Research Article

International Journal of Orthopaedics Research

# A Prospective Study on Treatment of Distal Radial Fractures Using Volar Locking Plate

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**Submitted**: 24 Feb 2020; **Accepted**: 03 Mar 2020; **Published**: 10 Mar 2020

## Abstract

***Introduction:*** *Distal radius fractures are one of the most common injuries which come to the orthopaedic surgeons. Displaced extra-or intra-articular fractures require anatomical reduction for a good outcome. Historically, these fractures were treated with manipulation and casting, with or without Kirschner (K) wire fixation. Modern plating techniques have been advocated to restore anatomical alignment and allow early mobilisation. Despite the wide variety of treatment options available there is still debate about the best way to treat these fractures. The aim of this study was to evaluate fifty cases of fracture distal end radius treated by open reduction and internal fixation using locking compression plating (LCP).*

***Methods:*** *The present study was carried out on 50 cases of acute fracture distal radius admitted at a tertiary care hospital treated by open reduction and internal fixation using locking compression plating (LCP) between January 2018 and December 2018. Functional results were rated at the end of the study as excellent, good or poor as criteria laid down by Gartland and Werley's combined subjective and objective criteria.*

***Results:*** *50 cases of fracture distal radius were selected for study that fulfill the inclusion criteria, were operated and studied. 10 fractures were fixed using Extra-articular Locking Compression T-Plates, 40 fractures were fixed using Juxta-articular Locking Compression T-Plates. According to the Gartland and Werley's rating scale, 20 had excellent results, 23 good results, and 07 fair results during latest follow up.*

***Conclusion:*** *Notwithstanding a very small sample size and a short follow up, Volar locking plate osteosynthesis at the distal radius signifies a significant improvement in the treatment of distal radial fractures in terms of restoration of the shape and function of the wrist.*

## Introduction

Distal radius fractures are the most common injury to present to orthopaedic trauma surgeons [1]. Displaced extra-or intra-articular fractures require reduction to allow a good outcome [2-5]. Historically fractures were treated with manipulation and casting, with or without Kirschner (K) wire fixation. Modern plating techniques have been advocated to restore anatomical alignment and allow early mobilization [6, 7]. The benefits of early mobilization have recently been questioned and there is still debate as to the best way to manage these injuries [8, 9].

Recently, it has been stressed that fractures of the wrist should be treated on the same principles as any other fracture involving joint that is, by anatomical reconstruction, stable fixation and early function [10]. Open reduction has become increasingly useful in reaching the goal of good reduction. The advantages of plating include accurate restoration of bony anatomy, stable internal fixation, a decreased period of immobilization, and early return of wrist function.

The aim of this study was to study and evaluate the functional outcome in twenty cases of fracture distal end radius treated by open reduction and internal fixation using locking compression plating (LCP).

## Material and Methods

The present study was carried out on 50 cases of acute fracture distal radius admitted at Military Hospital Kirkee treated by open reduction and internal fixation using locking compression plating (LCP) between January 2017 and December 2017. The inclusion criteria for study were

- Intra-articular fractures, partial-articular fractures of distal radius with step or gap in the joint surface more > 2mm and/ or instability due to metaphyseal comminution.

- Comminuted displaced extra articular fractures of distal radius especially osteoporotic unstable fractures.
- Recent fractures with failed close reduction and unsatisfactory check X-ray.
- Gustilo's grade 1 open fractures of above mentioned types

Radiograph of affected wrist including forearm and hand in AP and lateral projection. Fracture pattern, geometry and angulations were recorded.

All the patients were operated under general anesthesia/regional block at the discretion of the anaesthiologist and under pneumatic tourniquet control in supine position with limb on a side arm trolley. Fractures were exposed by volar approach.

Fractures were reduced and fixed using different type of LCP plate depending upon type of fracture anatomy. In extra articular LCP the distal screws of plates are directed towards the articular surface. For juxta articular LCP the distal screws of the plates are angled 5 degree pointing proximally. After stabilization, only the subcutaneous layer, skin was closed and dressing was done. Protective above elbow slab was given in some patients where stabilization was not adequate even after plating and supplementary K wires.

Post operatively the operated limb was kept elevated for 48 to 72 hours and was monitored clinically for any neurovascular deficit. Broad spectrum antibiotics were administered intravenously for two to five days, active and passive shoulder, elbow, wrist, fingers movements were started from the day of surgery. Above elbow POP slab was given in comminuted, unstable fractures. Protected use of limb was advised throughout the healing phase, but contact sports and lifting heavy weights were prohibited. Physiotherapy to regain movements of wrist, pronation and supination of the forearm were started immediately and consists of active movements and exercises. Patients were followed up clinically after a period of one month, following removal of sutures and later at three month interval till the time of recovery. Follow-up radiographs of the wrists were taken to assess reduction and bony union.

The mode of evaluation was both subjective and objective. The subjective evaluation included ability to return to pre-injury activity. The objective evaluation included the attitude of the forearm, deformity, range of movements of wrist and forearm and the functions of forearm. Functional results were rated at the end of the study as excellent, good or poor as criteria laid down by Gartland and Werley's combined subjective and objective criteria [11].

## Results

50 cases of fracture distal radius were selected for study that fulfill the inclusion criteria, were operated and studied during period of to January 2010 and December 2010. Data of these patients was recorded and analyzed. In the study of 50 cases majority of patients were between 20-34 years (43%). The mean age was 38.83 years.17 were male and 03 were female patients. Majority of patients sustained fractures due to road traffic accident (47%). The second most common cause was domestic fall (30%) followed by sport injury (10%).

All fractures were classified according to AO's Classification. 01 case was simple extra-articular, 03 were extra-articular with metaphyseal comminution, 07 were partial-articular, 02 were simple-articular and 07 were complex-articular. Majority of fracture in young and middle aged groups were intra-articular in nature while in elderly age group majority of fracture were extra-articular. There were 17 close fractures and 03 open fractures (Gustilo's type 1). 13 patients were operated within 05 days, 07 were operated within 10 days. The average time interval between injury and surgery was 5.6 days Bone grafting was not required in any of the patients. The operating time ranged from 25 minutes to 65 minutes. All cases were operated using volar approach with limited capsulotomy to look for articular congruity in intra-articular fracture .Sutures were removed on 14th postoperative day in all cases the wound healed by primary intention in all but one patient who had superficial infection. The wound healed by secondary intention after local wound care and antibiotics.

03 fractures were fixed using Extra-articular Locking Compression T-Plates, 17 fractures were fixed using Juxta-articular Locking Compression T-Plates. 04 patient required supplementation with K wire and splinting with slab for 04 week because of persistent instability of the reconstructed articular surface. Splinting was not given in other fractures.

### Radiological Evaluation and Grip Strength

Radial length improved from an average of 9mm before the reduction to an average of 11.8 mm at recent follow up. The average Radial length of contralateral side was 13 mm. Radial inclination improved from an average of 17˚ before the reduction to an average of 20.2˚ at recent follow up. The average Radial inclination of contralateral side was 23˚ volar tilt improved from an average of - 4˚ dorsal tilt before the reduction to an average of 6.5˚ at recent follow up. The average volar tilt of contralateral side was 11˚Articular congruity. The restoration of articular congruity of distal radius was assessed on anterioposterior radiograph and graded according to the congruity of the subchondral line of the distal radius. The articular congruity of distal radius was restored to zero to 1mm articular step-off (grade 0) in 15 fracture, and one to two mm incongruity (grade 1) in 04 and articular step-off of two mm or more (grade 2) in 01. Grip strength the grip strength on the injured side averaged 85% of that of the uninjured side.

### Range of Motion

The range of motion of the wrist and forearm at the latest follow-up has been recorded for all patients. There was mean of 16.4˚ (range15˚-20˚) of the radial deviation, 20˚ degree (range 13˚-30˚) of ulnar deviation, 65˚ (range 45˚-80˚) of dorsiflexion, 61˚ (range 40˚-70˚) of palmar flexion, 68˚ (range 45˚-80˚) of supination and 71˚ degree of (range60˚-85˚) pronation.

### Complications

03 complications occurred in 03 patients. One patient had superficial infection which settled after regular dressings, two patients developed extensor pollicis longus tendonitis out of which one settled conservatively and the other settled after removal of the implant. The possible cause was hardware impingement.

### Functional Scoring

Present study has used Gartland and Werley's combined subjective and objective criteria for evaluation of results. According to the Gartland and Werley's rating scale, 09 had excellent results, 09 good results, and 02 fair results during latest follow up.

**Figure 1:** Exposure of fracture site fracture fixation using Volar Locking Plate

**Figure 2(A):** Pre op radiograph **Figure 2(B):** Post op radiograph

**Figure 3:** Post op Range of Movements

## Discussion

Complex articular fractures of the distal radius represent an increasing challenge for surgeons and for the design of new surgical implants. There is extensive work to show that locked volar plates are well tolerated, allow early movement and maintain position even for intra-articular fractures [12, 13].

The population in our study were around the same age as previously studied groups treated with locking volar plates [12, 13]. The minimum age in our series was 20 yrs. and maximum was 68 yrs. with a mean age of 38.83 yrs. Nevertheless, we recognise that patients are actively selected for this surgical intervention based on patient and fracture characteristics. Our findings correlate well with other recent papers by Lozano-Cal-derón and Chung both demonstrating good radiological and clinical results with volar locking fixation of distal radius fractures [14, 15]. The various methods to treat this fracture have in the past failed to meet clinical expectations hence the progression from simple manipulation and casting, through pin and plaster, K wiring, external fixation and now ORIF [14, 16-18]. The results of treatment in plaster with manipulation from

Bacorn demonstrated poor results associated with poor reduction. McQueen demonstrated poor results of plaster immobilisation in elderly patients with late collapse of the fracture after the period of immobilisation had ended [17, 19]. The use of a fixed angle locking construct prevents this late collapse and is one of the reasons for its growing popularity [20]. Open reduction is not without its problems and complications have been reported. Tendon irritation, intra-articular screw placement and infection have all been implicated [21, 22]. Our study shows a clinical complication rate of 15% (3/20) which is comparable to other recent reports of locking plates in the literature [23]. We have had 02 cases of tendon irritation. The series includes our learning curve and this is demonstrated by the four cases of malreduction identified radiologically. Fortunately only one mal reduced fracture developed clinical symptoms as a consequence. Clearly not every fracture of the distal radius should be operated on; a decision must be taken based on the degree of displacement or deformity and the functional level of the patient. This study demonstrates that a good radiological and clinical outcome can be achieved with the use of volar locking plate fixation in angulated or displaced fractures with or without intra-articular disruption.

Previous work has shown that patients achieve most of their improvement in range of movement and grip strength by 6 months although they may continue to improve up to around 18 months [24, 25]. All of our patients achieved a recovery to over 85% of contralateral grip strength by 6 months and most had achieved over 90% of contralateral grip strength by this time.

None of our patients suffered any extensor tendon or flexor pollicis longus rupture although we had 02 cases of extensor pollucis tendinitis one of which was managed conservatively and one required implant removal. These complications are well described and we believe care should be taken intra-operatively to ensure that the dorsal cortex is reached but not penetrated by the distal locking screws and the pronator quadratus is laid back over the metalwork, tacking it into place where possible [21, 22]. Both extensor tendon and flexor pollicis longus rupture have been reported late in the literature and should be vigilantly looked for [22]. Our patients are routinely followed up with physiotherapy and subsequently asked to return to clinic should they have any further problems. Final radiographic examination at union confirmed that the locked volar plate maintained satisfactory position in keeping with previous studies.

It is well established that locked volar plating for distal radius fractures performs well when assessed by surgeon oriented and technical measures of success. Our study confirms that this technique is useful for complex articular injuries and performs well when judged by patient reported outcomes and measures of satisfaction. Despite statistically detectable differences in post-operative palmar flexion and grip strength, patients reported low pain scores and high levels of satisfaction.

Our study has several limitations, the cases were consecutive presentations and the decision to treat with ORIF was taken by the treating surgeon on a case by case basis, this will inevitably lead to a selection bias. Despite this our results are encouraging and add to the growing body of evidence in favour of ORIF for distal radius fractures using a volar locking plate construct [26].

## Conclusion

Notwithstanding a very small sample size and a short follow up and the following conclusions can be drawn out of the present study

- Volar locking plate osteosynthesis at the distal radius signifies a significant improvement in the treatment of distal radial fractures in terms of restoration of the shape and function of the wrist.
- The technically simple palmar access, with a low rate of complications, allows exact anatomical reduction of the fracture.
- The multidirectional fixed-angle system we used provides solid support for the joint surface even in osteoporotic bone and allows simple subchondral placement of screws with sustained retention of the outcome of reduction.
- Secondary correction loss can be avoided by this procedure. Early mobilisation can be achieved and is recommended.

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