Original Article

Journal of Orthopedic Education
Volume 4 Number 2, May - August 2018
DOI: http://dx.doi.org/10.21088/joe.2454.7956.4218.2

To Evaluate the Role of Locking Compression Plate in Treatment of Fractures of Distal End of Radius

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Received: 07 June 2018 **Accepted on:** 22 June 2018

Abstract

Background: Distal end radius fractures are the commonest fractures occurring in upper extremity that account for 17% of all upper limb injuries. Although it was described 184 years back controversies still exist regarding the best mode of treatment

Material &Methods: This study was conducted on 50 patients who were treated with operative fixation of fracture distal end of radius by locking compression plate in Department of Orthopaedics at Dr. S.N. Medical College Associated Hospital, Jodhpur. The study was both retrospective and prospective from December 2015 to November 2017.

Results: The mean age of our study population (n = 50) was 37.72 years (range, 18-70 years), and 27 patients (54%) were female. 30 fractures (60%) were of the dominant hand. The commonest injury mechanism was a fall on outstretched hand. On objective assessment of the wrist function with respect to grip strength, 23 patients (46%) had a good objective functional score, 4 patients (8%) had fair, while 21 (42%) had excellent functional objective score

Conclusion: Fractures fixed with volar LCP had good functional outcome withproper articular reconstruction and regular follow-up radiographs are required to assess that reduction of the fragments is maintained till fracture union is achieved.

Keywords: Distal End Radius Fracture; Volar Locking Plate; Functional Outcome.

Introduction

Distal end radius fractures are the commonest fractures occurring in upper extremity that account for 17% of all upper limb injuries [1]. Although it was described 184 years back controversies still exist regarding the best mode of treatment, immobilization and prediction of results.

The fractures of the lower end of radius crush the mechanical foundation of man's most elegant tool, the hand. No other fracture has a greater potential to devastate hand function. Because the distal radius is important in kinematics of radiocarpal and radioulnar joints, open reduction of the articular surface and restoration of the radial length, volar angulation and radial inclination are the prerequisite for good clinical outcome. Because the distal radius is the foundation of the wrist joint and an indispensable part of ligamentous support, reconstruction of articular congruity and stable fixation reduces the incidence of post-traumatic osteo-arthritis and allow early functional rehabilitation [2].

The classical dynamic compression plate from seventies was the key to rigid fixation, leading to primary bone healing. Nevertheless, the use of strong plates disturbed the vascularization of the bone fragments, leading to non-union and delayed union. These insights lead to the development of

the "biological osteosynthesis" a terminology introduced to indicate a new type of osteosynthesis leading to a sufficiently stable fixation of bone fragments allowing early mobilization, but without major disturbance of the vascularisation [3].

Locking compression plate in distal radial fractures owes advantage to avoid possible deprivation of blood supply to the distal metaphyseal fragments. The intrinsically stable locking compression plate utilizes a threaded screw head that locks into the plate holes when the screws are tightened, providing angular and axial stability and minimizing the possibility of screw loosening. This is particularly useful in the prevention of secondary displacement of the unstable fractures in elderly with osteoporotic bone [4].

By the development of locking compression plate the possibility of palmar plating for dorsally displaced fractures of the distal radius is available.The application of LCP through volar approach avoids injuries and irritation of extensor tendons, irritation of median nerve and provide good to excellent range of motion of the injured wrist which results in an early return to former activity.The palmer locking compression plate has been proven as a safe and effective implant for treatment of dorsally displaced fractures of distal radius [5].

Materials and Methods

This study was conducted on 50 patients who were treated with operative fixation of fracture distal end of radius by locking compression plate in Department of Orthopaedics at Dr. S.N. Medical College Associated Hospital, Jodhpur. The study was both retrospective and prospective from December 2015 to November 2017.

Inclusion Criteria

1. Age ≥20 years, Both males and females
2. Close fracture distal end of radius

Exclusion Criteria

1. Age < 20 years
2. Compound fracture
3. Patients not fit for surgery
4. Patients refuse for surgery
5. Compartment syndrome

All patients admitted with fractures of distal end of radius, a careful history was elicited from the patient and/or attendants to reveal the mechanism of injury and the severity of trauma.

The patients were then assessed clinically to evaluate their general condition and the local injury. Vital parameters was recorded, methodical examination wasdone to rule out fractures at other sites. Local examination of injured forearm andhand such as attitude and position of the affected upper limb compared withnormal counterpart, any abnormal swelling and deformity, their level anddirection.

Palpation to check any local rise of temperature, soft tissue tenderness, any palpable step, breach in continuity of bone, any revealed abnormal mobility,crepitus and shortening of the forearm.

Distal Vascularity was assessed by radial artery pulsations, capillary filling, pallor and paraesthesia at finger tips.

Neurological Examination

Sensory system was examined for pain and touch sensation in the radial. ulnar and median nerve innervated arrears. Power including handgrip was tested in forearm and hand muscles.

Movements: Flexion and extension of elbow. supination and pronation of forearm. Abduction and adduction and palmar flexion and dorsiflexion of the wristwere performed and any restriction of motion and pain observed.

Preoperative Planning

- Consent of the patient or relative was taken prior to the surgery.
- Appropriate length of the plate to be used was assessed with the help ofradiographs.
- A dose of tetanus toxoid and antibiotic was given preoperatively.
- Part Prepared.

Surgical Procedure

- Fractures was exposed through the distal part of the Henry approach between the FCR and radial artery via an 8 to 9cm longitudinal incision directly over the distal course of the FCR tendon.
- Then reduced with an initial hyperextension maneuver, followed by flexion of the wrist while

the apex of the deformity is stabilized with a thumb.

- The fracture was then temporarily fixed with an oblique Kirschner wire inserted percutaneously through the radial styloid.
- A volar locking plate applied and fixed with 2.7mm screw after positioning to fit the volar metaphyseal flare of the radius.

Post operative treatment

- Crepe bandage was applied over the affected forearm and either pre op posterior slab was continued or arm pouch was given depending upon the requirement.
- Limb is elevated and active movement of the fingers and elbow joint is encouraged. Suction drain was removed after 48 hours and Wound was inspected. Check X ray AP and Lateral view was taken at that time.
- Antibiotics and analgesics were continued till the time of suture removal which was done on 10-12 postoperative day.
- On discharge patient was advised physiotherapy of shoulder, elbow, wrist and finger movements. They was told not to lift heavy weight or exert the affected forearm.

Follow-up

- At each follow up, AP and lateral x-rays was taken and patients were instructed about the exercises of the elbow, digits and shoulder. At the end of the first week, the splints were replaced by dynamic splint which allow movements of wrist and hand freely. At the end of six weeks, radiographs were taken and active motion of the wrist consisting of wrist movements, supination, pronation, finger grip were started.
- Patients was assessed, which included the subjective impressions of the patient, objective grading of function and deformity, comparison of final and initial radiograph. A detailed questionnaire was completed with each patient to evaluate subjective factors such as pain, functional limitations and occupational considerations.

Objective examination including inspection of the wrist for deformity, tenderness, abnormal mobility of the distal radioulnar joint, measurement of the range of movements and grip strengthwas done. The subjective, objective and radiographic findings was quantified by Lidstrom's [6] system. The outcome of each fracture was graded as excellent, good, fair or poor.

Lidstrom's Criteria for Functional End Results

Excellent

- No deformity
- No residual disability
- Full wrist and forearm movements
- No loss of grip strength

Good

- Minimal deformity
- Residual disability
- Loss of movements upto 20^0
- Slight loss of grip strength

Fair

- Moderate deformity
- Moderate disability
- Loss of movements upto 40^0
- Moderate loss of grip strength

Poor

- Gross deformity
- Gross disability
- Gross limitation of wrist and forearm movements
- Severe loss of grip strength

Outcome Evaluation

Each patient in this study was assessed according to a battery of functional and radiographic outcomes. All the patients were called for follow up visits at 6 months. At each follow up patients were assessed for-

Disability Evaluation

Subjective Assessment: Subjective assessment of pain and disability was done at 6 months and 1 year using Patient rated wrist evaluation (PRWE) score, which is the most responsive and validated tool for evaluating the outcome in patients with distal end radius fracture.

Computing the Total Subjective Score

Total Score = Sum of Pain score + Function score;

Best Score = 0, Worst Score = 100.

Total score were graded into Excellent (0-25), Good (26-50), Fair (51-75), or Poor (76-100).

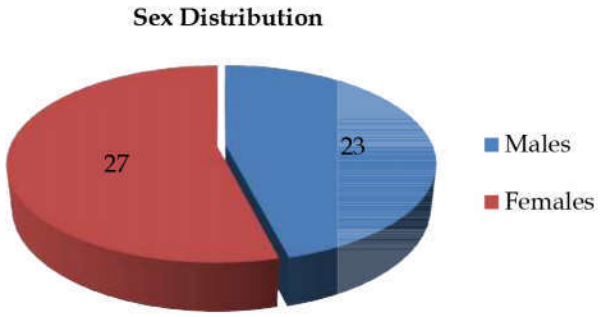
Objective Physical Characteristics: The objective clinical parameters evaluated in this study are grip strength and range of movements.

Fig. 1,2: Pre-Operative

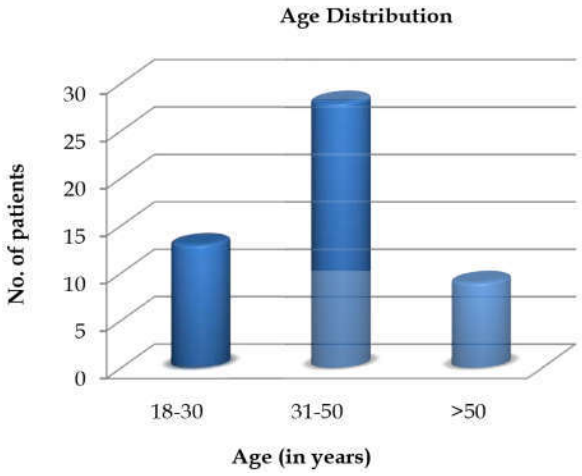
Fig. 3,4,5: Immediate Post-Operative

Results

Our study showed that the females were slightly preponderance (Graph 1) and maximum no. of cases seen in 31-50 years of age group (Graph 2). Mostly patients complain painful wrist after postoperative complication (Graph 3). Maximum no. of cases seen due to fall on outstretched hand (Graph 4). According to Lidstrom's Criteria the functional end results were mostly excellent and good result (Table 1).



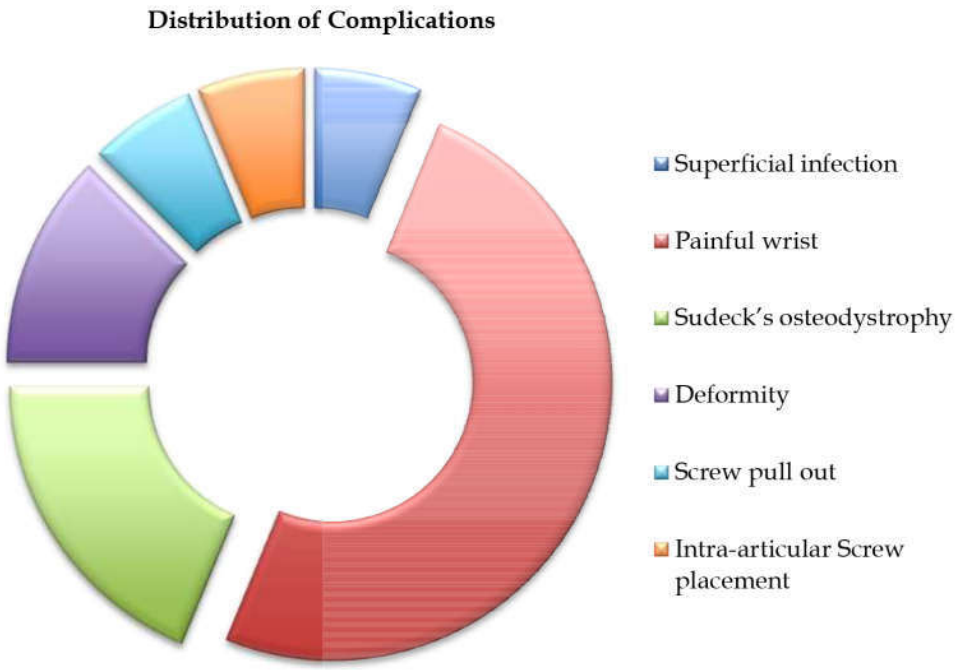
Graph 1: Sex Distribution



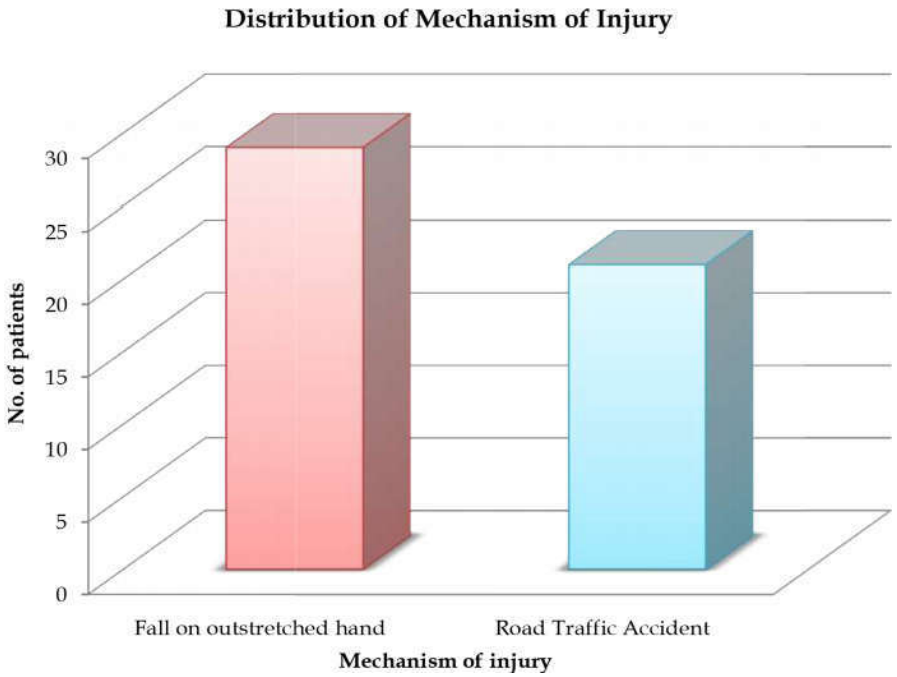
Graph 2: Age Distribution

Table 1: Functional End results using Lidstrom's Criteria

Grade	No. of cases	%
Excellent	19	38
Good	20	40
Fair	6	12
Poor	5	10



Graph 3: Distribution of Complications



Graph 4: Distribution of Mechanism of Injury

Discussion

Distal radius fractures remain an injury that fosters considerable interest and debate. Interest in distal radius fractures stems not only from its high incidence but also from developing understanding of outcome variables and influence of technology in evaluation and treatment [1]. Following a distal radial fracture, the attainment and maintenance of anatomical reduction of the articular surface is crucial to the preservation of wrist function. Trumble et al. stated that the degree to which articular step –off, gapping between fragments, and radial shortening can be improved with surgery correlates strongly with improved

outcome. Hence, a treatment method that is more likely to achieve these goals will result in better function [7].

The volar locking plate system has been shown to be a reliable plating system for the fixation of distal radius fractures [8]. The volar approach is less disruptive to the nearby tendon than the dorsal approach,because there is more space available for the plate on the volar surface of distal radius [9]. An advantage of the volar plating technique is the comfort that it provides to patients in initiating early finger and wrist motion. Early rehabilitation had the additional advantage of enabling the patient to regain independence in daily activity rather quickly. The locking screws in the volar locking plating system offer an additional advantage over previous implants. With previous volar plate designs involving nonlocking screws, screw purchase in the metaphysis of the distal part of the radius often was poor because of the limited amount of the cortical bone in this location.With the new design, the distal screws are locked to the plate, which stabilizes the screw against lateral movement (toggle) and resist loosening. This provides additional strength to the fixation by constructing a scaffold under the distal radial articular surface. The proximal diaphyseal screws fix the plate strongly to thick cortical bone, completing this stable form of fixation [8]. With the aim of articular restoration and early finger and wrist mobilization, the present study was conducted with volar locking plating system.

Most of the patients in this study were in age group of 18-67 yrs with a mean age of 37.72 yrs. The incidences of distal radial fractures are reported without any sex preponderance. Even in our study of 50 patients 27 males and 23 females no such difference was observed.

Mode of trauma in the present series was 29 patients have had H/O fall while rest 21 patients met with an RSA. In cases of patients with h/o fall, most of the candidates were females and belong to age group >40 Yr, which strongly support the preponderance of such fractures in females as mentioned in the literature.

Conclusion

Fractures fixed with volar LCP had good functional outcome with proper articular reconstruction. After which early physiotherapy and close monitoring of recovery in follow up visits will improve patient function regardless of radiological outcome.

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