

# Evaluation of Fractures of Distal Radius Treated with Joshi's External Stabilization System and Plaster Cast Application

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## ABSTRACT

**Introduction:** Pattern of distal radius fractures varies from very simple extra articular to complex intra articular fracture and it has been treated by different methods varying from closed reduction with plaster to open reduction with internal fixation leading to variable prognosis. This study was done to assess functional and radiological outcome of JESS application and plaster cast in treatment of distal radius fracture.

**Materials and methods:** 56 patients of distal radius of AO type A, B and C were included in this study. Out of which 19 patients were treated with closed reduction by ligamentotaxis with JESS application and others with closed reduction and above elbow pop cast applied under image intensifier. Follow up was done at 3,6,12 and 20 weeks and functional scoring was done using modified Gartland and Werley Score. Data was statistically analyzed using SPSS version 17.

**Results:** Functional scoring in fixator group was 93.42±6.62 and in plaster group was 88.64±6.78 (p=.01). At 12 weeks radial length 12.05±4.30mm in fixator group as compare to plaster group was 9.11±3.52 mm was statistically significant (p=.004). Ulnar variance in fixator group was -0.37±1.81 as compare to plaster group having 0.56±1.81 (p=.04) found significant deference. Superficial pin tract infection (4 cases) and loosening of pin (2 cases) found in 2 patients. Stiffness of fingers was common complication in plaster group.

**Conclusion:** To maintain radial length and ulnar variance JESS is a cost effective technique in treatment of distal radial fracture as compare to plaster cast.

**Keyword:** Distal radius fracture, JESS application, Radial length.

distal radial fractures treated by POP cast and closed reduction and external fixation by JESS.

## MATERIAL AND METHODS

This study was carried in department of Orthopaedics, King George's Medical University, Lucknow from June 2012 to May 2014. We enrolled 56 closed distal radius fracture AO type A, B and C in age group of more than 18 years. Patient were excluded if they had open fracture, poly trauma patients, infection and prior surgery. Importance and relevance of study was explained to all patients. Those who were willing to participate were included in study. Study was approved by ethical committee. Out of 56, 19 patients had given consent for surgery and treated with closed reduction by ligamentotaxis and application of JESS under brachial plexus block/general anaesthesia by putting two Schanz pins in radius and base of 1<sup>st</sup> metacarpal and connected with rod. Rest of all (37patients) were treated with closed reduction by ligamentotaxis and above elbow POP cast under fracture hematoma block under image intensifier.

Post operative and post reduction X- ray of wrist- Antero-posterior, Lateral views were done to assess the fracture reduction. Post operative i.v. antibiotics given for 3 days and oral antibiotics for 5 days. Further follow up done at 3, 6, 12 and 20 weeks. Post operatively limb kept elevated and active and passive finger movement allowed. Fixator and POP cast was kept for 6-8 weeks according to callus formation. Assessment was done objectively, radiologically and for any complication. Objective assessment included clinical and physical examination of affected limb along with range of movement. Radiologically we assessed Radial length, Radial

## INTRODUCTION

Distal radius fracture is a common fracture in upper extremity<sup>1,2</sup> and treatment modalities for this fracture have evolved over a long period of time from pop cast, k wire fixation, external fixation and open reduction internal fixation by plates. Most of the fractures have been treated with close reduction and POP cast. Although it is a simple mode of treatment but leads to loss of reduction and residual deformity.<sup>3</sup> External fixation of these fractures is required to maintain the reduction.<sup>4,5</sup> JESS is a kind of external fixator and has been used for other fractures and it is easy to apply, cost effective, less cumbersome.<sup>6,7</sup> Basic principle used in external fixator is ligamentotaxis.<sup>8,9</sup> This study was done to evaluate the results of

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angle, Volar tilt and Ulnar variance in both groups. The functional outcome score measured on the criteria of modified Gartland and Werley Score<sup>10</sup> at last follow up and compared with that of unaffected side. Data were analysed using statistically using SPSS version 17.

## RESULTS

Most of the patients in both Fixator (52.6%) and Conservative (37.8%) groups were below 40 years. The mean age of the patients of Fixator group was 33.05 ( $\pm 8.47$ ) years and 36.65 ( $\pm 13.01$ ) years in Conservative group. Majority of the patients in both Fixator (78.9%) and Conservative groups were males (75.7%) and the difference was statistically insignificant ( $p > 0.05$ ). The most common cause of fracture

distal end radius in our study is Road traffic accidents. Distribution of patients by AO classification is shown in Table 1 and it shows all three type of fracture were treated in both groups

The comparison of patients by functional scoring and range of movement is shown in the Table-2. The patient managed surgically were having better functional outcome and better range of motion and the difference was significant except for flexion at wrist joint which was slightly better in conservative group but the difference was not significant.

The pre-operative comparison of parameters is presented in the Table-3. There was no significant ( $p > 0.05$ ) difference in RL(radial length), RI(radial inclination) and RT (radial tilt) between Fixator and Conservative groups in pre-operative. However, UV(ulnar variance) was significantly ( $p = 0.03$ ) higher among the patients of Fixator ( $3.42 \pm 2.41$ ) than Conservative ( $1.54 \pm 2.91$ ).

The post-operative comparison of parameters is shown in the Table-4. The change from normal side to the post op level shows that attainment of normal radial length in surgical group is much more significant. The collapse in surgical group occurs at late three and six months follow up and that too to minor levels. The collapse in conservative group is more significant at each level of follow up.

At final follow up RL and UV was significantly better in patients treated surgically. is presented in the Table-4/Figure-1. The most common complication in conservative series was finger stiffness. Superficial pin-tract infection occurred in 4 (10.5%) patients in group B, but was resolved with oral antibiotics. Loss of reduced position occurred in 10 patients with POP cast within the first 3 weeks of injury, while there were only 2 cases of loss of reduced position in the other group. Reflex sympathetic dystrophy developed in 1 case of group A and none of group B.

## DISCUSSIONS

There was a predilection of involvement of dominant side in our study group. Most of patients were  $< 40$  yrs of age, which is socially productive group and hence need utmost attention for better functional outcome. In our study road traffic accidents were the most common cause of fracture in our study followed by slip on ground. We found that most of the patients in both Fixator (78.0%) and Conservative groups were males (75.7%) this can be due to the difference in life style as males are more exposed to outdoor activities. Majority of

Gender	Groups			
	Fixator (n=19)		Conservative (n=37)	
	No.	%	No.	%
A	6	31.6	22	59.5
B	1	5.3	3	8.1
C	12	63.2	12	32.4

**Table-1:** Distribution of patients by AO classification

	Groups		p-value <sup>1</sup>
	Fixator (n=19)	Conservative (n=37)	
Functional scoring	93.42 $\pm$ 6.62	88.64 $\pm$ 6.78	0.01*
Range of movement			
Extension	87.28 $\pm$ 9.95	81.85 $\pm$ 6.86	0.02*
Flexion	76.13 $\pm$ 10.84	76.82 $\pm$ 6.78	0.70
Pronation	82.70 $\pm$ 2.08	80.13 $\pm$ 4.82	0.03*
Supination	84.05 $\pm$ 1.68	82.64 $\pm$ 1.65	0.004*

<sup>1</sup>Unpaired t-test, \*Significant between the groups

**Table-2:** Comparison of patients by functional scoring and range of movement

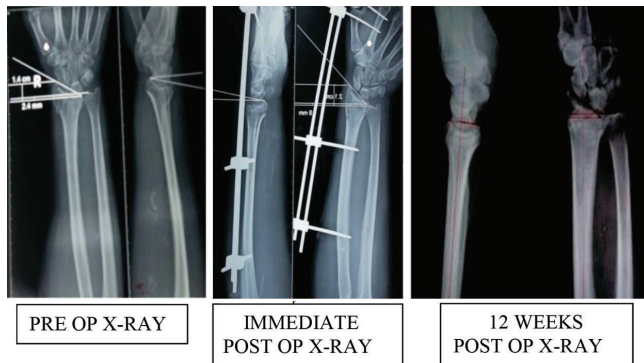
	Groups		p-value <sup>1</sup>
	Fixator (n=19)	Conservative (n=37)	
RL	6.05 $\pm$ 6.79	7.76 $\pm$ 4.23	0.25
RI	16.47 $\pm$ 8.89	19.95 $\pm$ 7.89	0.14
RT	-6.37 $\pm$ 20.80	-0.19 $\pm$ 16.74	0.23
UV	3.42 $\pm$ 2.41	1.54 $\pm$ 2.91	0.03*

**Table-3:** Pre-operative comparisons of parameters

	Groups at post operative		p-value <sup>1</sup>	Groups at 12 week follow up		P value
	Fixator (n=19)	Conservative (n=37)		Fixator (n=19)	Conservative (n=37)	
RL	14.42 $\pm$ 3.59	12.78 $\pm$ 1.98	0.02*	12.05 $\pm$ 4.30	9.11 $\pm$ 3.52	0.004*
RI	25.63 $\pm$ 8.00	26.11 $\pm$ 4.47	0.77	24.63 $\pm$ 8.58	21.35 $\pm$ 6.45	0.11
RT	5.21 $\pm$ 11.01	7.73 $\pm$ 5.46	0.25	1.37 $\pm$ 6.30	2.76 $\pm$ 5.14	0.38
UV	-1.63 $\pm$ 1.30	-0.76 $\pm$ 1.48	0.03*	-0.37 $\pm$ 1.81	0.56 $\pm$ 1.82	0.04*

<sup>1</sup>Unpaired t-test, \*Significant between the groups

**Table-4:** The comparison of parameters at immediate postoperative and 12 weeks postoperative



**Figure-1:** Shows pre-operative, post-operative and 12 weeks post-operative X-ray showing maintainance of radial length and ulnar variance in fixator group.



**Figure-2:** Showing range of movement at wrist joint after 3 months of JESS application

patients of the fixator were having comminuted fracture of AO type C and majority of patients of AO type A of fracture were treated by conservative method i.e. reduction setting and above elbow pop application.

Our study had shown better functional outcome in the patients treated by external fixator as the study by T.A. Clyburn<sup>11</sup> et al. He claimed that external fixator maintained reduction and allowed early functional range of motion of wrist in comminuted radial fracture in 29 patients.

On radiological follow-up the study shows that the Surgical procedure maintains radial length more effectively than POP cast and also retains it till the union better than POP cast and it is supported by N.H. Jenkins<sup>12</sup> et al, they treated 58 patients aged less than 60 years with Colles' fracture, either by a forearm plaster or by the application of an external fixation. The external fixator proved more effective at holding the manipulated position as compared to patients treated with plaster.

We used scoring system by the Gartland and werley and after evaluation we got 68.4% excellent, 15.8% good 15.8% fair results and the conservative group had 21.6% excellent, 56.8% good 16.2% fair and 5.4 %poor results and similarly Joosten U<sup>13</sup> et al evaluated 174 patients with severely displaced intraarticular fracture treated with bridging external fixator. After evaluating with Gartland and Werley score, they obtained 29.3% excellent, 42.5% good, 10.3% fair and 2.9% poor results.

Radiologically, the patient with surgical treatment were having better attainment of radial length till the union but difference in the dorsal tilt and radial inclination was insignificant in the conservative group and similar results were obtained in various studies<sup>14,15,16,17</sup>

The complications of the surgical method includes mainly pin tract infection and finger stiffness especially index finger similar to the study by Chan BK et al<sup>18</sup> who used AO external fixator in 30 patients with intra articular fractures of distal radius. After 90.2 weeks of evaluation they found excellent to good result in 65% of cases, but also some complication mainly fingers stiffness, pin tract infection and even loss of reduction.

## CONCLUSION

External fixation is a more effective method for the treatment of fractures of the distal radius in term of maintaining radial length, prevent collapse with few complication like superficial pin-tract infection, pin loosening than treated with above elbow plaster of paris. Radial tilt and radial inclination and variance correction were attained by both modes of treatment but due to more collapse in the conservative group, loss of correction was more.

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