

## **“To compare the functional Outcome of Distal Radius Fractures Treated with Closed Reduction and Cast Application Versus Volar Plating”**

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### **Abstract**

**Background:**Fractures of distal radius account for 20% of all fractures treated in emergency department. These fractures result from low energy injuries in elderly population and high energy injuries in young adults. Most of these fractures are relatively uncomplicated and are effectively treated by closed reduction and casting. However, fractures that are unstable intra-articular can jeopardize the integrity of the articular congruence and kinematics of articulations resulting in high prevalence of complications. So to overcome these above complications, there is a shifting trend towards surgical management.

**Aim:**To compare the functional outcome of distal end radius fractures treated with closed reduction and cast application versus volar plating in our institution.

**Methods:**A randomized prospective interventional study was done in our institution in which all the patients of distal end of radius fractures were included as per inclusion

and exclusion criteria. • 30 patients were included in the study and followed upto 6 months. They were distributed equally into two groups i.e. 15 patients were treated surgically and the rest 15 conservatively. As all the patients were having similar characteristics, therefore no difference was noted among the groups w.r.t. demographic information. Patients were recommended for follow up at 6 days, 6 weeks, 3months and 6 months interval and routine x-rays were taken and dash scoring done to assess the functional recovery

**Results:**30 patients were included in this study and followed upto 6 months. The Affected limb DASH score at 6 months was compared in operative and non operative patients. In current study, Good score of Affected hand post-reduction dash score at 3 months was significantly more among Operative management. Fair score was significantly more among Conservative management. Excellent score at 6 months was significantly more among Operative management.

**Conclusion:**It can be concluded that surgical intervention for fracture distal end radius reduces chances of wrist joint stiffness and loss of reduction which gave good functional results as compared to conservative intervention. Hence, in our opinion surgical intervention for treatment of fracture distal end radius is a good method with excellent outcome.

**Keywords:**Fracture, Unstable, Radius, Surgical, Outcome

## INTRODUCTION

Distal end of radius fractures are one of the most frequent skeletal injuries seen in orthopaedic departments Distal radius fractures account for a major share of all fractured bones and are more prevalent in young men and older females.<sup>3</sup>These fractures most often occur in young individuals during sports or in an accident.<sup>1</sup>The most prevalent cause in elderly persons is a fall on an extended hand. Colles, Smith, Barton, and Chauffeur's fractures are examples of specific variants.<sup>1</sup> X-rays are used to confirm the diagnosis, which is usually advised based on clinical symptoms.<sup>2</sup>The anatomical reduction of the articular surface and the extraarticular alignment of the distal section of the radius impair the functional result in treatment of distal radius fracture.<sup>4</sup>

The main goal of the treatment is that method of immobilization which maintain reduction to the normal anatomical position that leads to least amount of surgical morbidity.The outcome of the present available published data are tough to compare due to the various fracture patterns, different modalities of treatment and the conflicting outcomes in different studies.

## MATERIALS AND METHODS

30 Distal end radius fractures were divided into 2 groups of 15 in which 1<sup>st</sup> group was treated with closed reduction and cast application and 2<sup>nd</sup> group was treated with open reduction and volar plating, done between 2020 and 2022 At the Orthopaedics Department of Rajshree Medical and Research Institute, Bareilly, pre-reduction, post-reduction, 6 days, 6 weeks, 3 months and 6 months were assessed using DASH score.

**Aim:** To compare the functional outcome of distal end radius fractures treated with closed reduction and cast application versus volar plating in our institution.

**Objective:** To assess and follow the functional and radiological outcome of results of Distal Radius fractures treated with closed reduction and cast application versus volar plating in our institution.

### Methods

**Study Site:** Department of Orthopaedics, Rajshree Medical Research Institute Bareilly

**Study Population:** Patients of age 18 years and above with fractures of distal end of Radius.

**Study Design:** Randomized Prospective Interventional

**Sample size: 30**

To calculate the sample size based on the prevalence with an approximate 95% confidence level, following formula will be used,

Sample Size (n) =  $Z^2 \times P(100 - P) / r^2$

- Z = 2.84 at 95% confidence interval
- P = Prevalence 9%
- Q = (100-P)
- r = Allowable error 15%

**Study Duration:** The study was conducted over a period of 2 years i.e. from 1<sup>st</sup> February 2020-30<sup>th</sup> November 2022

### Ethical Considerations

• Informed consent was obtained from all the participants. Ethical approval for the study was obtained from the Institutional Ethical Committee.

### Methods

- 30 patients were included in the study and followed up to 6 months. They were distributed equally into two groups i.e. 15 patients were treated surgically and the rest 15 conservatively. As all the patients were having similar characteristics, therefore no difference was noted among the groups w.r.t. demographic information. Patients were recommended for follow up at 6 days, 6 weeks, 3 months, and 6 months interval and DASH scoring was done to assess the functional outcome.

### **Statistical Analysis**

The results are presented in frequencies, percentages and mean± SD. Chi-square test was used for comparisons. The p-value<0.05 was considered significant. All the analysis was carried out on SPSS 24.0 version.

### **INCLUSION CRITERIA**

- 1) Patients in the age group >18 years
- 2) Patients with distal radius fractures following road traffic accident or slip or fall on outstretched hand or assault
- 3) Closed fractures

### **EXCLUSION CRITERIA**

- 1) Patients who didn't give consent
- 2) Pathological fractures
- 3) Vascular injury
- 4) Fractures with neurological involvement.
- 5) Infection or Poor skin conditions at operative site.

Radiographic evaluation was done using PA and Lateral X ray views of affected wrist

Surgical technique

Group 1 patients were treated with closed reduction and casting

Group 2 patients were surgically managed with volar plating. Patient was taken to the table in supine position and anaesthesia was given (regional/general anaesthesia).

All patients were shifted to the operating table and placed in the supine position after being painted and draped with a tourniquet around the upper arm. The volar approach (modified Henry's approach), was used the flexor carpi radialis tendon was palpated and a skin incision was made over the anterior aspect of the forearm proximal to proximal wrist crease. Pronator quadratus was separated from the radius border in an L-shape in order to access the fracture's dorsal site. In some patients, the pronator quadratus muscle was repaired with synthetic absorbable suture, while in other patients, the pronator quadratus was left intact as

it is. Volar plating was performed after fracture reduction with traction and manipulation under C-Arm guidance. The plate was fixed to the bone with screws.

Passive exercises were initiated on the first postoperative day with physiotherapy support. Additionally, all active and passive movements and mobilisation were initiated following suture removal, and after six weeks, minimal weight bearing was permitted.

The outcome was evaluated using

1. DASH score
2. range of motion in terms of wrist joint flexion, extension, forearm supination and pronation, ulnar deviation, and radial deviation

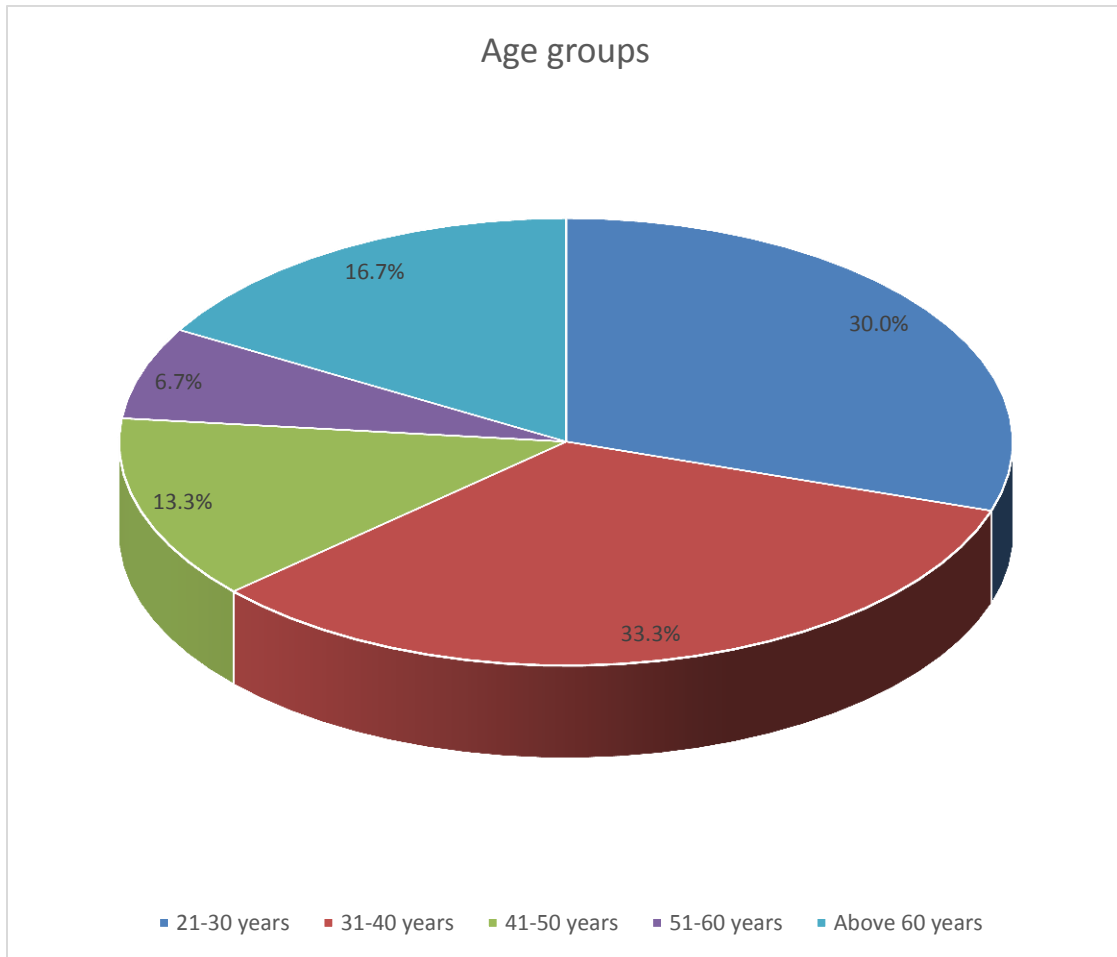
follow up was done at 6 days, 6 weeks, 3 months and 6 months post-operative were assessed using DASH score

## RESULTS

**Table 1: Distribution of study population according to Age**

Age groups	Frequency	Percent
21-30 years	9	30.0%
31-40 years	10	33.3%
41-50 years	4	13.3%
51-60 years	2	6.7%
Above 60 years	5	16.7%

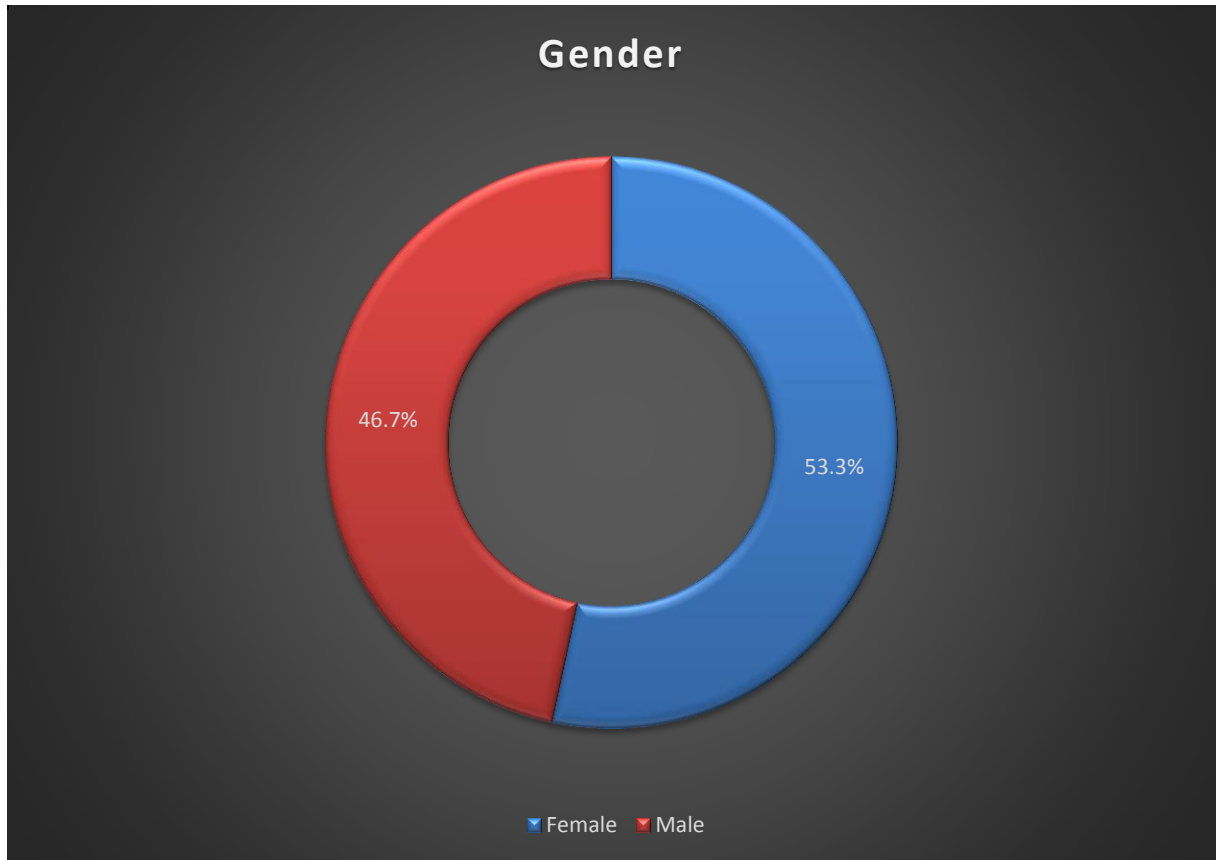
Majority of the study population belonged to 31-40 years (33.3%), 21-30 years (30.0%), Above 60 years (16.7%), 41-50 years (13.3%) and 51-60 years (6.7%).



**Table 2: Distribution of study population according to Gender**

Gender	Frequency	Percent
Male	14	46.7%
Female	16	53.3%
Total	30	100.0%

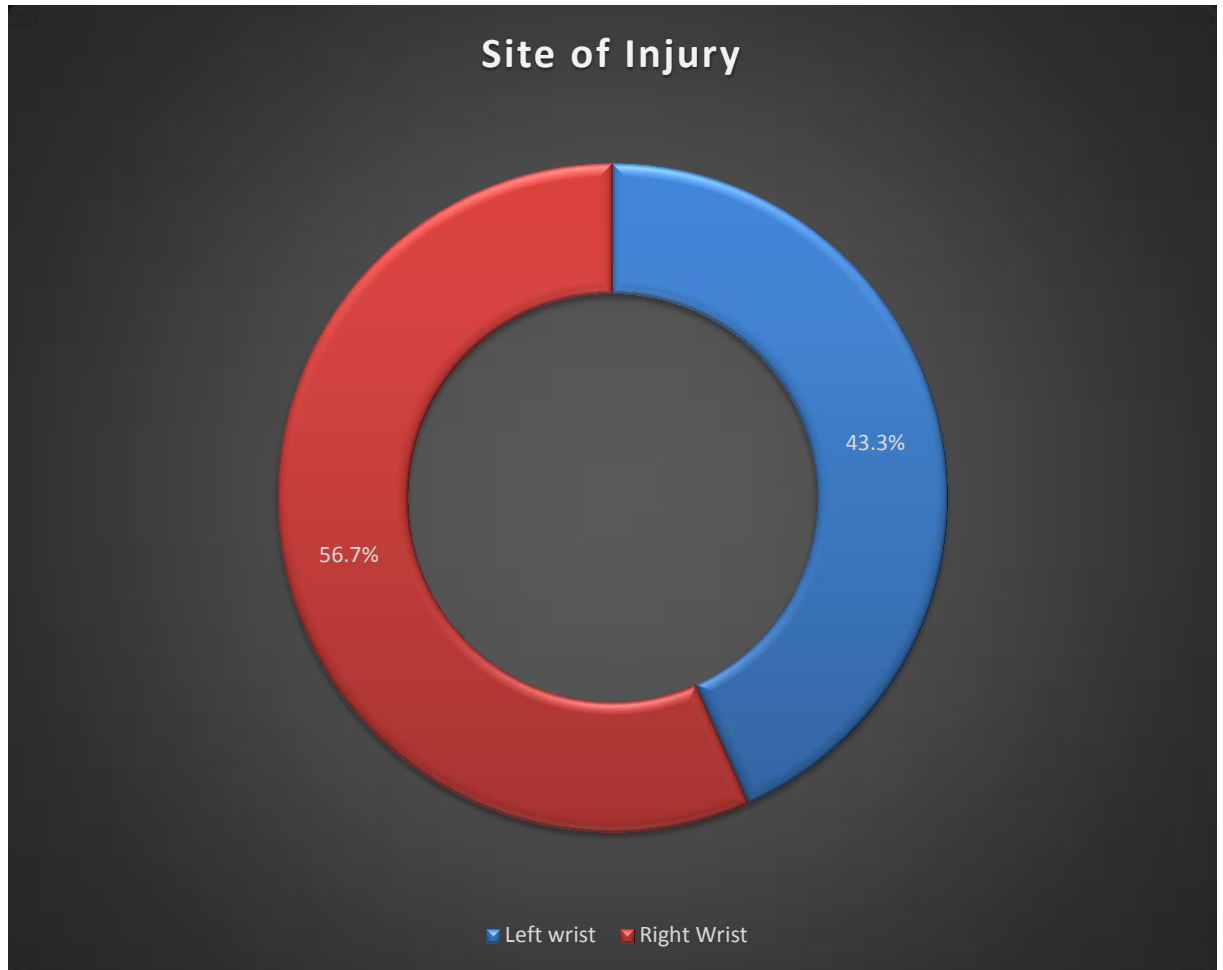
The study population had 46.7% males and 53.3% females.



**Table 3: Distribution of study population according to Site of Injury**

Site of Injury	Frequency	Percent
Left wrist	13	43.3%
Right Wrist	17	56.7%

Majority of the study population had injury on the right wrist (56.7%) followed by left wrist (43.3%).

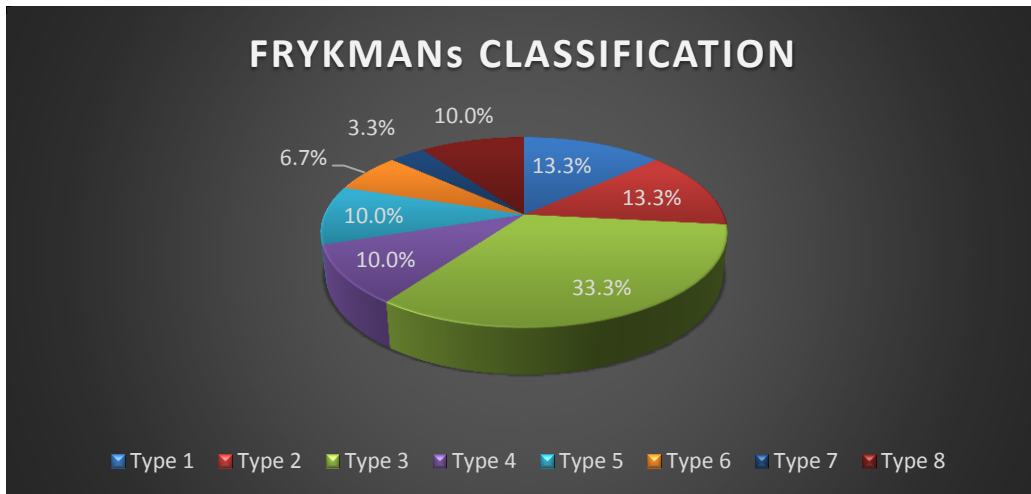


**Table 4: Distribution of study population according to Frykmans Classification**

Frykmans Classification Type	Frequency	Percent
Type 1	4	13.3%
Type 2	4	13.3%
Type 3	10	33.3%
Type 4	3	10.0%
Type 5	3	10.0%
Type 6	2	6.7%
Type 7	1	3.3%
Type 8	3	10.0%



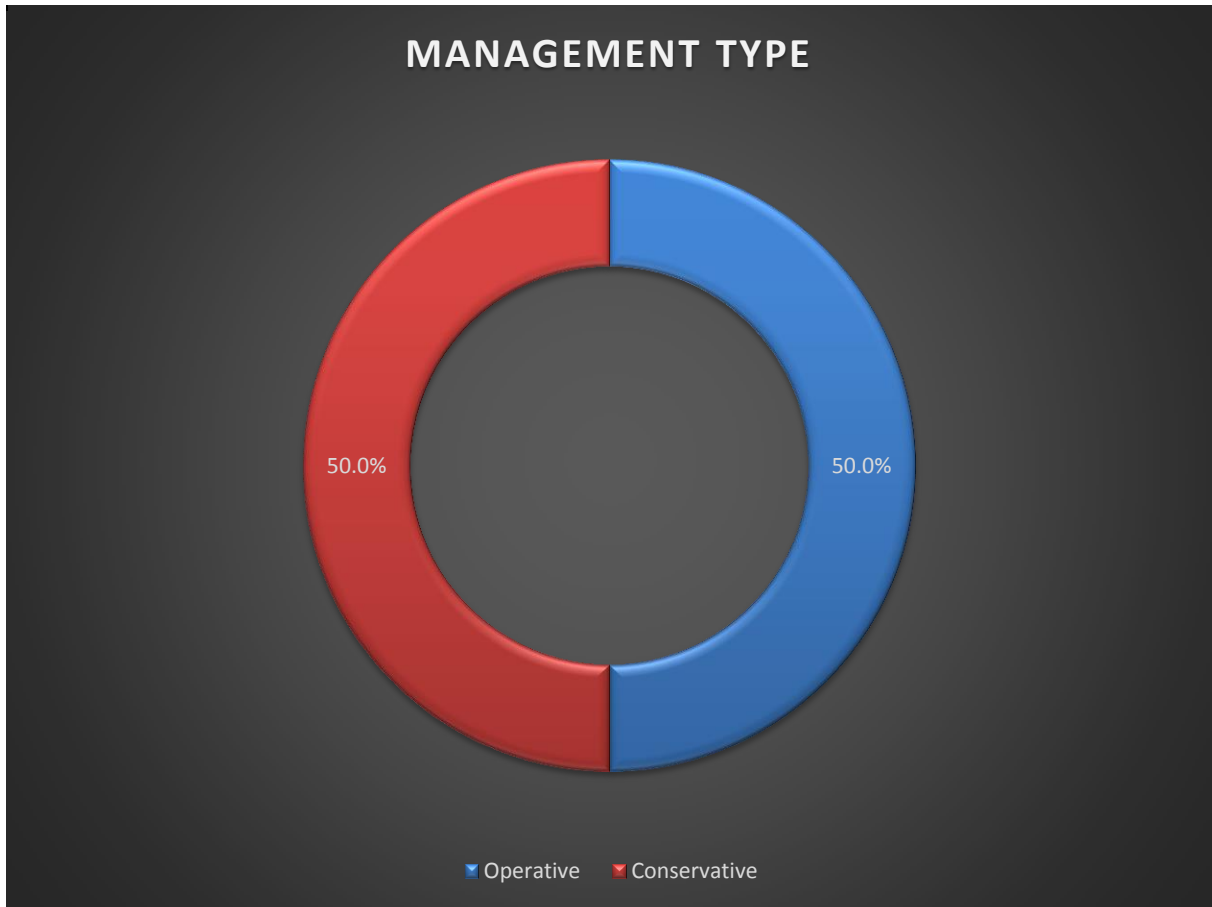
As per Frykmans Classification, Type 1 occurred among 13.3%, Type 2 among 13.3%, Type 3 among 33.3%, Type 4 among 10.0%, Type 5 among 10.0%, Type 6 among 6.7%, Type 7 among 3.3% and Type 8 among 10.0%.



**Table 5: Distribution of study population according to**

Management Type	Frequency	Percent
Operative	15	50.0%
Conservative	15	50.0%

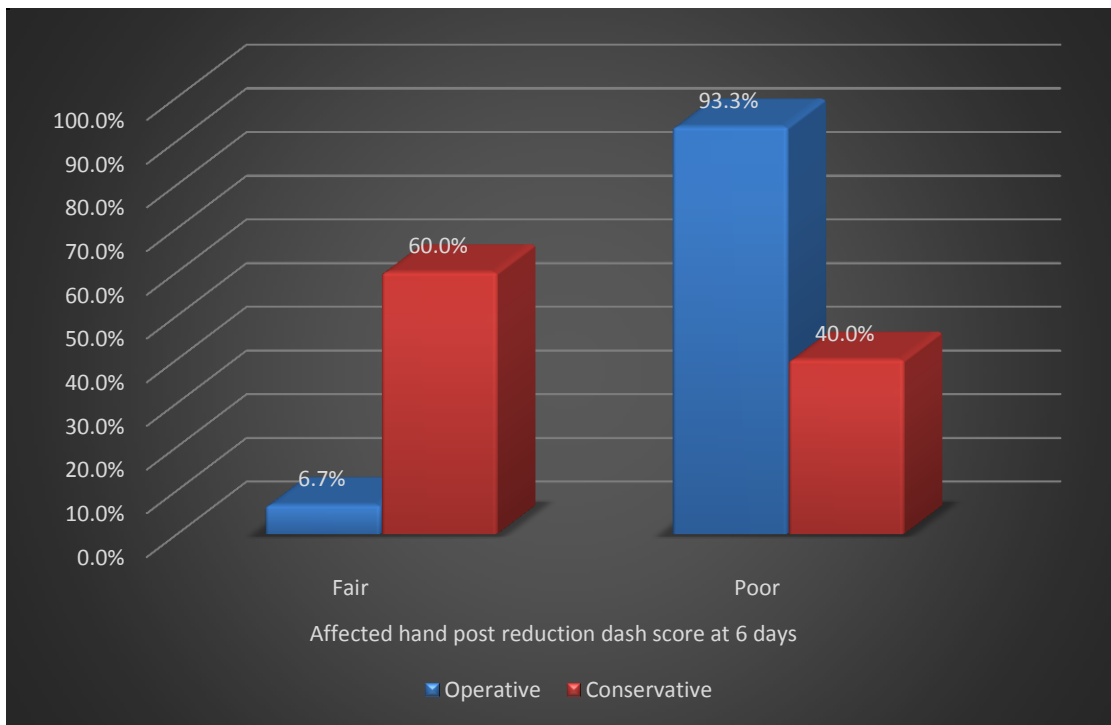
Operative management was done among 15 (50.0%) and Conservative among 15 (50.0%) patients.



**Table 6: Distribution of study population according to**

Affected hand post-reduction dash score at 6 days	Management Type	
	Operative	Conservative
Fair	1	9
	6.7%	60.0%
Poor	14	6
	93.3%	40.0%
<b>Chi-square value = 9.600, p-value = 0.002*</b>		

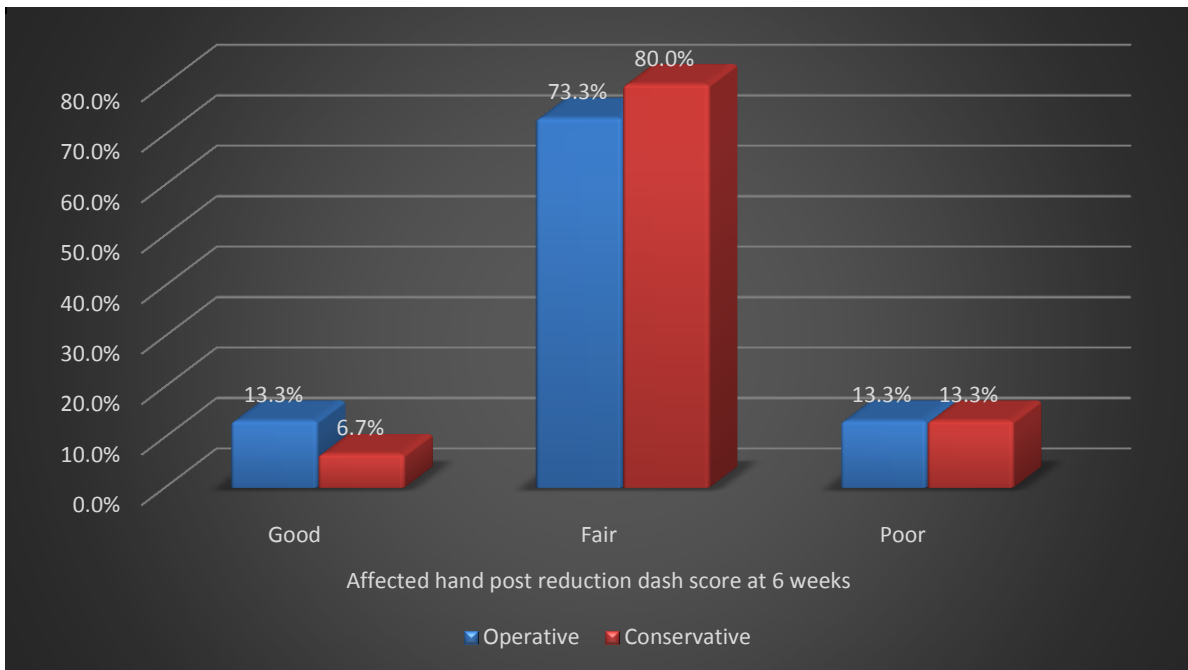
The comparison between Operative and Conservative management using chi-square test there was a significant difference in Affected hand post-reduction dash score at 6 days between Operative and Conservative management. Fair score was significantly more among Conservative management.



**Table 7: Distribution of study population according to**

Affected hand post reduction DASH score at 6 weeks	Management Type	
	Operative	Conservative
Good	2	1
	13.3%	6.7%
Fair	11	12
	73.3%	80.0%
Poor	2	2
	13.3%	13.3%
<b>Chi-square value = 0.377, p-value = 0.828</b>		

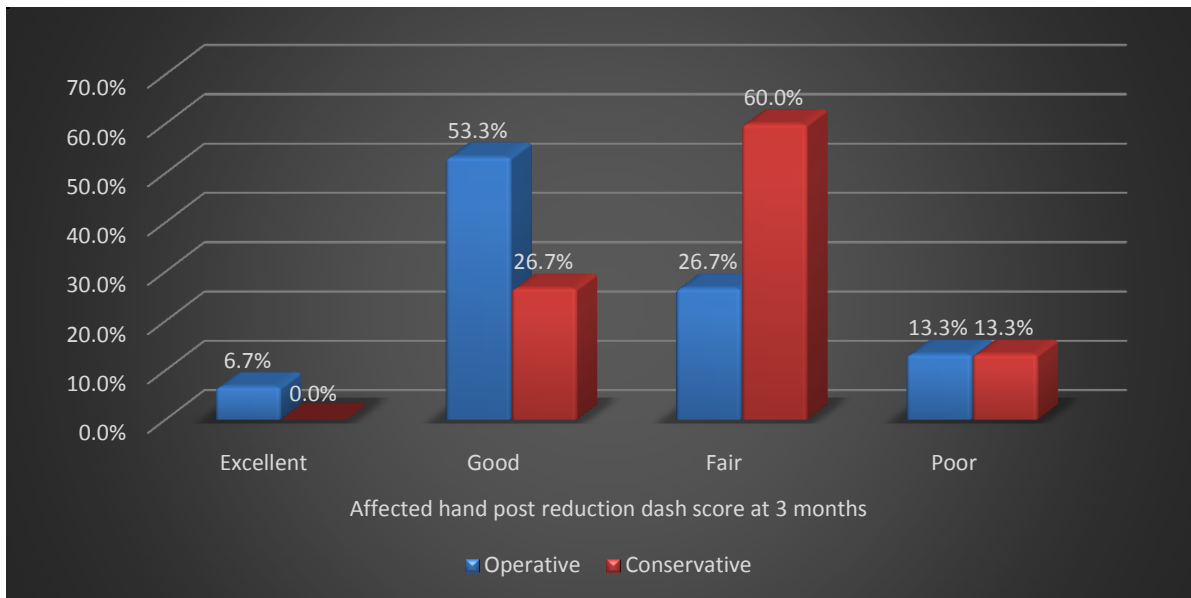
The comparison of Affected hand post reduction DASH score at 6 weeks between Operative and Conservative management using chi-square test which showed no significant difference.



**Table 8: Distribution of study population according to Affected hand post reduction DASH score at 3 months**

Affected hand post reduction DASH score at 3 months	Management Type	
	Operative	Conservative
Excellent	1	0
	6.7%	.0%
Good	8	4
	53.3%	26.7%
Fair	4	9
	26.7%	60.0%
Poor	2	2
	13.3%	13.3%
<b>Chi-square value = 7.768, p-value = 0.045*</b>		

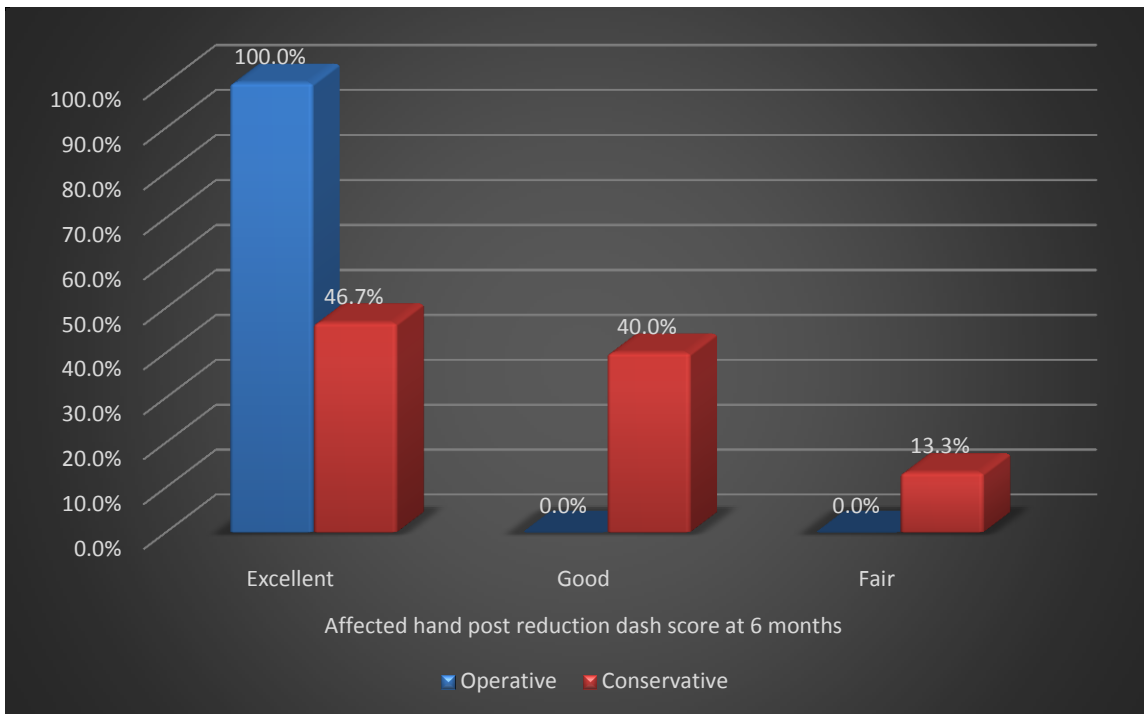
The comparison between Operative and Conservative management using chi-square test that Good score of Affected hand post-reduction dash score at 3months was significantly more among Operative management. Fair score was significantly more among Conservative management.



**Table 9: Distribution of study population according to Affected hand post reduction DASH score at 6 months**

Affected hand post reduction DASH score at 6 months	Management Type	
	Operative	Conservative
Excellent	15	7
	100.0%	46.7%
Good	0	6
	.0%	40.0%
Fair	0	2
	.0%	13.3%
<b>Chi-square value = 10.909, p-value = 0.004*</b>		

The comparison of Affected hand post reduction DASH score at 6 months between Operative and Conservative management using chi-square test showed that excellent score at 6 months was significantly more among Operative management.



**Table: Distribution of study population according to**

FRYKMANs CLASSIFICATION TYPE	Affected limb pre reduction DASH score	
	Fair	Poor
Type 1	2	2
	50.0%	50.0%
Type 2	3	0
	100.0%	0.0%
Type 3	4	7
	36.4%	63.6%
Type 4	0	3
	0.0%	100.0%
Type 5	0	3
	0.0%	100.0%
Type 6	1	1
	50.0%	50.0%
Type 7	0	1
	0.0%	100.0%
Type 8	0	3
	0.0%	100.0%
$\chi^2$ value = 11.795, p-value = 0.107		

The Affected limb pre-reduction DASH score was compared as per FRYKMANs CLASSIFICATION TYPE using the chi-square test showed no significant association between Affected limb pre-reduction DASH score and FRYKMANs CLASSIFICATION TYPE.

**Table: Distribution of study population according to**

FRYKMANs CLASSIFICATION TYPE	Affected hand post reduction dash score at six days		
	Fair	Good	Poor
Type 1	3	0	1
	75.0%	0.0%	25.0%
Type 2	3	0	0
	100.0%	0.0%	0.0%
Type 3	9	1	1
	81.8%	9.1%	9.1%
Type 4	2	1	0
	66.7%	33.3%	0.0%
Type 5	2	1	0
	66.7%	33.3%	0.0%
Type 6	2	0	0
	100.0%	0.0%	0.0%
Type 7	1	0	0
	100.0%	0.0%	0.0%
Type 8	1	0	2
	33.3%	0.0%	66.7%
$\chi^2$ value = 14.411, p-value = 0.420			

The Affected limb DASH score at 6 days was compared as per FRYKMANs CLASSIFICATION TYPE using the chi-square test showed no significant association between Affected limb DASH score at 6 days and FRYKMANs CLASSIFICATION TYPE.

**Table: Distribution of study population according to**

FRYKMANs CLASSIFICATION TYPE	Affected hand post reduction dash score at six weeks			
	Excellent	Fair	Good	Poor
Type 1	0	2	1	1
	0.0%	50.0%	25.0%	25.0%
Type 2	0	2	1	0

	0.0%	66.7%	33.3%	0.0%
Type 3	0	6	4	1
	0.0%	54.5%	36.4%	9.1%
Type 4	1	1	1	0
	33.3%	33.3%	33.3%	0.0%
Type 5	0	0	3	0
	0.0%	0.0%	100.0%	0.0%
Type 6	0	2	0	0
	0.0%	100.0%	0.0%	0.0%
Type 7	0	0	1	0
	0.0%	0.0%	100.0%	0.0%
Type 8	0	0	1	2
	0.0%	0.0%	33.3%	66.7%
$\chi^2$ value = 27.640, p-value = 0.151				

The Affected limb DASH score at 6 weeks was compared as per FRYKMANs CLASSIFICATION TYPE using the chi-square test showed no significant association between Affected limb DASH score at 6 weeks and FRYKMANs CLASSIFICATION TYPE.

**Table: Distribution of study population according to**

FRYKMANs CLASSIFICATION TYPE	Affected hand post reduction dash score at 3 months			
	Excellent	Fair	Good	Poor
Type 1	0	1	2	1
	0.0%	25.0%	50.0%	25.0%
Type 2	0	2	1	0
	0.0%	66.7%	33.3%	0.0%
Type 3	1	2	7	1
	9.1%	18.2%	63.6%	9.1%
Type 4	1	0	2	0
	33.3%	0.0%	66.7%	0.0%
Type 5	1	0	2	0
	33.3%	0.0%	66.7%	0.0%
Type 6	1	0	1	0
	50.0%	0.0%	50.0%	0.0%
Type 7	1	0	0	0
	100.0%	0.0%	0.0%	0.0%
Type 8	0	0	2	1
	0.0%	0.0%	66.7%	33.3%
$\chi^2$ value = 20.125, p-value = 0.513				



The Affected limb DASH score at 3 months was compared as per FRYKMANs CLASSIFICATION TYPE using the chi-square test showed no significant association between Affected limb DASH score at 3 months and FRYKMANs CLASSIFICATION TYPE.

**Table: Distribution of study population according to**

FRYKMANs CLASSIFICATION TYPE	Affected hand post reduction dash score at 6 months		
	Excellent	Fair	Good
Type 1	1	1	2
	25.0%	25.0%	50.0%
Type 2	1	0	2
	33.3%	0.0%	66.7%
Type 3	8	1	2
	72.7%	9.1%	18.2%
Type 4	3	0	0
	100.0%	0.0%	0.0%
Type 5	3	0	0
	100.0%	0.0%	0.0%
Type 6	2	0	0
	100.0%	0.0%	0.0%
Type 7	1	0	0
	100.0%	0.0%	0.0%
Type 8	3	0	0
	100.0%	0.0%	0.0%
$\chi^2$ value = 13.691, p-value = 0.473			

The Affected limb DASH score at 6 months was compared as per FRYKMANs CLASSIFICATION TYPE using the chi-square test showed no significant association between Affected limb DASH score at 6 months and FRYKMANs CLASSIFICATION TYPE.

### Discussion

Distal radius fractures are common and mismanaged injuries. Several studies have been directed towards clarifying which surgical treatment method would be best for fracture of the distal extremity of the radius. In this context, Osada et al. <sup>7</sup> recently documented the increasing popularity of open reduction and internal fixation, especially since the introduction of locked volar plates. The majority of the studies have used subjective tools for measuring quality of life, such as the Gartland and Werley calculation and the DASH calculation while others have given greater emphasis to the radiographic parameters obtained after surgical reduction of fractures of the distal extremity of the radius.<sup>8,10</sup> In present study, majority of the study population belonged to 31-40 years

(33.3%), 21-30 years (30.0%), Above 60 years (16.7%), 41-50 years (13.3%) and 51-60 years (6.7%). Similar to our study, . In the study by Kevin and Chung et al,<sup>16</sup> the average age of the patients was 48.9 years with minimum age 18 years and maximum years 83 years. Arora et al.<sup>11</sup> stated that the average age of the patients was 57 years (17-79 years). In the study by Killic A et al.,<sup>8</sup> the average age of the patients was 45 years (18-77 years). In our study, the study population had 46.7% males and 53.3% females. Chavhan AN et al.<sup>15</sup> stated that most (71.4%) of the patients were females as compared with males (28.6%). The study done by Hanae Minegishi et al<sup>9</sup> included mostly females (80%) and males were 20%. Fok WM et al,<sup>10</sup> reported that there were 57.7% male and 42.3% were female while Tank Gyaneshwar study<sup>13</sup> had 65% females and 35% males. In current study, Majority of the study population had injury on the right wrist (56.7%) followed by left wrist (43.3%). Khan et al.<sup>5</sup> found that Left side was involved in 37 % and the right side was involved in 63% We observed that as per Frykmans Classification, Type 1 occurred among 13.3%, Type 2 among 13.3%, Type 3 among 33.3%, Type 4 among 10.0%, Type 5 among 10.0%, Type 6 among 6.7%, Type 7 among 3.3% and Type 8 among 10.0%. Testa et al.<sup>12</sup> found that in the surgical group, type A fracture was among 20.5%, type B fracture among 38.46% and an intra articular fracture among 41% and in the conservative group, type A fracture among 36%) B fractures among 40% and C fractures among 23%. The DASH questionnaire has been widely used to analyze problems related to the arm, shoulder, and hand from the patient's perspective. The questionnaire evaluates the degree of difficulty in performing physical activities, the severity of symptoms along with the impact of the health problem on the patient's daily functioning.<sup>6</sup>

In current study, Good score of Affected hand post-reduction dash score at 3 months was significantly more among Operative management. Fair score was significantly more among Conservative management. Excellent score at 6 months was significantly more among Operative management. In line with our study, Ochenetal.<sup>14</sup> analyzing data from all age-groups, has also reported significantly better DASH scores in patients undergoing operative management of distal radius fractures as compared to those undergoing non-operative treatment (Mean difference -5.22).

### **Summary and conclusion**

The present study was done to compare the functional outcome of distal radius fractures treated with Closed Reduction and Cast Application versus Volar Plating.

Majority of the study population belonged to 31-40 years (33.3%), 21-30 years (30.0%), Above 60 years (16.7%), 41-50 years (13.3%) and 51-60 years (6.7%).

The study population had 46.7% males and 53.3% females.

Majority of the study population had injury on the right wrist (56.7%) followed by left wrist (43.3%).

As per Frykmans Classification, Type 1 occurred among 13.3%, Type 2 among 13.3%, Type 3 among 33.3%, Type 4 among 10.0%, Type 5 among 10.0%, Type 6 among 6.7%, Type 7 among 3.3% and Type 8 among 10.0%.

Operative management was done among 15 (50.0%) and Conservative among 15 (50.0%) patients.

Good score of Affected hand post-reduction dash score at 3 months was significantly more among Operative management. Fair score was significantly more among Conservative management. Excellent score at 6 months was significantly more among Operative management.

It remains clear by this study that using ORIF with a plate and screw is the best treatment for distal radius fractures.

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