



RESEARCH ARTICLE

TO EVALUATE THE FUNCTIONAL OUTCOME OF VOLAR PLATING IN DISTAL END RADIUS FRACTURES

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Key words:-

Distal End Radius Fracture, Volar Plating, Gartland And Werley Score

Abstract

Introduction: Most frequent bone injuries seen in orthopaedic practice is distal end radius fractures.[1] It occurs most frequently in adult patients after the fourth decade of life and comprises around 10% to 20% of all the fractures attended as emergencies.[2] The causes of the injury are fall on outstretched hand/work related accidents/car accidents/sports injuries. The importance of fixation of the distal radius (DR) fractures have evolved over the past two decades. Cast immobilization was the initial method, followed by K-wire fixation and then internal fixation with a variety of plates.[4] After using a variety of the available volar locking plates to fix intra-articular fractures, a significant improvement in wrist function was observed. In addition, surgical technique has improved, resulting in less disfigurement. The purpose of this study was to evaluate the outcome of a fracture of the distal radius (DR) treated surgically by ORIF (open reduction and internal fixation) with a volar plate, and to prospectively follow the degree of recovery of wrist range of motion and patient functional outcomes.

Result: The present study was conducted on patients presenting with fracture of the distal end of radius, who were treated with open reduction and internal fixation with volar plating. The results of the study are summarized as below: ? Majority of the patients were in age group 21-30 and 31-40 years with a mean age of 35.90 ± 12.21 years. The youngest patient was 18 years old and oldest one was 58 years old. ? Majority of the patients were males. ? In majority of the patients, left side involvement was seen in comparison to right side involvement. ? Coronary artery disease, diabetes mellitus type-2 and hypertension were seen in 1 patient each in our study. Rest of the patients had no comorbidities. The reason for not having significant comorbidities was that majority of the patients in our study were young. ? All these patients underwent open reduction and internal fixation with volar plating. Majority of the patients (77.4%) achieved fracture union within 1-2 months, while 19.4% achieved it within 3 months. 1 patient (3.2%) was able to achieve the union within a month of surgical intervention. The fracture union was achieved in a short time. The wrist function was assessed using Gartland and Werley score. The mean Gartland and Werley score showed significant improvement from 1 month to 6 months in all

the patients. ? At 6 months, 87.1% patients had excellent outcome and 12.9% patients had good outcome. ? Complications were seen in 4 patients. Of them 1 patient complained of complex regional pain syndrome and 3 patients complained of wrist stiffness

Conclusion: We found that open reduction and internal fixation with volar plating provided excellent to good wrist outcome in patients with distal end radius fractures with minimal complications. Volar plating provides stable fixation for early mobilization, leading to early resumption to pre-trauma functional level. Although we obtained excellent to good results with open reduction and internal fixation with volar plating in distal end radius fractures, the results cannot be extrapolated to the general population as the sample size was small. Hence, we recommend that large multi- centric studies be performed before generalizing the results.

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Introduction:-

Most frequent bone injuries seen in orthopaedic practice is distal end radius fractures.^[1]

It occurs most frequently in adult patients after the fourth decade of life and comprises around 10% to 20% of all the fractures attended as emergencies.^[2]

Distal radius fracture however have a bimodal age distribution^[3] among these one with younger age group results due to high-energy trauma and another group of elderly patients resulting with low energy trauma.^[4]

The causes of the injury are fall on outstretched hand/work related accidents/car accidents/sports injuries. The importance of fixation of the distal radius (DR) fractures have evolved over the past two decades. Cast immobilization was the initial method, followed by K-wire fixation and then internal fixation with a variety of plates.^[4]

After using a variety of the available volar locking plates to fix intra-articular fractures, a significant improvement in wrist function was observed. In addition, surgical technique has improved, resulting in less disfigurement.

By immediately reconstructing the anatomy, plating allows stable internal fixation and rapid recovery of wrist function.^[5]

The antiglide effect of the support plate helps to reduce and stabilize intra-articular fractures.^[6]

The purpose of this study was to evaluate the outcome of a fracture of the distal radius (DR) treated surgically by ORIF (open reduction and internal fixation) with a volar plate, and to prospectively follow the degree of recovery of wrist range of motion and patient functional outcomes.

Materials & Methods:-

This is an observational type of study at SAMC & PGI Indore, from April 2021 to September 2022. The Gartland and Werley Scoring was used to evaluate the outcome. The study was carried out on 31 patients of closed distal radius fracture, operated with ORIF with volar plating. Information on the patients was compiled from clinical details, case files and operation theatre records who were followed up for the duration of 6 months.

Inclusion Criteria involves Patients with age 18 and above and Patients with closed distal radius fracture. Patient with distal end radius fracture both intra-articular and extra-articular.

Exclusion criteria involves Patient with associated distal ulna fractures and with open fractures or pathological fracture. Patient and/or his/her legally acceptable representative not willing to provide their voluntary informed consent form for the participation in the study

Post operative radiograph (Anteroposterior and lateral) view were taken of wrist to see the alignment of fracture reduction . Follow up was done at 2 weeks, 1 month, 3 months, 6 months.

Observation And Results:-

TableNo. 1:- Distribution of patients according to age.

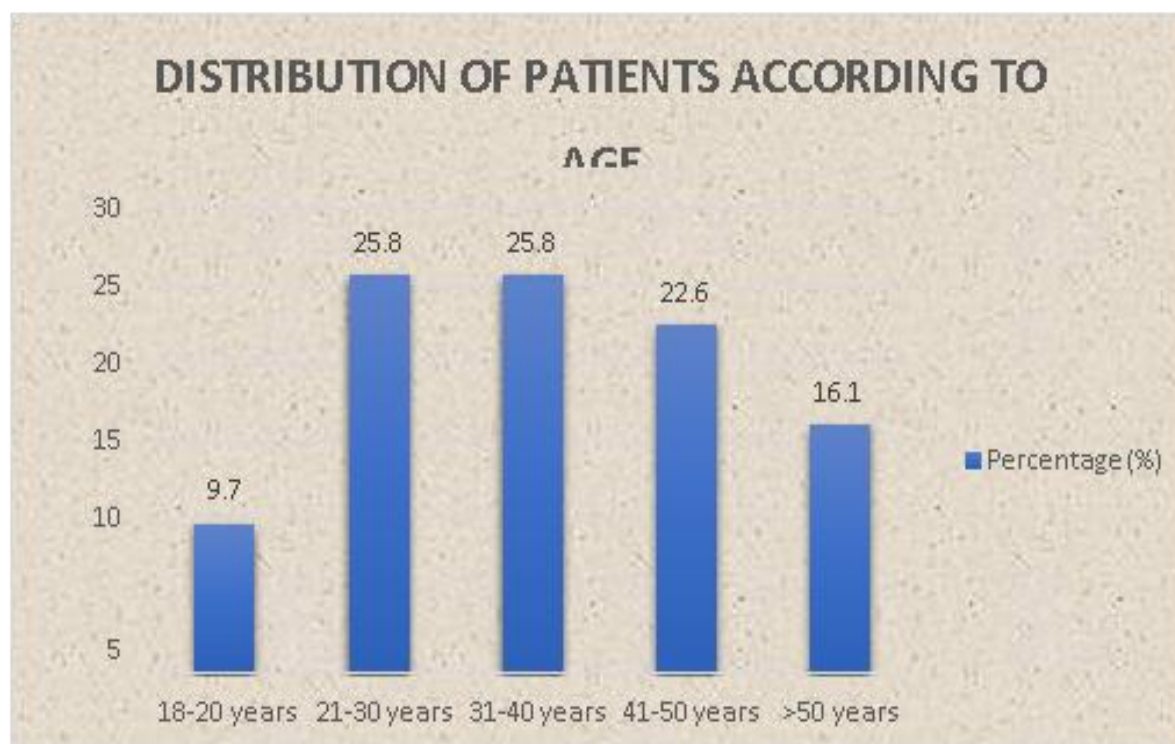
Age	Frequency	Percentage
18-20years	3	9.7
21-30years	8	25.8
31-40years	8	25.8
41-50years	7	22.6
>50years	5	16.1
Total	31	100.0

The above table shows the distribution of patients according to age.

3(9.7%)patients were in age group 18-20 years,8(25.8%)were in age group 21-30years,

8(25.8%)were in age group 31-40years,7(22.6%)were in age group 41-50years,and 5(16.1%)patients were in age group more than 50years.

Most patients were in age group 21-30 and 31-40years.



Graph1:- Bar diagram shows the distribution of patients according to age.

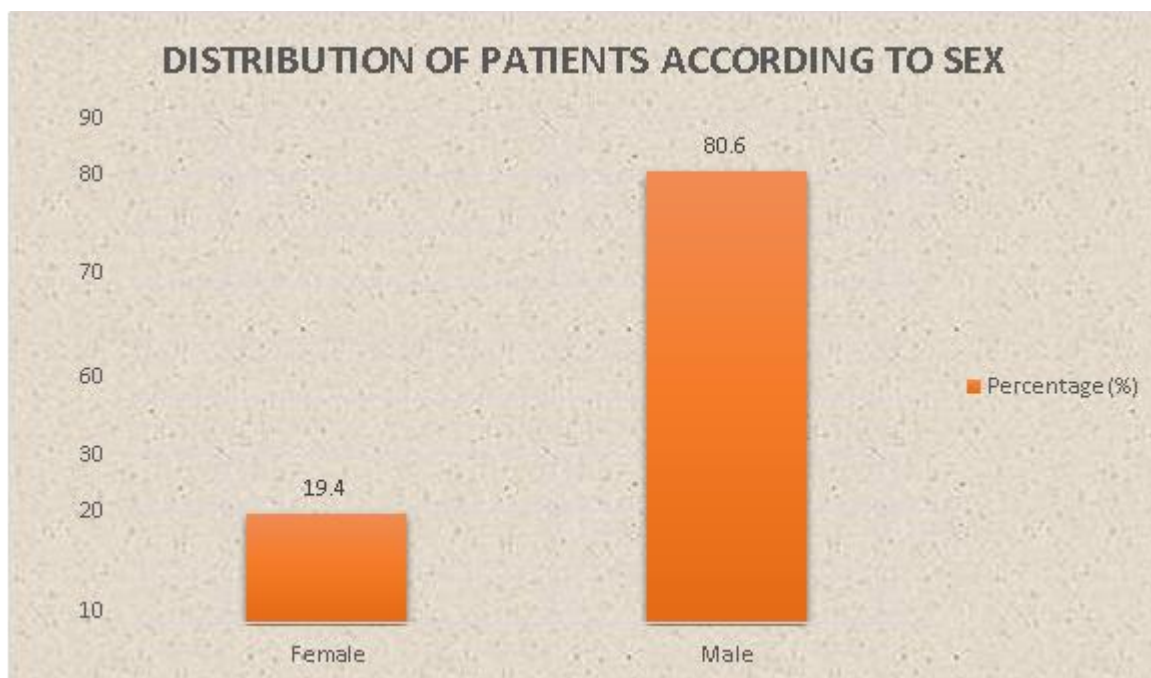
TableNo. 2:- Distribution of patients according to sex.

Sex	Frequency	Percentage
Female	6	19.4
Male	25	80.6

Total	31	100.0
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The above table shows the distribution of patients according to sex.

6(19.4%)patients were females and 25(80.6%)patients were males.Males were in majority in present study.



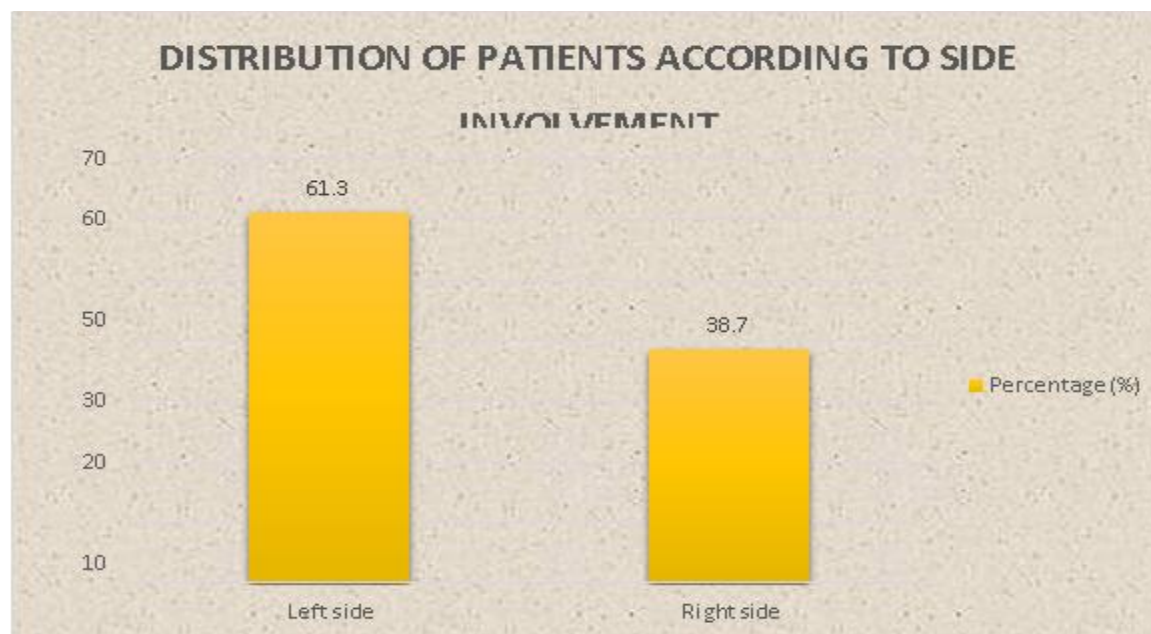
Graph2:- Bar diagram shows the distribution of patients according to sex.

TableNo. 3:- Distribution of patients according to side involvement.

SideInvolvement	Frequency	Percentage
Leftside	19	61.3
Right side	12	38.7
Total	31	100.0

The above table shows the distribution of patients according to side involvement.

In 19(61.3%) patients, left side was involved and in 12(38.7%) patients, right side was involved. Left side involvement was more common than right side involvement.



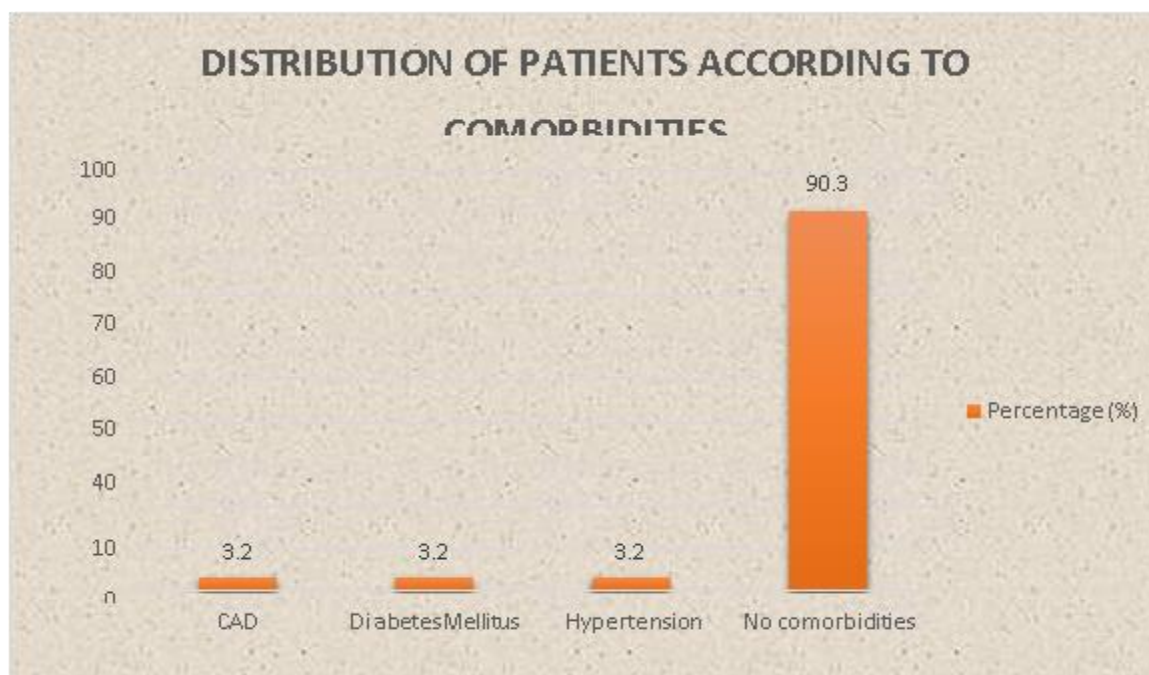
Graph3:- Bar diagram shows the distribution of patients according to side involvement.

TableNo. 4:- Distribution of patients according to comorbidities.

Comorbidities	Frequency	Percentage
CAD	1	3.2
DiabetesMellitustype-2	1	3.2
Hypertension	1	3.2
Nocomorbidities	28	90.3
Total	31	100.0

The above table shows the distribution of patients according to comorbidities.

CAD was seen in 1(3.2%) patient, diabetes mellitus type-2 in 1(3.2%) patient and hypertension in 1 (3.2%) patient. In 28(90.3%) patients, there were no comorbidities.

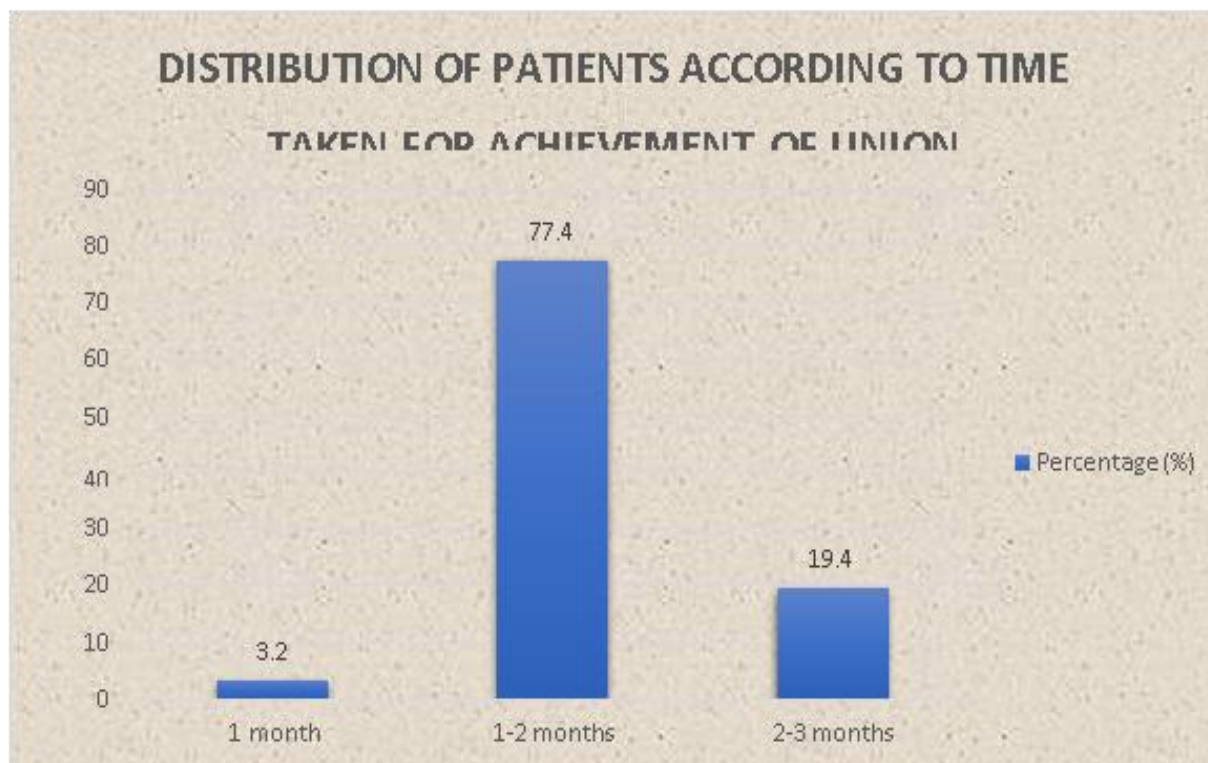
**Graph4:-** Bar diagram shows the distribution of patients according to comorbidities.**TableNo. 5:-** Distribution of patients according to time taken for achievement of union.

TimeTaken	Frequency	Percentage
1 month	1	3.2
1-2months	24	77.4
2-3months	6	19.4
Total	31	100.0

The above table shows the distribution of patients according to time taken for achievement of union.

1(3.2%) patient achieved union within 1 month, 24(77.4%) patients achieved union between 1-2 months and 6(19.4%) patients achieved union by 2-3 months.

Majority of the patients achieved union between 1-2 months. The mean union time was 2.09 ± 0.51 months (ranging from 1 to 3 months).



Graph 5:- Bar diagram shows the distribution of patients according to time taken for achievement of union.

TableNo. 6:- Comparison of Mean Gartland and Werley Score at different time intervals.

Time Interval	No. of Patients	Mean \pm SD	t' value	P value
At one month	31	6.90 \pm 2.12	15.372, df=30	0.001*
At three months	31	1.97 \pm 2.58		
At three months	31	1.97 \pm 2.58	2.706, df=30	0.011*
At six months	31	1.48 \pm 1.88		

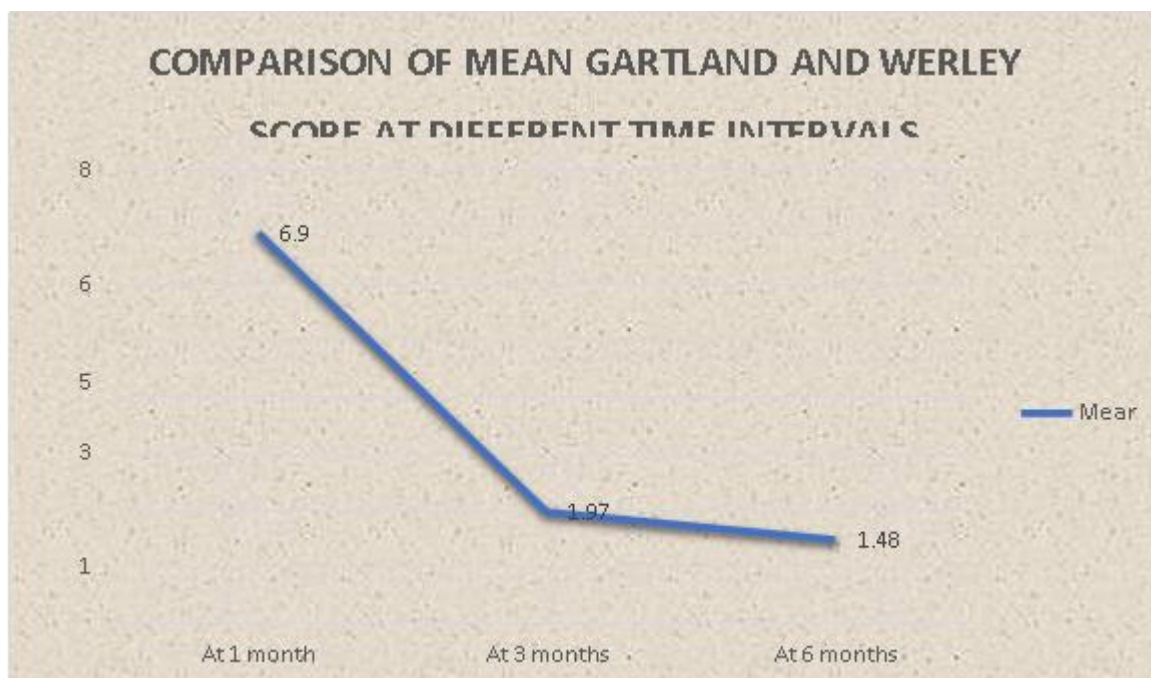
Paired 't' test applied. P value < 0.05 was taken as a statistically significant

The above table shows the mean Gartland and Werley Score at different time intervals.

The mean Gartland and Werley Score at 1 month it was 6.90 \pm 2.12, at 3 months it was 1.97 \pm 2.58 and at 6 months it was 1.48 \pm 1.88.

There was statistically significant improvement in the mean Gartland and Werley Score at 3 months compared to 1 month (P=0.001) and at 6 months compared to 3 months (P=0.001).

There was persistent improvement in the Gartland and Werley score from 1 month till 6 month follow-up.



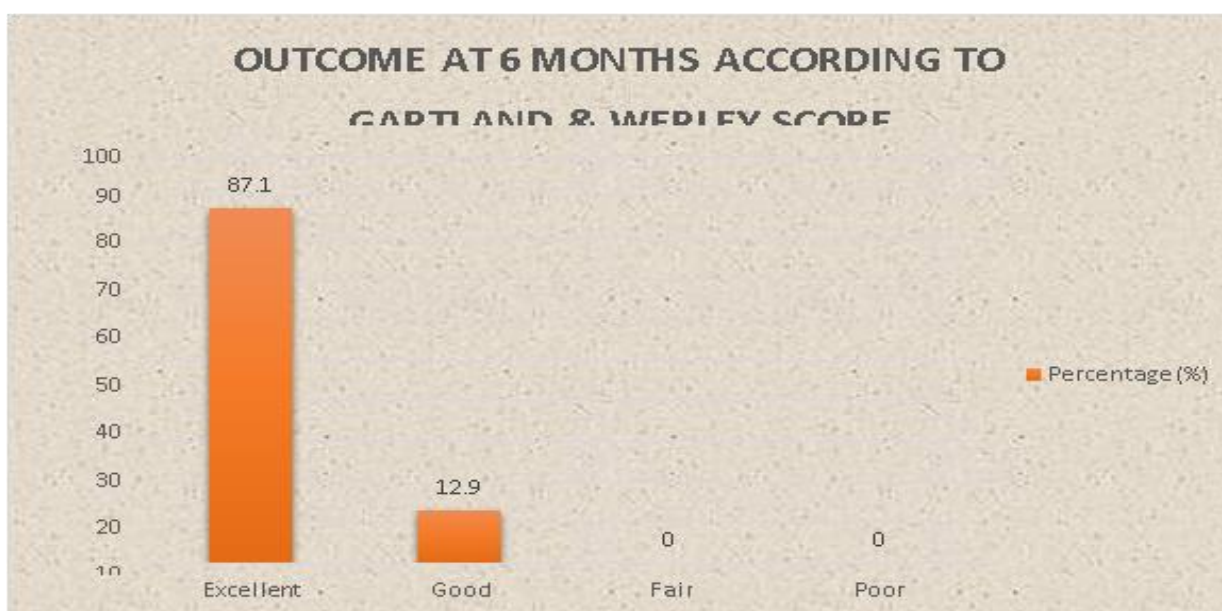
Graph 6:- Bar diagram shows the comparison of mean Gartland and Werley Score at different time intervals.

TableNo. 7:- Outcome at 6months according to Gartland & Werley Score.

GartlandandWerleyScore	Frequency	Percentage
Excellent	27	87.1
Good	4	12.9
Fair	0	0.0
Poor	0	0.0
Total	31	100.0

The above table shows the outcome at 6 months according to Gartland & Werley Score.

At 6months,excellent outcome was seen in 27(87.1%)patients and good outcome in 4(12.9%]



Graph 7:- Bar diagram shows the outcome at 6 months according to Gartland&WerleyScore.

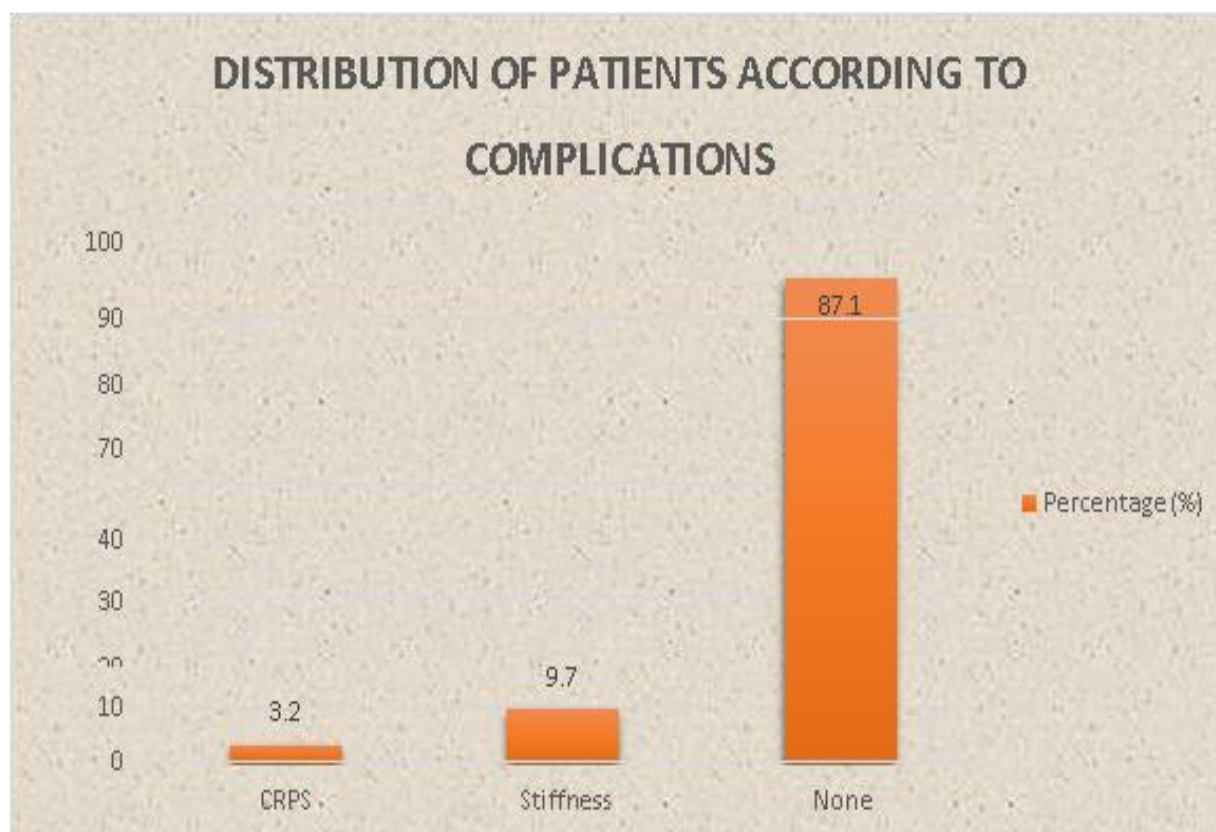
TableNo. 8:- Distribution of patients according to complications.

Complications	Frequency	Percentage
CRPS	1	3.2
Stiffness	3	9.7
None	27	87.1
Total	31	100.0

The above table shows the distribution of patients according to complications

Complex regional pain syndrome was seen in 1 (3.2%) patient and stiffness in 3 (9.7%) patients.

In 27 (87.1%) patients, no complications were seen.

**Graph8:-** Bar diagram shows the distribution of patients according to complications.

Discussion:-

Distal end radius fractures are most common skeletal injuries, which has a bimodal age distribution. In younger age group, it occurs due to high-energy trauma, while in elderly it occurs due to low energy trauma. Over a century, the treatment of fracture distal end radius has evolved from cast immobilization to K-wire fixation. At present internal fixation with various plates has not only proved to be effective in early return of the wrist function, but because of improvement in surgical technique, it has led to lesser disfigurement. Present study was undertaken to evaluate the functional outcome of distal radius fractures treated with open reduction and internal fixation with volar plate.

We had included 31 patients who underwent open reduction and internal fixation with volar plate for fracture of distal end of radius.

Majority of the patients were in age group 21-30 and 31-40 years with a mean age of 35.90 \pm 12.21 years. The youngest patient was 18 years old and oldest one was 58 years old. The mean age of the patients was 64.4 years (Minegishi et al.^[8]), 43.35 years (Santhosh et al.^[9]), 43.22 years (Sharma et al.^[10]). Our mean age is less

in compared to the studies done by these authors. The reasons being that, in our study, majority of the patients were of younger age.

Majority of the patients were males. Males outnumbered the females (**Santhoshet al.**^[9], **Pradhan et al.**^[11], **Ojha et al.**^[12], **Ahmed et al.**^[13], **Gowda et al.**^[14]), which corroborates with our study findings. The fractures of the distal end of radius are more commoner in men in comparison to the females till age of 49 years and beyond that these are more commoner in women.^[17]

In majority of the patients, left side involvement was seen in comparison to right side involvement. Contrary to our findings, a study done by **Sanaboyina et al.**^[15] reported right side (dominant wrist) involvement in majority of the patients.

Coronary artery disease, diabetes mellitus type-2 and hypertension were seen in 1 patient each in our study. Rest of the patients had no comorbidities. The reason for not having significant comorbidities was that majority of the patients in our study were young.

All these patients underwent open reduction and internal fixation with volar plating. Majority of the patients (77.4%) achieved fracture union between 1-2 months, while 19.4% achieved it between 2-3 months. 1 patient (3.2%) was able to achieve the union within a month of surgical intervention. The fracture union was achieved in a short time. According to the study done by **Sharma et al.**^[10] the mean time to union was 7.96 weeks. In **Chavhan et al.**^[6] study, the mean union time was 7 weeks. Our mean union time was comparable with these studies, while study done by **Ahmed et al.**^[13] reported a mean union time to be 11.98 ± 1.64 weeks, which is longer than that seen in our study and studies done by other authors.

The wrist function was assessed using Gartland and Werley score. The mean Gartland and Werley score showed significant improvement from 1 month to 6 months in all the patients. At 6 months, 87.1% patients had excellent outcome and 12.9% patients had good outcome. In **Santhosh et al.**^[9] study, 40% patients had excellent, 46.66% had good, 6.66% had fair and 6.66% had poor results, according to Gartland and Werley Scoring system. Similarly, another study done by **Keizer et al.**^[16] reported excellent outcome in 53.8% patients, 42.3% good and 3.8% fair results. **Gowda et al.**^[14] reported excellent outcome in 50% patients, 43.3% good and 6.7% fair results. The results achieved in our study are much better than that reported by Santhosh, Keizer and Gowda.

Complications were seen in 4 (12.9%) patients. Of them 1 patient complained of complex regional pain syndrome and 3 patients complained of wrist stiffness. **Sharma et al.**^[10] reported an overall complication rate of 15.22%. **Mohapatra et al.**^[84] reported superficial skin infection in 8%, serous discharge in 4% and loss of reduction in 4% patients, with an overall complication rate of 16%. While, a study done by **Singh et al.**^[17] reported no complications after open reduction and internal fixation with volar plating. In our study, we found a slightly higher rate of complications, when compared with the other studies.

The limitation of present study was that, the surgeries were performed by different surgeons, hence there may be variation in the results obtained. Even though present study has a limitation, the results of our study are comparable with the available literature.

Conclusion:-

We found that open reduction and internal fixation with volar plating provided excellent to good wrist outcome in patients with distal end radius fractures with minimal complications. Volar plating provides stable fixation for early mobilization, leading to early resumption to pre-trauma functional level.

Although we obtained excellent to good results with open reduction and internal fixation with volar plating in distal end radius fractures, the results cannot be extrapolated to the general population as the sample size was small. Hence, we recommend that large multi-centric studies be performed before generalizing the results.

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