



**ORIGINAL RESEARCH PAPER**

**Orthopaedics**

**POLYAXIAL ANATOMICAL VOLAR LOCKING PLATE – ONE SOLUTION FOR ALL**

**KEY WORDS:** distal radius, polyaxial screws

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**ABSTRACT**

**INTRODUCTION:** Distal radius intra-articular fractures are frequent and various methods of fixation are available. When there is shearing type barton fracture buttress plate is the only choice of implant. Invention of locking plate revolutionized treatment of intraarticular fractures. But in comminuted fractures available designs of locking plate does not address all 3 columns, leading to usage of different plates for each column.

**OBJECTIVE:** To evaluate the design of volar locking plate with polyaxial locking screws for addressing all columns particularly volar barton fragments

**METHODS AND MATERIAL:** 35 patients aged from 18 – 60 years with distal radius fractures are operated with same implant. Patients were followed up at regular intervals 4weeks, 8 weeks, 12 weeks followed by once in 3 months. Mean follow up period is 1 year.

**RESULT:** Patients are evaluated with Gartland and Werley demerit point system. Out of 35 patients -28 patients had excellent outcome, 7 patients had good outcome

**Conclusion:** Volar locking plate with polyaxial screws can be implant of choice to address all the types of intrarticular distal radius fractures with good results.

**INTRODUCTION:**

Intra-articular fractures of the distal radius represent a therapeutic challenge as compared with unstable extra-articular fractures.<sup>1</sup> Beside being more complicated to reduce and stabilize with internal fixation, these injuries frequently result in malunion, which may result in a less satisfactory long-term functional outcome, if not anatomically reduced. In the past, these fractures were managed with external fixation or a combination of limited open reduction, Kirschner wire (K-wire) augmentation, and bone grafting.<sup>1</sup> However, no implant could able to reduce the shearing fragment. Invention of locking plate revolutionized treatment of intraarticular fractures. Recent development of specifically designed locking implants for the distal radius, fragment-specific fixation has emerged as an option . But in comminuted fractures available design of locking plate does not address all 3 columns, leading to usage of different plates for each column.<sup>2</sup> Open reduction and internal fixation (ORIF) using volar fixed-angle plates has also shown to be a valid treatment option for unstable, dorsally displaced distal radial fractures.

In this retrospective study carried out at our institution we evaluated the functional outcomes of intra-articular distal end radius fracture fixation using anatomical polyaxial volar locking compression plate by open reduction technique.

**METHODS AND MATERIALS:**

Totally, thirty five adult patients with intra-articular distal radial fractures treated at Vinayaka Mission's Medical College and Hospital, Karaikal between June 2018 to July 2021 in the Department of Orthopaedics were included in the study.

**Inclusion Criteria**

Radiological findings confirming intra articular fracture of distal end radius, Frykman classification Type III to Type VIII.

- All adults included from 18-60 years
- Both male and female included
- Closed fracture only.
- Fracture less than two weeks days old.

**Exclusion Criteria**

Open fractures.

- Patients not fit for surgical intervention
- Patients with severe osteoporotic bone.
- Patients with pathological fractures.
- Fracture more than two weeks old
- Patients with head injury and vascular injury

**Time Period To Undergo Surgical Procedure:**

All patients were operated within 14 days of the occurrence of the fracture after complete anaesthetic evaluation. Injection cefuroxime 1.5 gram was administered half an hour before surgery

**Operative Technique:**

Modified Henry's approach was used for the incision of fracture fixation in our study. It uses the interval between Flexor Carpi Radialis (FCR) and the radial artery of the affected side. An initial Z-type incision was made over the wrist crease radial to the FCR tendon followed by extending the exposure distally by incising medial to the radial artery identified using its veina committens carefully and was retracted laterally with the brachioradialis. The FCR and other flexor tendons were retracted medially. The volar carpal branch of the radial artery was encountered and divided in the extended exposure. Caution was expressed with regard to retraction of the soft tissue. Continuous traction on the median nerve with retractors and particularly, self – retaining retractors was avoided.

Lateral border of pronator quadratus was cauterized and elevated from the radial surface of the distal radius. Periosteum was elevated using the periosteal elevators and fracture fragments exposed were reduced and occasionally held with Kirschner's wires. Reduction was obtained by cortical interdigitation of the metaphyseal portion of the fractures and observing the effect of the reduction with image intensifier.

The anatomical volar locking plate was applied with the central portion of the plate elevated 1 to 2mm off the underlying cortex without any offset of plate. The distal extent of the plate was up to the water-shed elevation on the distal radius followed by which the distal most screw levels where initially fixed using 2.7mm locking screws. Care was taken to

fix the radial styloid process first followed by other screw fixation along with the proximal screw layers. Finally the plate was affixed to the radius and fixed with 3.5mm cortical screws at desired level as it acted as a spring pushing the fragments together. Pronator quadratus muscle was used at the time of closure, to cover, in part, the implants that were applied to the palmar surface of the radius.

Once stable fixation was achieved and hemostasis secured, the wound was closed in layers with drain insitu and sterile dressing was applied. The tourniquet was deflated as well as removed and capillary refilling was simultaneously checked on the fingers. The operated limb was supported with a dorsal below elbow POP slab with wrist in the neutral position.

**Post Operative Care:**

Post-operative pain and inflammation were managed using anti-inflammatory analgesics both intravenously as well as orally along with proteolytic enzymes. All patients were give intravenous antibiotics twice daily for 7 days. Affected limb was kept elevated in a below elbow dorsal splint and patients were asked to perform active finger movements as soon as the pain became in evident on the first postoperative day itself.

Immediate postoperative check X-rays were taken in both AP and Lateral views to confirm the reduction. Initial wound inspection was done on the second post-operative day followed by removal of the drain, subsequently dressings were done at fourth, sixth and eighth postoperative day. Simultaneously, sutures were removed on the 10<sup>th</sup> postoperative day. The splints were discarded, replaced by an elasto-crepe bandage and the patients were discharged after the suture removal with advice of active finger movements. In non-compliant patients, the splints were continued till the first follow up.

After discharge, all patients were reviewed after first 4 weeks. Patients were assessed subjectively for pain at the fracture site, clinically for tenderness and any signs of infection. Supination and pronation of the forearm and active movement of the ipsilateral elbow and shoulder were advised throughout the period of healing. The range of wrist movements was recorded and any deformity was determined. After the completion of 4 weeks post-operatively vigorous physiotherapy was started, this included flexion- extension excercises.

Check X-rays were taken at 4 weeks to assess consolidation or collapse at the fracture site and to note any displacement.

The fracture was considered to be united when clinically there was no tenderness.

**Demerit – Point System Of Gartland And Werley**

| Residual Deformity   | Points     |
|--|------------|
| Prominent ulnar styloid  | 1          |
| Residual dorsal tilt   | 2          |
| Residual elevation of hand   | 2-3        |
| Point range  | 0-6        |
| Subjective evaluation  |            |
| Excellent: no pain, disability, or limitation of motion  | 0          |
| Good: occasional pain, limitation of motion; no disability                                       | 2          |
| Fair: occasional pain, limitation of motion, feeling of weakness, activities slightly restricted | 4          |
| Poor: pain, limitation of motion, disability, activities more or less restricted                 | 6          |
| Objective evaluation*  |            |
| Loss of dorsiflexion   | 5          |
| Loss of ulnar deviation  | 3          |
| Loss of supination   | 2          |
| Loss of pronation  | 2          |
| Loss of palmar flexion   | 1          |
| Loss of radial deviation   | 1          |
| Loss of circumduction  | 1          |
| Pain in distal radio-ulnar joint   | 1          |
| Grip strength - 60% or less of opposite side   | 1          |
| Complications  |            |
| Arthritic change   |            |
| Minimum  | 1          |
| Minimum with pain  | 2          |
| Moderate   | 3          |
| Moderate with pain   | 4          |
| Severe   | 4          |
| Sever with pain  | 5          |
| Nerve complications  | 1-3        |
| Loss of finger motion  | 1-3        |
| Point range  | 0-10       |
| End result point range   |            |
| Excellent  | 0-2        |
| Good   | 3-8        |
| Fair   | 9-20       |
| Poor   | 21 & above |

Objective evaluation is based on range of motion. The minimum required for normal function: dorsiflexion 45 degrees, palmar flexion 30 degrees, radial deviation 15 degrees, ulnar deviation 15 degrees, pronation 50 degrees, supination 50 degrees.

**RESULTS:**

The present study consists of 35 cases of intra articular distal end radius fracture treated at Vinayaka mission's medical college and hospital, Karaikal, from June 2019 to July 2021.

**Table – Evaluation Of Clinical Outcome According To Gartland And Werley Score System**

| RESULT    | NO:OF CASES | PERCENTAGE (%) |
|-----------|-------------|----------------|
| EXCELLENT | 28          | 80             |
| GOOD      | 07          | 20             |
| FAIR      | 00          | 0              |
| POOR      | 00          | 0              |
| TOTAL     | 30          | 100            |



**DISCUSSION:**

Several studies have shown that extra-articular fractures along with impacted stable fractures with minimal shortening can be managed by conservatively.<sup>4</sup> However, distal radius fractures which involve the radiocarpal and/ or the radioulnar joints require an anatomical reduction of the joint surface to reduce the incidence of post traumatic arthritis as a consequence.

Thus, intra-articular fractures that cannot be reduced by existing methods along with comminuted, displaced as well as unstable stand in need for operative treatment.<sup>3</sup>

The operative method selected to achieve the treatment target requires a careful study of the individual fracture pattern, level of activity, bone property and general medical condition.

The present study was undertaken to assess the functional outcome of surgical fixation of comminuted intra-articular distal end radius fracture with anatomical volar locking compression plate.

**Age Distribution**

In this study, intra-articular distal end radius fracture was common in the third and fourth decade of life with an average of 36.6 years.

**Sex Distribution**

Present study shows a male preponderance of 94% as compared to the female side of 6%. Increased incidence in males is probably due to their involvement in outdoor activities and heavy manual labour.

**Involved Side**

The right sided wrist (77%) was involved as compared to the left side (23%). This might be due to the fall on the dominant wrist in majority of individuals.<sup>5</sup>

**Mode Of Injury**

Present study shows 55% of the patients had road traffic accident and 39% had a fall on outstretched hand with 6% due to assault.

This might be accounted due to the night time travelling, driving under the influence of alcohol or fatigueness post heavy work.

**Deformity On Presentation:**

The present study showed ulnar deviation to be the most common deformity on presentation (66%) followed by closed dinner fork deformity (17%), garden spade deformity (11%) and radial deviation (6%).

The preponderance of ulnar deviation in the present study might be due to the increased stress to the ligamentous support of the distal radioulnar joint.<sup>5</sup>

**Type Of Fracture:**

Based on Frykman's classification in the present study, there was 54% type V, 26% type III and 20% type VII.

This might be due to the geographical variance. The involvement of wrist pattern and mode of injury is indistinguishable from other studies taken into consideration.

The prime quality of anatomical volar compression plate that it can address all comminuted intra-articular distal end radius fracture including fractures involving the sigmoid notch as well as dorsal comminution makes it the implant of choice to address all Frykman's type V fracture patterns.

**Duration Of Surgery:**

The mean duration of surgery in the present study was two hours which was comparable to other Indian studies.

**Duration Of Union:**

Most of the fracture united at an average period of 2 months (69%). There was no mal-union or non-union noted in the present study. Our study is comparable to other Indian studies<sup>7,8</sup> and illustrates excellent reports as compared owing to good reduction techniques, single surgeon protocol and good post-operative care and rehabilitation.

**Complication:**

In the present study, there was no associated postoperative infection or skin breakdown was noted.

**Clinical Outcome Of The Procedure:**

In this study, 80% excellent, 20% good outcome was obtained by using Gartland and Werley demerit point system.

Out of 35 patients, twenty eight patients had obtained excellent results had no residual deformities or pain. These patients were operated within three days after injury. Range of motion was within normal functional range with no arthritic changes or other complications. Radial length, volar tilt and articular step-off were within acceptable limits. These patients cooperated well and underwent good physiotherapy.

Out of 30 patients, seven with good results had minimal residual deformities, pain and slight limitations of movements. These patients were operated within 3 -4 days of injury. At the end of follow up their functional outcome was within acceptable parameters as they too cooperated to undergo continuous physiotherapy.

**CONCLUSION:**

Volar locking plate with polyaxial screws can be implant of choice to address all the types of intrarticular distal radius fractures with good results.

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