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### **Study of distal radius fracture treated with minimally invasive plate osteosynthesis technique**

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#### **Abstract**

**Objective:** To study the results in terms of functional and radiological outcome of distal radius fractures treated with volar locking compression plates using MIPO technique.

**Introduction:** Minimally invasive procedures decrease surgical damage as well as the incidence of complications. They have their main indication in patients with marked soft tissue lesions. Small incisions, made away from the fracture site, help to minimize further soft tissue injury during surgical stabilization, and they preserve bone vascularity, contributing to bone union and fewer complications. They were first used to treat complex lower extremity metaphysodiaphyseal and periarticular fractures that could not be treated properly using intramedullary nails. Subsequently, its application was expanded to include upper extremity fractures, mainly humerus fractures, but little has been published about its use in distal radius fractures<sup>[3]</sup>.

**Methodology:** A cohort of 20 cases of distal radius fractures treated with MIPO Technique using volar locking compression plates during Jan 2016 to Sep 2016.

**Results:** Out of 20 patients, 13 excellent (65%), 6 good (30%) and 1 fair (5%) and no poor results were obtained using Modified Gartland and Werley's scoring system.

**Keywords:** Distal radius fracture, MIPO Techni que, volar locking compression plate, Modified Gartl and and Werley' s scoring system. Pronator quadratus (PQ) muscle

#### **Introduction**

Fractures of the distal radius constitute one of the most common skeletal injuries treated by orthopaedic surgeons. These injuries account for one sixth of all fractures and represent 17% of all the fractures evaluated in emergency room. The majority of the fractures in elderly are extra-articular, whereas there is much higher incidence of intra-articular fractures in younger individuals<sup>[1]</sup> The objective of this study was to evaluate the objective and subjective results achieved after stabilization of distal radius fractures with locked volar distal radius plates using a minimally invasive plate osteosynthesis (MIPO) technique. Minimally invasive procedures decrease surgical damage as well as the incidence of complications. They have their main indication in patients with marked soft tissue lesions. Small incisions, made away from the fracture site, help to minimize further soft tissue injury during surgical stabilization, and they preserve bone vascularity, contributing to bone union and fewer complications. In distal radius fractures volar locked plates inserted using the MIPO technique makes it possible to achieve good reduction and stable fixation, with minimal pain, and good functional and asthetic results. However, these are technically demanding procedures and require knowledge of indirect reduction techniques and fluoroscopy.

#### **Methods**

This study focuses on 3 months outcome of distal radius fracture treated with distal radius locking plate using MIPO technique at a tertiary care hospital during the period of Jan 2016 to Sep 2016. Final outcome of distal radius fracture was assessed using Modified Gartland and Werley' Score.

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**Inclusion Criteria**

- All fractures of distal radius in adult with recent (<4week) history of trauma.
- Close fractures
- Open grade 1 & 2 fractures

**Exclusion Criteria**

- Patients aged below 18years
- Medically unfit for surgery
- Fractures in pregnant females
- Pathological fractures
- Open grade 3 fractures
- Patients having vascular injury

Radiographs were taken and fracture was classified according to AO Classification. Pre-operative workup including blood investigation, X-ray, ECG and pre-anaesthetic check up was done. Pre-operative radiographs were assessed for radial angulation, palmar tilt, radial length and radial shift. Preoperatively antibiotics were given as per hospital protocol. All patients were operated with distal radius volar locking plate using MIPO Technique. The first step was traction and indirect reduction maneuvers under fluoroscopy. A distal oblique incision was then made following the orientation of the articular surface of the radius, beginning proximal to the wrist crease and extending proximally 2 to 3 cm; this exposed the entire distal edge of the pronator quadratus (PQ) muscle and the distal aspect of the volar surface of the radius. Next, the distal border of the PQ muscle was elevated using a periosteal elevator to form a submuscular tunnel, and the plate was slid under it. Once the plate was aligned with the radial diaphysis, its correct length was confirmed under fluoroscopy. A 2 to 3cm long proximal incision was made at the proximal screw holes. First, one of the proximal screws was placed, preferably using an oval screw hole to allow the plate's location to be corrected if necessary. The indirect reduction maneuvers were repeated until adequate reduction and correct implant alignment was achieved, then the distal pegs were put into the place. Both active and passive physiotherapy was encouraged in immediate postoperative period. Regular clinical and radiological follow up was done at 4, 8 and 12 weeks interval postoperatively. Final assessment was done using Modified Gartl and and Werley's Score. All patients who had a minimum follow up of at least 3 months were included in the study.

**Observation and Analysis**

The study comprised of 20 cases of distal radius fracture. Following observations were made

**Age Incidence**

Age in Years	No. of Cases	Percentage %
21- 30	5	25
31- 40	2	10
41- 50	6	30
51 – 60	5	25
61 – 70	2	10
Total	20	100

**Life Style**

Life style	No. of Patients	Percentage
Sedentary	2	10
Household/ Average	3	15
Strenuous / Labourer	13	65
Skilled/ Professional	2	10
Total	20	100

**Mode of Injury**

Mechanism of Injury		No. of Cases	Percentage (%)
High Energy Trauma	Vehicular Accident	10	85
	Fall from Height	4	
	Assault	3	
Low Energy Trauma	Fall while walking	3	15
Total		20	100

**AO Classification**

AO Type	No. of Cases	Percentage (%)
A	15	75
B	1	5
C	4	20
Total	20	100

**Residual Deformity**

Deformity	No. of Patients	Percentage %
Prominent Ulna Styloid	4	20
Dorsal Angulation	0	0
Radial Deviation	0	0
Mixed Deformity	0	0
No Residual Deformity	16	80
Total	20	100

**Over all Result**

TYPE (using Gartland & Werley's demerit system)	No. of Patients	Percentage%
Excellent	13	65
Good	6	30
Fair	1	5
Poor	0	0
Total	20	100

**Pre-Operative**



Follow-Up At 4 Weeks



Follow Up At 12 Weeks



Dorsiflexion



Palmarflexion



Supination



Pronation



Ulnar deviation



Radial deviation

### Discussion and Analysis

The MIPO technique was first described for the treatment of lower extremity fractures with combined fracture patterns, poor bone quality and/or significant soft tissue damage. In the past years, use of these MIPO techniques has been extended to upper extremity [3]. MIPO technique was popularized by

Krettek *et al* who described fracture fixation using conventional plates placed under sub muscular tunnels and demonstrated that the technique helped in preserving bone vascularity. The study comprised of 20 cases of distal radius fracture with male preponderance with 70% males. The increased incidence in males was probably due to their

involvement in outdoor activities, riding vehicles and heavy manual labour. 85% of the patients had high energy trauma with majority of cases due to road traffic accidents. Most of the patients were occupationally unskilled labourers. Most of the fractures were of type A of the AO classification and were close fractures. There were no complications like infection, tendon or nerve entrapment, reflex sympathetic dystrophy or delayed or mal-union in our study. The average grip strength was 72.4% compared to contralateral hand measured using gripometer. The average radial height, radial angulation and palmar tilt was 12.78, 21.64 and 8.22 respectively. Using Gartlan & Werley's demerit system we had 13 (65%) excellent results, 6(30%) good results and 1 (5%) fair results. No poor results were recorded.

### Conclusion

Majority of the patients returned to work within 3 months of surgery. Patients operated with MIPO technique have good grip strength with early physiotherapy. The approach taken between 'FCR' (Flexor Carpi Radialis) and Radial Artery interval is safe as no complication like tendon or nerve entrapment has been recorded in our study. Use of locked compression plates in distal radius fractures provide good to excellent results with correction and maintenance of distal radius anatomy. Outcome of close distal radius fracture is better than open grade 1 fracture. This could be due to better surrounding soft tissue conditions in close fracture. Most of the fractures are due to road traffic accidents. However, the outcomes in both high and low energy trauma cases are equivalent. Limitations of this study was small population (20 patients) and short term follow up.

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