



# International Journal of Orthopaedics Sciences

E-ISSN: 2395-1958

P-ISSN: 2706-6630

IJOS 2023; 9(2): 45-57

© 2023 IJOS

<https://www.orthopaper.com>

Received: 30-01-2023

Accepted: 08-03-2023

**Dr. Reenkesh Ishwarbhai Chaudhri**

Department of Orthopaedics,  
Medical College Baroda & SSG  
Hospital, Maharaja Sayajirao  
University, Vadodara, Gujarat,  
India

**Dr. Gaurang M Patel**

Associate Professor, Department  
of Orthopaedics, Medical College  
Baroda & SSG Hospital,  
Maharaja Sayajirao University,  
Vadodara, Gujarat, India

**Dr. Arish R Patel**

Department of Orthopaedics,  
Medical College Baroda & SSG  
Hospital, Maharaja Sayajirao  
University, Vadodara, Gujarat,  
India

**Dr. Kushan M Vaghela**

Department of Orthopaedics,  
Medical College Baroda & SSG  
Hospital, Maharaja Sayajirao  
University, Vadodara, Gujarat,  
India

**Dr. Arjan V Karmaur**

Department of Orthopaedics,  
Medical College Baroda & SSG  
Hospital, Maharaja Sayajirao  
University, Vadodara, Gujarat,  
India

## A study of functional outcome of distal end radius fractures treated by volar plating

**Dr. Reenkesh Ishwarbhai Chaudhri, Dr. Gaurang M Patel, Dr. Arish R Patel, Dr. Kushan M Vaghela and Dr. Arjan V Karmaur**

DOI: <https://doi.org/10.22271/ortho.2023.v9.i2a.3353>

### Abstract

- To study the results of operative management of distal radius fractures in terms of functional and radiological outcome, with open reduction and internal fixation with Volar compression plates.
- To study the effectiveness and complications of distal radius fractures treated with Volar compression plates
- To obtain a percentage of Functional recovery in patient of Distal Radius treated with Open Reduction and Internal Fixation with Volar compression plates.
- The study comprised of 30 cases of distal radius fractures in adults.
- All patients were treated with open reduction and internal fixation with a volar compression plate. The follow-up ranged from 4-6 months. The average age was 46.7 years with the fracture being more common in the 3rd to 7th decades.
- Males were predominant with right wrist affection more than left. All fractures were either due to road traffic accidents or fall on the outstretched hand.
- 46.66% of the cases were unskilled labourers.
- Most of the fractures were of AO type A2, A3, B2, B3, C1, C2.
- The average surgical lag time was 2.43 days. Surgery was delayed till the fifth day in cases, as the patients were not fit for surgery.
- Most of the patients had their range of motion within the normal functional range. One patient had wrist stiffness. All of them were able to go back to work.
- The mean fracture union time in our study was 6.5 weeks.
- Complications were minimal. There was 1(3.33%) case of wrist stiffness due to faulty implantation like intra-articular screw placement.
- There was 1(3.33%) case of non union.
- Using the scoring system by Green and O'Brien Score (Cooney modification), we had 06(20%) excellent results, 14(46.66%) good results, 08(23.33%) fair results & 4(13.33%) poor results.

**Keywords:** Volar plating, distal end radius fractures

### Introduction

Fractures of the distal radius constitute one of the most common skeletal injuries treated by orthopedic surgeons. These injuries account for one sixth of all fractures and represent 17% of all the fractures evaluated in emergency room.

The incidence of these fractures appears to be both age and gender specific. There are three peaks of the fracture distribution:

1. Children aged 5-14 years
2. Male under the age of 50
3. Females over the age of 40 years

### These fractures represent two very different injuries

1. In old age due to osteoporosis.
2. The traumatic injury in younger males, where the injury is not as strongly related to gender, but related to high energy injuries (21% of all fractures) rather than to simple fall.

The majority of the fractures in elderly are extra-articular, whereas there is much higher incidence of intra-articular fractures in younger individuals.

**Corresponding Author:**

**Dr. Reenkesh Ishwarbhai Chaudhri**

Department of Orthopaedics,  
Medical College Baroda & SSG  
Hospital, Maharaja Sayajirao  
University, Vadodara, Gujarat,  
India

As the consensus prevails, the vast majority of the distal radius fractures are intra-articular injuries resulting in disruption of both radio-carpal and radio-ulnar joints.

The management of distal radius fractures has undergone an extraordinary evolution over the preceding two decades. Options are: Universal cast treatment, Neutralization with bridging external fixators, Percutaneous pinning with or without cast application, Dorsal buttress plating & Volar plating.

Although some patients still seem to confirm Abraham colles' famous remarks that casted wrist "will at some remote period again enjoy perfect freedom in all of its motions and be completely exempt from pain".

Essentially, we know that elderly patients will tolerate more displacement (and close treatments) than younger patients, but some still have poor outcomes.

Open Reduction and Internal Fixation is an alternative but definitively valid treatment option for displaced intra-articular and extra-articular distal radius fractures, which cannot be taken care of with close manipulation, ligament otaxis& casting or external fixation.

Restoration of the radio-carpal joint stability anatomically, radiologically and restoration of the functions clinically is the prime desire.

Operative treatment with internal fixation is increasingly becoming popular as it provides direct control & maintenance of the physio-anatomical parameters, prevents the collapse and spares the bridging of the wrist joint and early mobilization.

The distal radius fractures can be accessed with either volar or dorsal approach. Plating technique with volar approach is the preferred one as it avoids the extensor tendon injury as well as avoids difficult dissection and plating on irregular dorsal distal radius surface.

We have decided to study the results of management of distal radius fractures with the open reduction and internal fixation with Volar compression plates.

## Materials and Methods

30 Adult patients with distal radial fractures treated between October 2021 to October 2022 under the Department of Orthopaedics, Government Medical College and SSG Hospital, Vadodara were included in this study.

## Study Population

Patients of the Department of Orthopaedics enrolled under study of distal end radius fractures treated with volar plating and consented to participate in the study defined by inclusion and exclusion criteria.

## Sample size

Total 30 patients operated for volar Plating were identified to be included in study.

## Inclusion criteria

- Adults (aged over 18 years), both male and female with unstable, comminuted or intra articular fractures of distal end radius
- Close fractures
- Open grade 1 & 2 fractures
- Displaced fractures

## Exclusion criteria

- Patients aged below 18years
- Medically unfit for surgery

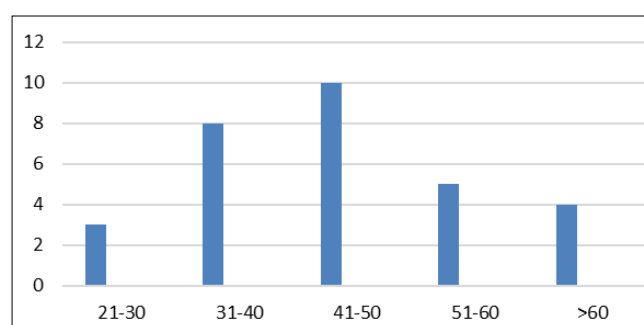
- Pathological fractures
- Open grade 3 fractures
- Compound fractures associated with vascular injuries
- Patients not willing for surgery

## Results

The present study consists of 30 cases of distal radius fractures treated at Sir Sayajirao General Hospital, Vadodara Gujarat. All cases were followed up periodically during the period of October 2021 to October 2022. The following are the observation made to the available analysed as follows.

**Table 1: Age incidence**

Age In Years	No. of cases	Percentage (%)
21 – 30	3	10%
31 – 40	8	26.66%
41 – 50	10	30%
51 – 60	5	16.66%
>60	4	13.33%
Total	30	100%

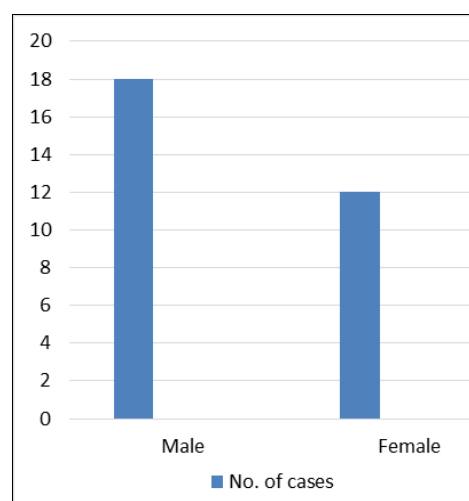


**Fig 1: Age incidence**

- In this series, more younger age group involvement seen due to out door activities.
- 3 (10%) patients were between 21-30 years, 8(26.66%) between 31-40 year, 10(30%) between 41-50 years, 5(16.66%) between 51-60 years and 4(13.33%) patients between >60 years.

**Table 2: Gender Distribution**

Gender	No. of cases	Percentage (%)
Male	18	60%
Female	12	40%
Total	30	100%

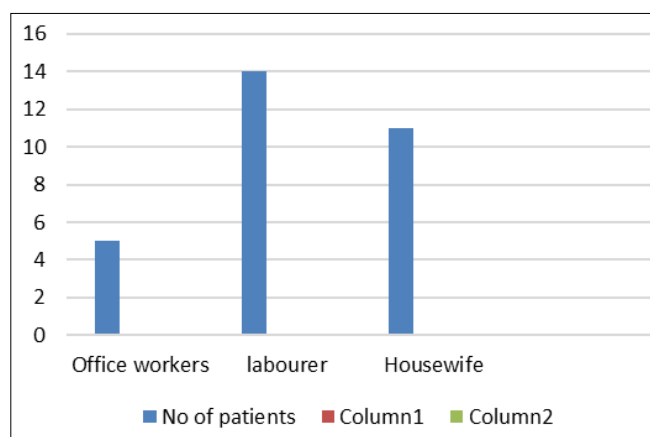


**Fig 2: Gender distribution**

- Male predominance due to more involvement in out door activities.
- Out of 60 patients, 18 (60%) were males and 12 (40%) were females.

**Table 3:** Occupation

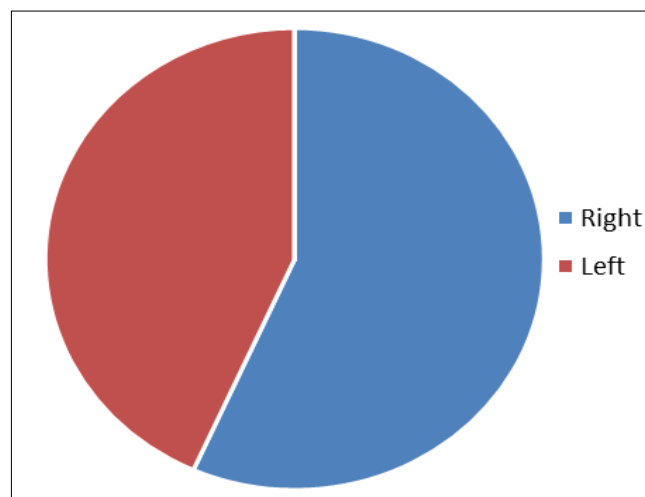
Occupation	No. of Patients	Percentage (%)
Office workers	05	16.66%
Labourer	14	46.66%
Housewife	11	36.66%
Total	30	100%

**Fig 3:** Occupation

- The above table shows that distal radial fractures are common in labourers which is 46.66% mostly due to fall from height and in vehicular accidents.

**Table 4:** Side of involvement

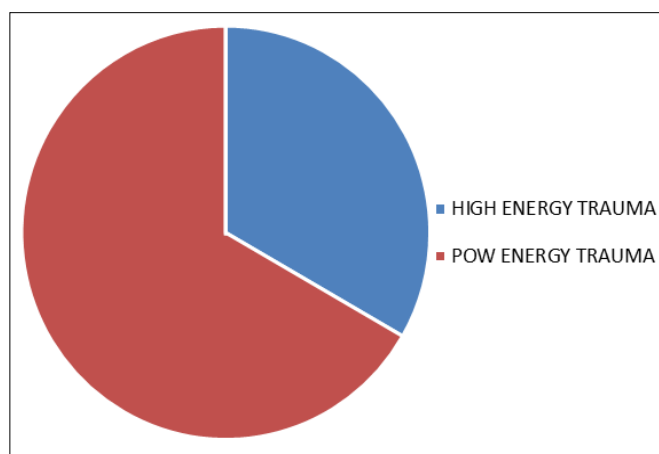
Side	No. of cases	Percentage (%)
Right	17	56.66%
Left	13	43.33%
Total	30	100%

**Fig 4:** Side of involvement

- More involvement of dominant side seen .
- Right side (dominant wrist) was involved in 17(56.66%) patients and the left side was involved in 13(43.33%) patients.

**Table 5:** Mode of injury

Mode of Injury		No. of Cases	Percentage (%)
High Energy Trauma	Vehicular Accident Fall from Height Assault Others	10	33.33%
Low Energy Trauma	Fall while walking	20	66.66%
Total =		30	100%

**Fig 5:** Mode of injury

We had 20 patients of low velocity trauma and 10 patients with high velocity trauma like road traffic accidents and fall from height which is more commonly seen in young age group due to more out door activities.

**Table 6:** AO classification

Type	No. of cases	Percentage (%)
A1	00	00%
A2	16	53.33%
A3	03	10%
B1	00	00%
B2	03	10%
B3	05	16.66%
C1	01	03.33%
C2	02	06.66%
C3	00	00%
Total	30	100%

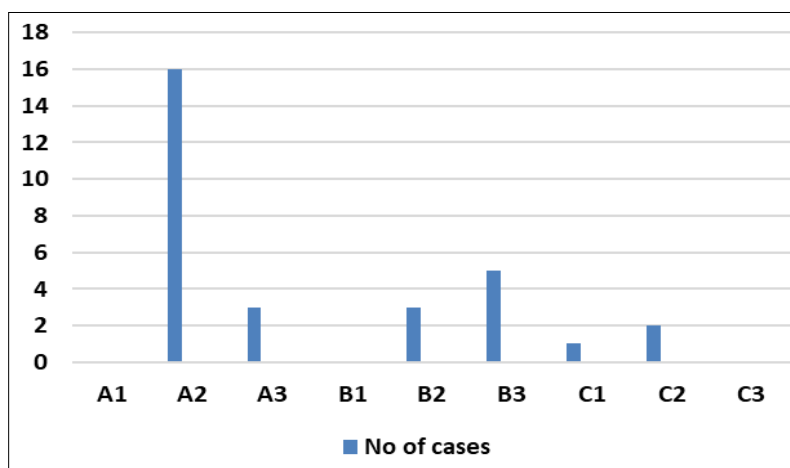


Fig 6: AO classification

Of the 60 cases 16(53.33%) of the fractures were of Type A2, 03(10%) of Type A3, 03(10%) of Type B2, 05(16.66%) of type B3, 01(00.33%) of Type C1, 2(00.66%) of Type C2.

A2 = radius, simple and impacted.

A3 = radius, multifragmentary.

B2 = radius, frontal, dorsal rim.

B3 = radius, frontal, volar rim.

Table 7: Extra articular and intra articular fracture:

Type	No. of cases	Percentage (%)
Extra Articular Fractures	19	63.33%
Intra Articular Fractures	11	33.665
Total	30	100%

- 19(63.33%) of the fractures were of Extra Articular Type. 11(33.33%) were Intra Articular Type fractures.

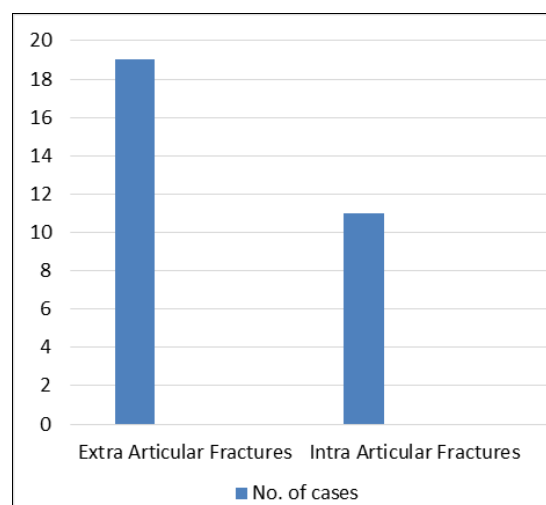


Fig 7: Extra articular and intra articular fracture

Table 8: Associated Injuries

Associated Injuries	No. of cases	Percentage (%)
Ipsilateral lower third ulna fracture	02	06.66%
Fracture proximal tibia	01	03.33%
Distal radioulnar joint disruption	01	03.33%
Ipsilateral fracture greter tuberosity humerus	01	03.33%
No associated injury	25	83.33%
Total	30	100%

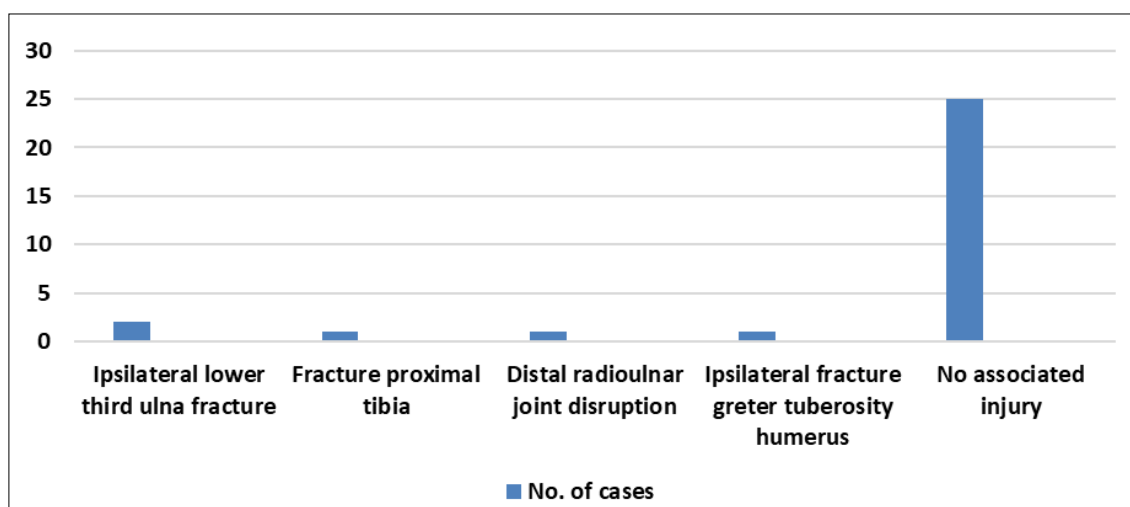
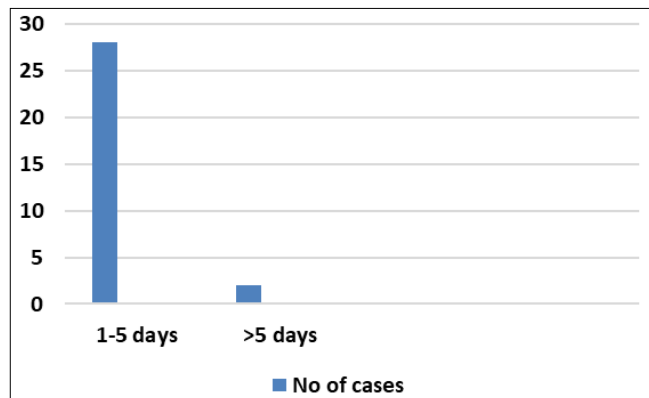


Fig 8: Associated Injuries

- Out of 30 cases, 05 (16.66%) patients had associated injuries.
- 25(83.33%) patients were with no associated injuries.

**Table 9:** Surgical Lag Time:

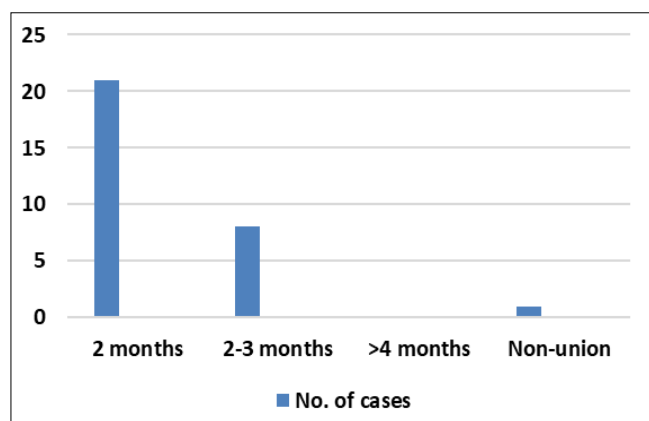
Surgical Lag Time	No. of cases	Percentage (%)
1-5 days	28	93.33%
>5 days	02	06.66%
Total	30	100%

**Fig 9:** Surgical Lag Time:

- Surgery was done between 1-5 days in 28 (93.33%) patients as an election procedure.
- Surgery was delayed upto the 6<sup>th</sup> day in 02 (00.66%) patients because they were not fit for surgery and operated after they became fit for surgery.

**Table 10:** Duration of fracture union (radiological)

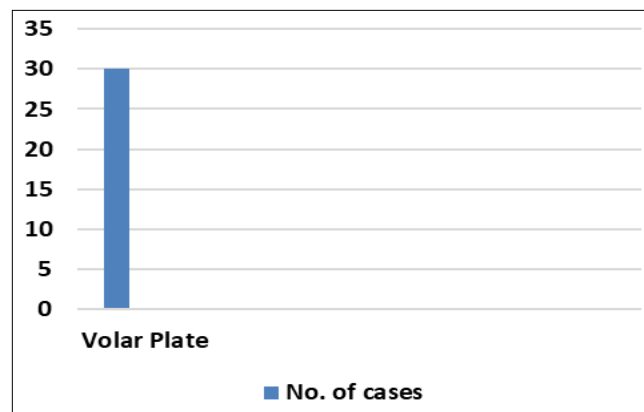
Time of union (radiological)	No. of cases	Percentage (%)
2 months	21	70%
2-3 months	08	26.66%
>4 months	00	00%
Non-union	01	03.33%
Total	30	100%

**Fig 11:** Duration of fracture union

- In the present study 21 (70%) patients had union within 2 months and 08 (26.66%) patients had union in 2-3 months.
- There were 01 (03.33%) case of nonunion.

**Table 12:** Method of fixation:

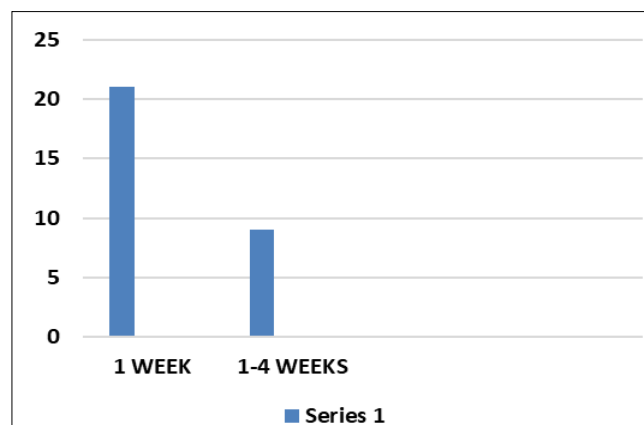
Method of fixation	No. of cases	Percentage (%)
Volar Plate	30	100%
Total	30	100%

**Fig 12:** Method of fixation

In our study 30 patients with volar barton fracture were treated by volar plate alone.

**Table 13:** Duration of splintage

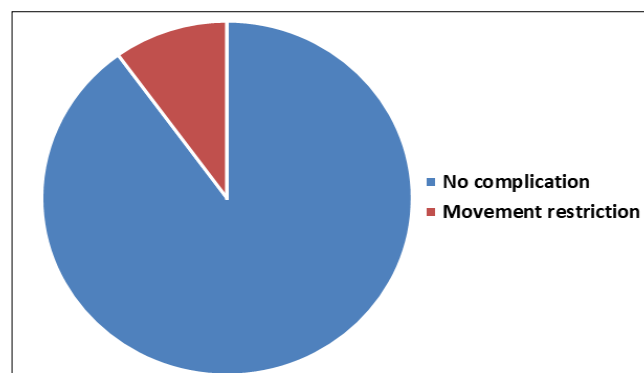
Duration of Splintage	No. of cases	Percentage (%)
1 Weeks	21	70%
1-4 weeks	09	30%
Total	30	100%

**Fig 13:** Duration of splintage

- The minimum period for which the fracture was splinted in this series was 7 days and maximum period was 28 days.

**Table 14:** Complications

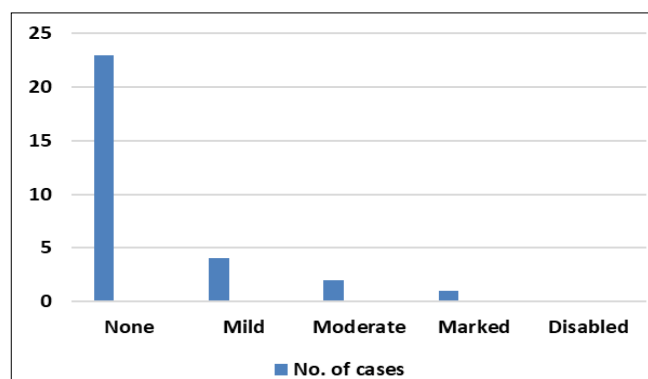
Complications	No. of cases	Percentage (%)
Movement restriction	03	10%
No complications	27	90%
Total	30	100%

**Fig 14:** Complications

- 3(10%) patients had movement restriction.
- Other 27(90%) patients do not had complications.

**Table 15:** Assessment of severity of pain:

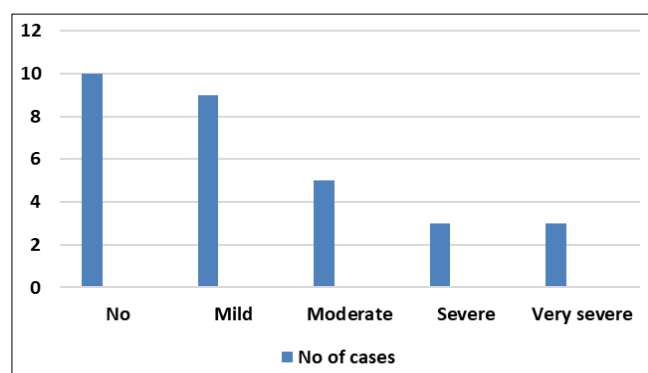
Severity	No. of cases	Operative Percentage%
None	23	76.66%
Mild	04	13.33%
Moderate	02	06.66%
Marked	01	03.33%
Disabled	00	00.00%
TOTAL	30	100%

**Fig 15:** Severity of Pain

- Most of our patients had no pain at the follow-up.
- This could be due to accurate reduction, soft tissue care especially of flexor tendons and attention to implants especially the screw size.

**Table 16:** Grip Weakness

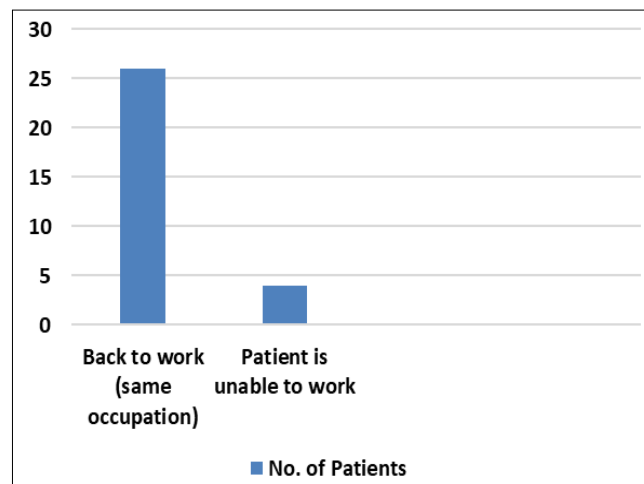
Grip Weakness	No. of Patients	Percentage %
No	10	33.33%
Mild	09	30%
Moderate	05	16.66%
Severe	03	10%
Very severe	03	10%
Total	30	100%

**Fig 16:** Grip weakness

- In our study most of the patient gain good grip strength and only 3 cases developed significant weakness.

**Table 17:** Ability to go back to work

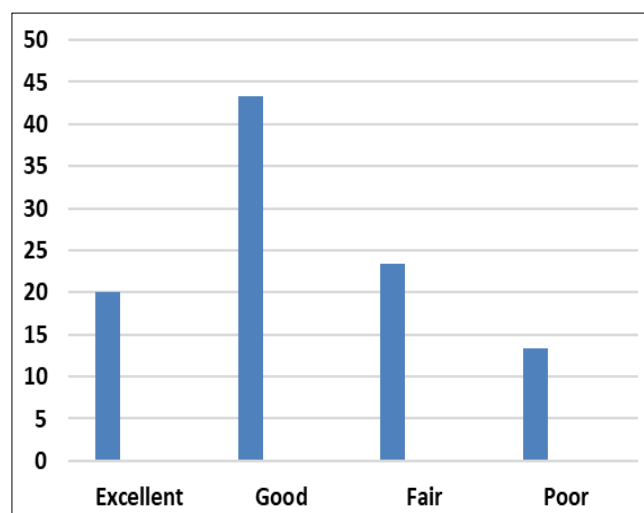
Ability to go back to Work	No. of Patients	Total (%)
Back to work (same occupation)	26	86.66%
Patient is unable to work	04	13.33%
Total	30	100%

**Fig 17:** Ability to go back to work

- 26 patients had no difficulty to join previous work.
- 4 cases that had difficulty.

**Table 18:** Results

Type	No. of Patients	Percentage%
Excellent	06	20%
Good	13	43.33%
Fair	07	23.33%
Poor	04	13.33%
Total	30	100%

**Fig 18:** Results

- The assessment of results made using the scoring system according to Green and O'Brien Score (Cooney modification) System, based on objective and subjective criteria, residual deformity and complications.

**Distribution of results****Table 19:** Age group & results

Age Group	21-40 Yrs	41- 60 Yrs	>60 Yrs	Total
Excellent (20%)	04	00	02	06
Good (43.33%)	04	08	01	13
Fair (23.33%)	03	03	01	07
Poor (13.33%)	00	04	00	04
Total (100%)	11	15	04	30

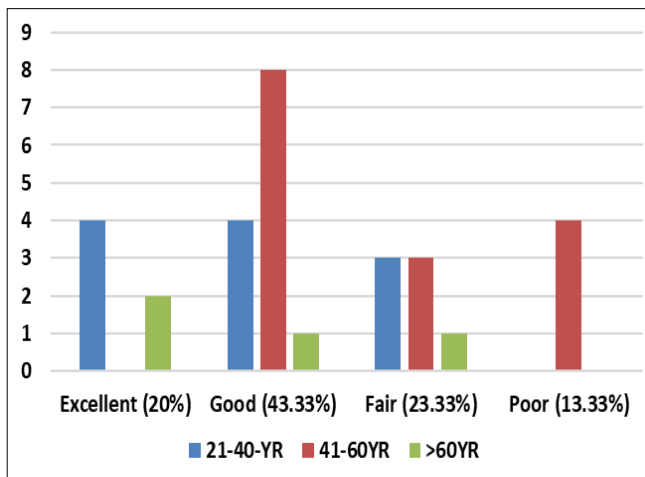


Fig 19: Age Group &amp; Results

- Apart from four patients, one each from the age group of (41-50) yrs, (51-60) yrs and (>60) yrs had good result.
- The good results are seen in younger groups while more of poor results are found in elder age group.

Table 20: Gender and Result

Gender	Male (18)	Female (12)	Total
Excellent (20%)	04	02	06
Good (43.33%)	08	05	13
Fair (23.33%)	04	03	07
Poor (13.33%)	02	02	04
Total (100%)	18	12	30

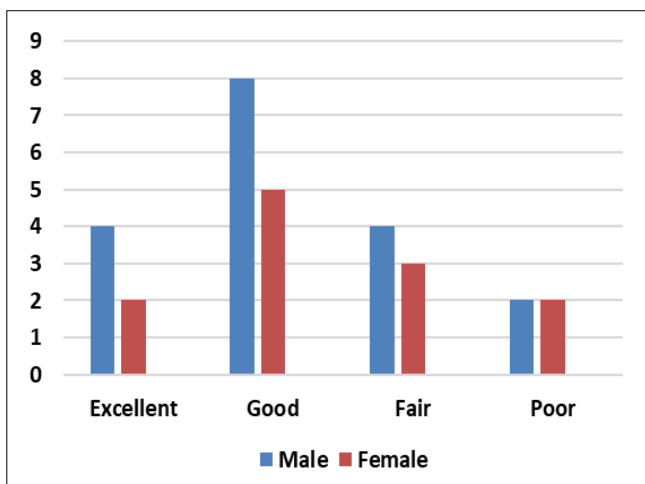


Fig 20: Gender and result

- No correlation between gender and final outcome was found in our series.

Table 21: Occupation and Result

Occupation	Office worker	Labourer	Housewife	Total
Excellent (20%)	03	01	02	06
Good (43.33%)	00	08	05	13
Fair (23.33%)	02	03	02	07
Poor (13.33%)	00	02	02	04
Total (100%)	05	14	11	30

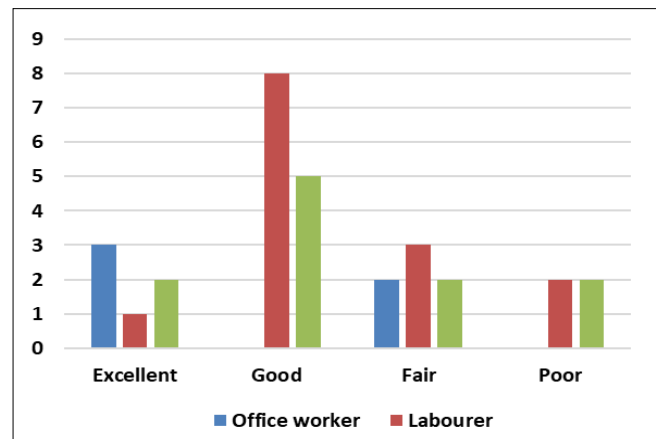


Fig 21: Occupation and result

- All group shows good results more poor results found in labourer and housewife groups.

Table 22: Mode of trauma and Results

Outcome	High Energy Trauma	Low Energy Trauma	Total
Excellent (20%)	01	05	06
Good (43.33%)	02	11	13
Fair (23.33%)	04	03	07
Poor (13.33%)	03	01	04
Total (100%)	10	20	30

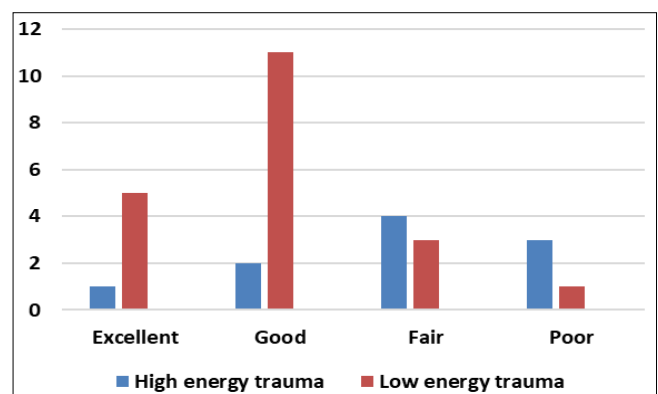


Fig 22: Mode of trauma and result

- All the good, fair and poor results in our series had sustained a high velocity trauma, High velocity trauma tends to cause excessive comminution at the fracture site and disrupts the normal anatomical relations of the bone and the surrounding soft tissues abnormality, affecting the final outcome.

### Type of fracture and result

Table 23: AO Classification

AO type	A1	A2	A3	B1	B2	B3	C1	C2	C3
Excellent (20%)	00	03	00	00	00	01	00	02	00
Good (43.33%)	00	09	01	00	02	01	00	00	00
Fair (23.33%)	00	03	02	00	01	00	01	00	00
Poor (13.33%)	00	01	00	00	00	03	00	00	00
Total (100%)	00	16	03	00	03	05	01	02	00





Fig 23: Classification

- All the patients treated from each of the group yielded excellent results except four. This could be due to excessive comminution of the fracture site in AO types
- and extension of the fracture in the metaphyseal region.
- The poor result in B3 type fracture in patients is due to extensive comminution.

Table 24: Articular Involvement and Result

Type	Extra articular Fractures	Intra articular Fractures	Total
Excellent (20%)	03	03	06
Good (43.33%)	10	03	13
Fair (23.33%)	05	02	07
Poor (13.33%)	01	03	04
Total (100%)	19	11	30

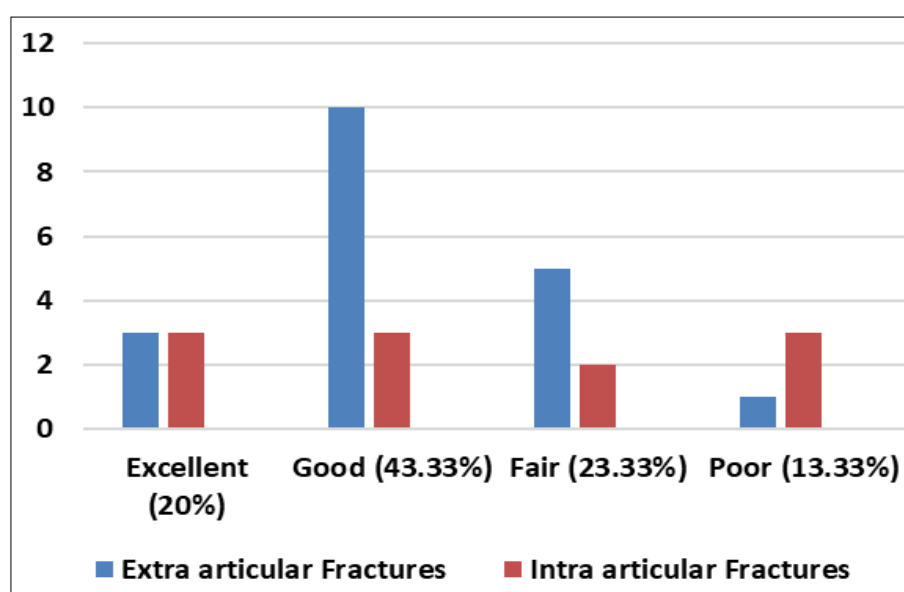


Fig 24: Articular involvement and result

- Though articular involvement has an impact on the outcome of surgery, the excellent result in most of the patients in our series is attributed to the
- maintenance of articular congruity at the time of fracture reduction and fixation.

Table 25: Method of Fixation

Outcome	Volar plate	Total
Excellent (20%)	06	06
Good (43.33%)	13	13
Fair (23.33%)	07	07
Poor (13.33%)	04	04
Total (100%)	30	30



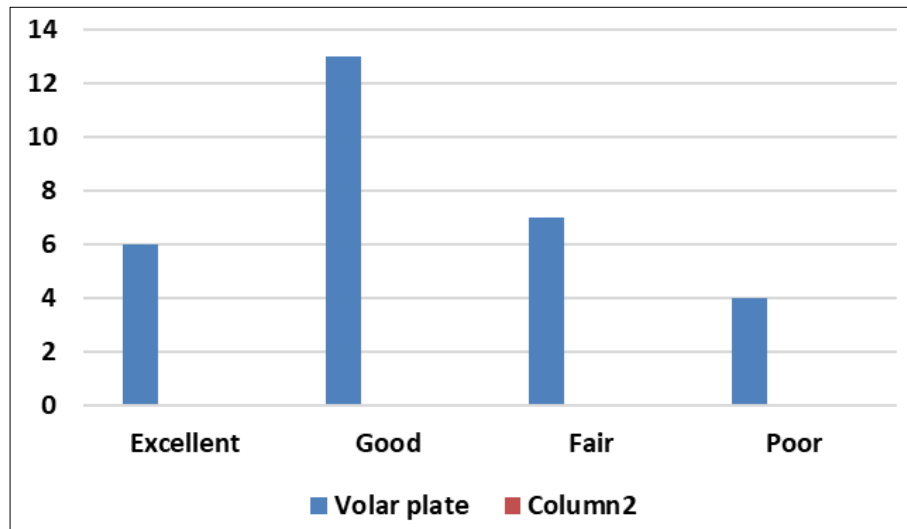


Fig 25: Method of fixation

- Our study shows volar plate gives better results in case of fracture lower end radius .

#### Case illustration

##### Clinical and radiological outcome

Case no. 6 Narendra Babubhai Sankhala (37/m)

##### Excellent Result

##### Movements at final follow up



### Preoperative X-Ray



Antero-Posterior View Lateral View

### First Month Follow Up X Ray



Antero-Posterior View Lateral View

### Fourth Month Follow Up X Ray



Antero-posterior view lateral view

**Case No 13: Niluben Balvannt Singh Rathod (53/F)**  
**Movement at final follow up**



**Preoperative X Ray**



Antero-Posterior View Lateral View

**First Month Follow Up X Ray**



Antero-Posterior View Lateral View

## Fourth Month Follow Up



Antero-Posterior View Lateral View

### Discussion and Analysis

More than 200 years have passed since Colles' described the fracture of the distal end of the radius. It is remarkable that this common fracture remains one of the most challenging of the fractures to treat. There is no consensus regarding the description of the condition and the appropriate outcome.

Distal radius fractures are the most frequently seen upper extremity fractures. The main objective of its treatment is the re-establishment of anatomic integrity and functioning. In unstable intra-articular fractures, re-establishment of intra-articular integrity of the wrist and maintaining the radial length are often not possible with closed methods. In such cases, where an open reduction is required, various surgical methods and fixation materials can be used. A better understanding of wrist anatomy and functioning through the studies conducted in recent years, as well as the increasing expectations of patients have expanded the borders of surgical treatment. Besides, improvements in fixation materials have provided new opportunities.

Due to their intra-articular and unstable nature, B and C type of AO system distal radius fractures are treated surgically. Today, open reduction and plate fixation are widely recognized surgical methods. Locked plates are in the progress of replacing conventional buttress plates. While facilitating the positioning, those anatomical plates with screw-plate interlocking fracture have more biomechanical strength against forces applied on the fracture surfaces. Because of their biomechanical strength, locked plates are preferred in osteoporotic and / or multiple fragmentary fractures.

However, there is no consensus neither about how to approach to distal radius nor the positioning of plate. During recent years, volar approach has become more popular.

The present study was undertaken to assess the functional outcome of operative management of distal radius fracture using a volar locked compression plate.

### Conclusion

The present study was undertaken to assess the functional, clinical & radiological outcome of operative management of distal radius fracture in adults by volar compression plate in

Department of Orthopaedics, Medical College Baroda and SSG hospital and the following were conclusions drawn.

Distal radius fractures are more common in 3rd to 7th decades. Male preponderance is due to their involvement in heavy manual labour, outdoor activities and riding vehicles. Most of the fractures in younger individual were due to motor vehicle accidents or high energy trauma which were usually intra articular and displaced. The fractures occurring in the elder individuals were due to trivial fall on out stretched hand & were low energy trauma leading to extra articular fracture in osteoporotic bone.

Locked plates that widely used provided successful results especially for treatment of intra articular unstable fracture of distal radius. This method, which is effective in anatomic realignment allowed early joint mobilization, owing to its fixation strength. Close placement of screws to joint interface and screwing capabilities in different directions are its biomechanical superiorities. Volar and dorsal approach provides both access with minimal surgical trauma on distal radius and fixation with the better adaptation of surrounding soft tissue. In the subjects of our study, a successful anatomic alignment was acquired with volar and dorsal approach, regardless of the direction of fracture angulation. The patients who were young adults in majority, went back to their daily activities with 90% recovery.

Use of locked compression plates in distal radius fracture provided good to excellent results with correction and maintenance of distal radius anatomy. By using this plates joint motion & daily functioning were recovered in shorter duration.

### Acknowledgments

The acknowledgments of the funding body, institutional head, coworkers, field assistants, local people, etc. should be briefed and declaration of any conflict of interest related to work.

### Conflict of Interest

Not available

### Financial Support

Not available



## References

1. Wong KK, Chan KW, Kwok TK, Mak KH. Department of Orthopaedics and Traumatology, Kwong Wah Hospital, Hong Kong (Journal of Orthopaedic Surgery. 2005;13(2):153-157
2. Ayhnn Kilic, Yavuz Kahukcuoglu, Ufuk Ozkaya, Murat Gul, Sami Sokucu, Umit Ozdogan. 2009;43(4):303-308. Doi: 10.3944/Aott.2009.303
3. Anakwe RF, Khan LAK, Cook Re, McEachan JE. Journal of Orthopaedic Surgery and Research. 2010;5:51
4. Paritosh Gogna, Harpal Singh, Selhi Rohit, Singla Ashish Devgan, Narender Kumar Magu, Pankaj Mahindra, *et al.* Hindawai Publishing Corporation ISRN Orthopedics; c2013.
5. Margret Fok WM. MBChEB, FRCSEd (Orth), FHKAM, FHKCOS Melissa A. Kiausmeyer: MD1 Diego. L. Fernandez, MD Jorge. L. Orbay MD Alex Lluch Bergada. MD 3 Wrist Surg. 2013;2:247-254.
6. Fitoussi F, Chow SP. Treatment of displaced Intra articular fractures of the distal end of Radius with Plates, J Bone Joint Surg (A). Sep 1997;79-A(9):1303-1311.
7. Gerostathopoulos Nicolaos, Kalliakmanis Alkiviadis, Fandridis Emmanouil, Georgoulis Stylianos. Trimed Fixation system for Displaced fractures of the Distal Radius Journal of Trauma 2007 April;62(4):913-918.
8. Ruch David S. Fractures of the distal Radius and Ulna, Chapter 26 in Rockwood and Green's Fractures in Adults, Philadelphia: Lippincott Williams & Wilkins. 6<sup>th</sup> Ed; c2006. p. 909-964.
9. Cognet JM, Geanah A, Marsal C, Kadoch V, Gouzou S, Simon P. [Plate fixation with locking screw for distal fractures of the radius] Rev Our Orthop Rennstrice Appar Mot. 2006 Nov;92(7):663-72.
10. Adani R, Tarallo L, Amorico MG, Tata C, Atzei A. The treatment of distal radius articular fractures through LCP system. Hand Surg. 2008;13(2):61-72.

### How to Cite This Article

Chaudhri RI, Patel GM, Patel AR, Vaghela KM, Karmaur AV. A study of functional outcome of distal end radius fractures treated by volar plating. International Journal of Orthopaedics Sciences. 2023;9(2):45-57.

### Creative Commons (CC) License

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International (CC BY-NC-SA 4.0) License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.