conservative method, Gartland & Werley Score, Distal end of radius fracture, north Karnataka

Introduction

The fracture of the distal end of the radius is one of the most common fractures and accounts for approximately 1/6th of all fractures treated in emergency departments

⁽¹⁾. It occurs commonly in elderly women after falls and in young men after high velocities. If untreated, or failure in proper management, may cause permanent deformity and disability.

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There are a lot of treatment modalities, which include closed reduction and casting, closed reduction and percutaneous pinning, external fixation, open reduction, and internal fixation with a variety of implants. Any treatment modality should be primarily aimed at restoring radial articular contiguity, alignment, length, motion, and stability. This mostly implies that operative innervations become essential for the management of unstable DRFs to achieve successful outcomes⁽²⁾. Good restoration and maintenance of anatomy with accurate and stable reduction and early wrist mobilisation are necessary to get good results. JESS has been used for fracture stabilisation in the Indian subcontinent for the last 30 years⁽³⁾. It is minimally invasive surgery that uses fewer instruments and takes less time, and it is effective⁽⁴⁾. It also leaves joints free for early mobilisation. Hence, an attempt is made to compare the functional outcome of the non-operative cast method and the operative JESS under image intensifier guidance.

Material and Method

30 (thirty) adult patients with distal end radius fractures who regularly visited the Orthopaedics Department of Khaja Banda Nawaz University Faculty of Medical Sciences, Gulbarga-585102, Karnataka, were studied.

Inclusive Criteria: Unilateral or bilateral fracture, aged between 20-70 years, closed fractures. Fractures were up to 2.5 cm from the distal articular surface of the radius. Fractures with a history of trauma lasting less than 2 weeks (<2 weeks) the patients who gave their consent in writing were selected for study.

Exclusion Criteria: Patients below 20 years and above 70 years Open fractures, fractures beyond 2.5 cm from the distal surface of the radius, Fractures with trauma lasting more than 2 weeks.

Methods: A detailed history of every patient was recorded. 15 patients treated by cast, and the other 15 patients treated by closed reduction with JESS. Apart from x-ray, haematological evaluation was done (CBC, RBS, blood grouping, Rh typing, BT, CT, PT INR, RFT, LFT, serum electrolytes, HIV, HBSAG, urine routine), and, additionally, an ECG, chest x-ray (AP view), and 2D echo were recorded to rule out the

cardio-vascular status of the patients.

Pre-operation evaluation:

1. Immediate management inspected the mode of injury, the severity of trauma, swelling, ecchymosis, tenderness, and bony irregularity, and the relative position of the radial and ulnar styloid processes was elicited. Radial artery pulsation, capillary filling, pallor, and parenthesis The movements of the arm and forearm were checked. The involved forearm was immobilised below the elbow with a cast and a CC sling. Pain and inflammation were managed using analgesics.
2. Closed reduction with cast application for a colles fracture under short-term general anaesthesia was performed supine on the table; the shoulder was abducted, and then anaesthesia was applied to the thumb with concentration above the elbow by an assistant. The fracture was dissected by a direct and firm pull, traction alone reduced lateral displacement and rotation; and it was manipulated to correct residual deformity. While manipulating the right colles fracture, the right hand was placed on the patient's right thenar eminence over the dorsal and lateral aspects of the radial styloid and the left thenar eminence of the ulnar and palmar aspects of the limb, just proximal to the fracture line. Pressure was applied to the lower end of the radial bone with the right hand, not to the carpal bones with hands in the position. By pushing the lower radial fragment into pronation, it is also possible to correct the supination deformity.

Immobilisation: After reduction, the traction on the thumb was maintained, and a plaster cast 10 cm wide was applied over a thin layer of orthopaedic wool. Special care was taken to pad the styloid processes of the ulna and radius. The cast extends from the metacarpal head to just below the elbow. The cast maintained the ulnar deviation of the hand by having a tongue of plaster shape the top radial side of the index metacarpal. While the plaster was setting, the wrist was moulded in the same way as when reducing the fracture by holding the wrist in a few degrees of flexion at the wrist and a few degrees of ulnar deviation.

Smith fracture (reverse colles fracture) is a fracture dislocation of the wrist in which the distal fragment is displaced anteriorly. Displacement was reduced by applying traction and counter-traction by assistants and manipulating the surgeon with his palms, and then the cast was applied from the metacarpal head to below the elbow, covering the whole circumference with the wrist in a few degrees of dorsiflexion.

Valar Barton's fracture was reduced by applying traction and counter traction by the assistant and manipulating it by the surgeon, and then a cast was applied from the metacarpal head to below the elbow with the wrist in a few degrees of dorsiflexion.

Dorsal Barton's fracture was reduced by traction applied to the thumb with counter traction above the elbow by assistants and manipulated by the surgeon, and then a cast was applied from the metacarpal head to just below the elbow with the wrist in a few degrees of flexion and a few degrees of ulnar deviation. Reduction was checked by x-ray.

Postoperative rehabilitation for the cast group:

The patient was advised to begin active finger movements the next day as frequently as possible, not to wet the cast, and to watch for alarming symptoms of compartment syndrome. The plaster cast was removed at 6 weeks, followed by active and strengthening exercises of the fingers, wrist, forearm, and elbow, and physiotherapy advice.

Surgical Technique: Closed Reduction with JESS: was performed as per the guidelines of Mumbai JESS Research and Development 2016⁽³⁾ K-wire connecting rods Drill clamps Allen keys were the instruments used in JESS.

The duration of the study was March 2021 to August 2022.

Statistical analysis: Comparison of the distribution of cases following surgery and comparison of radial length post-operatively, Gartland - Werley Scores, wise distribution cases, and quality of outcome were compared with a t test and classified with a percentage. The statistical analysis was carried out in SPSS software. The ratio of males and females was 1:2.



Figure-1: JESS Instruments

Observation and Results

Table-1: Side wise distribution of cases

- Left - 7 (46.7%) in cast (group-A) group, 7 (46.7%) in JESS group.
- Right - 8 (53.3%) in cast (group-A) and 8 (53.3%) in group JESS.
- Total 15 (100%) in each group, 30 cases were studied.

Table-2: Comparison of length of Radius in both groups

- Post-operatively - 10.53 (\pm 1.18) in group-A, 11.8 (\pm 1.01) in group-JESS, t test was 3.14 and $p < 0.001$
- At 6th Week - 9.20 (\pm 0.86) in group-A, 11.46 (\pm 0.99) in group-JESS, t test was 6.68 and $p < 0.001$
- At 24th Week - 9.13 (\pm 0.91) in group-A, 11.20 (\pm 0.94) in group-JESS, t test was 6.09 and $p < 0.001$

Table-3: Gartland and Werley Scores wise distribution

- score < 5 - 2 (13.3%) in group-A (cast group), 9 (6.0%) in JESS group
- score 5-10 - 6 (40%) in cast group, 4 (26.6%) in JESS group, 1 (6.71) in JESS group

- score 5-10 - 6 (40%) in cast group, 4 (26.6%) in JESS group
- score 11-20 - 5 (33.4%) in cast group, 1 (6.7%) in JESS group
- score > 20 - 2 (13.3%) in cast group, 1 (6.7%) in JESS group, χ^2 test value 7.03, and $p < 0.01$ (p highly significant)

Table-4: Post-surgical complication

- 2 (13.3%) observed in cast group, 1 (6.7%) pin tract infection in JESS group
- 2 (13.3%) residual pain in cast group, 3 (20%) mal-union in cast group

Table-5: Comparison outcome in both groups

- Excellent - 2 (13.3%) in cast group, 9 (60%) in JESS group
- Good result - 6 (40%) in cast group, 4 (26.6%) in JESS group
- Fair - 5 (33.9%) in cast group, 1 (6.7%) in JESS group
- Poor - 2 (13.3%) in cast group, 1 (6.7%) in JESS group, χ^2 value 7.08 and $p < 0.001$

Table 1: Side wise distribution of cases

Side	Group-A (Cast)		Group-B (JESS)	
	No	%	No	%
Left	7	46.7	7	46.7
Right	8	53.3	8	53.3
Total	15	100.0	15	100.0

Table 2: Comparison of Radial Length between the groups

Radial Length	Group-A (Cast)	Group-B (JESS)	Un paired t-test & p-value
	Mean \pm SD	Mean \pm SD	
Post op	10.53 (\pm 1.18)	11.8 (\pm 1.01)	t=3.142, p=0.004 HS
6 th Week	9.20 (\pm 0.86)	11.46 (\pm 0.99)	t=6.686, p=0.000 HS
24 th Week	9.33 (\pm 0.91)	11.20 (\pm 0.94)	t=6.096, p=0.000 HS

Table 3: Gartland and Werley Scores wise distribution of cases

Gartland and Werley Scores	Group-A (Cast)		Group-B (JESS)		Total	
	No	%	No	%	No	%
< 5	2	13.3	9	60.0	11	36.7
5-10	6	40.0	4	26.6	10	33.3
11-20	5	33.4	1	6.7	6	20.0
> 20	2	13.3	1	6.7	3	10.0
Total	15	100.0	15	100.0	30	100.0
X ² -test value and p-value	X ² = 7.033 p=0.017					

Table 4: Post-Surgical complication

Complications	JESS Group	Conservation Group
Stiffness of wrist	-	2
Stiffness of Fingers	-	1
Pin tract Infection	1	-
Residual Pain	-	2
Reduced grip strength	-	0
Mal-union	-	3
Sudek's Osteodystrophy	-	-
Subluxation of inferior radio ulnar joint	-	-
Carpal tunnel syndrome	-	-
Rupture of EPL	-	-
Radio-carpal arthrosis	-	-

Table 5: Comparison of study outcome wise distribution of cases

Outcome	Group-A (Cast)		Group-B (JESS)		Total	
	No	%	No	%	No	%
Excellent	2	13.3	9	60.0	11	36.7
Good	6	40.0	4	26.6	10	33.3
Fair	5	33.4	1	6.7	6	20.0
Poor	2	13.3	1	6.7	3	10.0
Total	15	100.0	15	100.0	30	100.0
X ² -test value and p-value	X ² = 7.033 p=0.017					

Discussion

Present a comparative study of the treatment of the distal end of the radius fracture by the non-operative method versus the operative method with Joshi's external stabilisation system in the north Karnataka population. The left side fractures were 7 (46.7%) in the cast group, and the same number of 7 (46.7%) was for the JESS group. The right side had 8 (53.3%) for the cast group and the same number for the JESS group (Table-1). The length of the radius was compared in both groups: post-operatively, 10.53 (± 1.8) in the cast group and 11.8 (± 1.01) in the JESS group, t test was

3.14 and $p < 0.001$. At 6th week, with a 9.20 (± 0.86) mean value in the cast group, 11.46 (± 0.99) in the JESS group, the t test was 6.68 and $p < 0.001$. The t test was 6.09 and $p < 0.001$ at the 24th week, 9.13 (0.91 in the cast group) and 11.20 (0.94 in the cast group) (Table 2). As per the Gartland and Werley Scores, <5 was 2 (13.3%) in the cast group, 9 (60%) in the JESS group, Score 5-10 - 6 (40%) in the cast group, and 4 (26.6%) in the JESS group. In the score study - 10-20 - 5 (33.4%) in the cast group, 1 (6.7%) in the JESS group. >20 score - 2 (13.3%) in the cast group, 1 (6.7%) in the JESS group (Table-3). Post-surgical complications were 2

(13.3%) stiffness in the conservative or cast group, 1 (6.66%) stiffness of fingers in the conservative (cast) group, 1 (6.66%) pin tract infection in the JESS group, 2 (13.3%) residual pain in the conservative (or cast) group, and 3 (20%) malunion observed, in the cast or conservation group (Table-4). In the comparison of study outcomes, 2 (13.3%) in the cast group, 9 (60%) were excellent, 6 (40%) in the cast group, and 4 (26.6%) in the JESS group, were good 5 (33.4%) in the cast group and 1 (6.7%) in the JESS group were fair. Poor were 2 (13.3%) in the cast group and 1 (6.7%) in the JESS group, with an x2 value of 7.03 and p 0.001 (Table 5) (Figure-1). These findings are more or less in agreement with previous studies ⁽⁵⁾⁽⁶⁾⁽⁷⁾.

In the present study, we found a better functional outcome in distal end radius fracture patients treated by closed reduction and fixation with the JESS fixator, which maintains the reduction and allows early functional range of motion of the fingers and wrist as compared to conservative treatment⁽⁸⁾.

On the radiological follow up it was confirmed that closed reduction and fixation with the JESS fixator maintain anatomical parameters more effectively than plaster of Paris (POP) casts and retain them till the union better than POP casts. So it is proven that the JSS fixator is more effective in holding the reduced position as compared to patients treated with closed reduction with cast application while at the same time leaving the wrist joint for mobilisation ⁽⁹⁾⁽¹⁰⁾.

As compared to other fixators, the JESS fixator is low-cost, light-weighted, requires fewer instruments, and can be operated by any new orthopaedic surgeon. It is readily available, less traumatic to soft tissues, and has the advantage of early post-operative wrist mobilisation. The early mobilisation of the wrist leads to normalisation of functional recovery, earlier resolution of wrist swelling, and decreased joint stiffness ⁽¹¹⁾.

Closed reduction and fixation with JESS allows good anatomical reduction with good fixation of fracture and at the same time it leaves wrist joint free from mobilization with ideal fracture union with functional mobility than closed pop group patients.

Summary and Conclusion

From the present comparative study, it is concluded that JSS fixation under C-arm is a simple, minimally invasive, and cost-effective technique that provides better stability in the treatment of distal end radius fractures with minimal post-operative

complications. The present study demands that such clinical trials be carried out with a large number of patients where the latest techniques are available to confirm the significance of the comparative study.

Limitations of the study: Owing to the tertiary location of the research centre, the small number of patients, and the lack of the latest technologies, we have limited findings and results.

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