

Comparative Study of Surgical Outcome of Distal Radius Fracture Treated By External Fixator and Plating

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Abstract

Background and Objective: Distal radius fracture is the most common fracture we treat. The management has undergone an extraordinary evolution over the preceding twenty years. Universal cast treatment gave to the neutralization with a bridging external fixator, which in turn was replaced by dorsal buttress plating. The technical advance of palmar locking plating has again changed the management of this fracture in a real and seemingly permanent way. There was no consensus regarding the management of a particular type. A randomized comparative study was undertaken to study the functional outcome between the closed reduction external fixation over volar locking plating. **Methods:** 60 patients with distal radius fractures were selected who were who were admitted in Vydehi Institute of Medical Sciences and Research Centre, Bangalore. Patients were randomized into 2 groups, one group treated with closed reduction external fixation and other group with Open reduction with plating in each group with 30 patients. Post operatively follow up was done for 6 month and functional outcome was assessed using Green & O'Brien scoring. **Result:** The study comprised of 34 males and 26 females aged between 18-65 years, with mean age of 35.26 years. Functional outcome score using Green & O'Brien scoring on follow up we got 35% excellent results, 39% good results, 25% fair results, 5% poor results and 13% with complications. **Conclusion:** Open Reduction with Volar locking Plate provided stable anatomical construct, Restoration of anatomy, early mobilization, Complications were minimal and presented on follow up were wrist stiffness. External Fixation provide stable fixation in par with open reduction and plating but had more complications such as wrist stiffness and pin tract infections, delayed healing. The conclusion were based on this short term study hence both cannot be compared and needs long term study.

Keywords: Distal Radius fracture; Open Reduction Internal Fixation; Volar locking Plate; Closed Reduction External Fixation.

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Introduction

Distal Radius fractures account for 14% of all extremity fractures, and 17% of all fractures treated in emergency department. There appears to be a Bimodal distribution of distal radius fractures consisting of a younger group who sustains relatively high energy trauma to the upper extremity and an elderly group who sustains both high energy and low energy injuries. In older age groups, more women are affected than men. The majority of fracture in older population are due to fall, while in younger these fractures are due to motor vehicle accidents[1].

Severe high energy trauma results in intra articular involvement and comminution. Treatment of such injuries is difficult. These fractures are often unstable and difficult to reduce anatomically, and are associated with high prevalence of complications of post traumatic osteoarthritis. It is also known that extra articular malalignment can lead to decreased grip strength, limited motion and carpal instability. Up until a few decades ago, distal radius fractures were often casually regarded as Colles fractures. With better understanding of the various fracture types, classifications such as

Frykman, Melone and AO were developed. There was a need for a better method of treatment after careful study of the individual fracture pattern. Fracture union is no longer the only goal, as the restoration of normal anatomy with early functional recovery, as well as resultant full and painless motion of the wrist, take over as the ultimate goals of treatment[2].

Many things are subject to trend and fashion, and the treatment of distal radius fracture is no exception. Pins and plasters gave way to External fixation and now internal fixation has begun to supplant all other treatment modalities[3].

Published clinical trials directly comparing treatment regimens of closed reduction, external fixation and open reduction and internal fixation are lacking. The results of the currently published data are difficult to compare. Most studies are retrospective in nature and use various classifications and inconsistent outcome tools, especially in regard to comminuted fractures with joint incongruity[4-7].

Fractures of distal end of radius continue to pose a therapeutic challenge. The purpose of this study was to evaluate the surgical outcome through comparison between both the methods, External Fixator and Open reduction Internal fixation with plating. In order to conclude the advantages and disadvantages of each of them.

Aims and Objectives

1. To evaluate the surgical management using External Fixator and Plating influencing the functional outcome.

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2. To know the advantages, disadvantages and complications of using External Fixator and Plating.
3. To compare the results between the External Fixator and Plating in terms of anatomical reduction of fracture, Union of fracture and Functional recovery.

Materials and Methods

Source of data

Study includes 60 patients admitted in orthopaedics ward from OPD and casualty of Vydehi Institute of Medical Sciences & Research Centre, Bangalore for Fracture of the Distal End of Radius.

Method of collection of data

Prospective follow up of 60 Patients admitted for fracture of the distal end of Radius treated by either External fixator or ORIF with Plating in Department of Orthopaedics, Vydehi Institute of Medical Sciences & Research Centre, Bangalore.

Inclusion Criteria

1. A patient between 18 - 65 years of age group
2. All patients having isolated Distal end radius fracture

Exclusion Criteria

1. Distal radius fracture associated with other Injuries around the wrist joint.
2. Open fractures, except Gustillo Anderson Type 1 fractures.
3. Pathological fractures.
4. Distal radius fracture associated with Neurovascular Deficit.

The method of study consists of-

- Detail history taking & clinical examination.
 - Mode of sustenance of the injury.
 - Investigations after taking written informed consent
- X-Ray of the wrist and forearm of the affected limb, chest X-Ray, Hb%, Total Count, Differential Count, ESR, Renal function tests, Liver function tests, Lipid profile, FBS/PPBS, HIV, HB_sAg, Urine for albumin, sugars, ketone bodies, microscopy.
- Stable fractures are treated by closed reduction, cast application.
 - Unstable fractures are treated by surgical Intervention.

Criteria required to diagnose Unstable fracture are

1. Displaced after initial treatment with closed reduction & splinting.
2. Lagontaine criteria (any of three criteria required)
 - A. Dorsal angulation > 20 degrees
 - B. Dorsal comminution
 - C. C. Intraarticular fracture
 - D. An associated ulnar styloid fracture
 - E. Age of > 60 years.
- Of the 60 cases treated by surgical intervention are Randomized into 2 groups, one group treated with external Fixator and other group treated with Open Reduction internal fixation with Plating. Patients are followed up by clinical examination and X-rays taken immediately after operation and functional outcome assessed by green o'brien classification modified by cooney et al scoring at 6, 12 and 24 weeks after surgery.

Preoperative Evaluation

Immediate Management

Following admission to the hospital, a careful history taken from patients to reveal the mechanism of injury and severity of trauma. Their general condition, associated systemic diseases and injuries were noted. All the findings were noted in the patients proforma. All patients presented with the involved elbow flexed and wrist supported with the other hand. Careful inspection of the deformity, swelling and ecchymosis were done. Clinically tenderness, Bony irregularity, crepitus and the relative position of the radial and ulnar styloid process were elicited. Movements of the forearm and elbow were checked and found to be painful and limited. Distal vascularity was assessed by radial artery pulsations. The involved forearm was immobilized in a below elbow Plaster of paris slab and kept elevated. Pain and inflammation were managed using analgesics.

Preoperative Planning

Routine examination of blood was done for hemoglobin percentage, total and differential count, Fasting blood sugar, blood urea, serum creatinine, bleeding and clotting time, HIV and HBsAg. Examination of urine was done for presence of albumin and sugar. Blood pressure and ECG were recorded in all patients. Preparation of parts was done 1 day before surgery. Tetanus toxoid injection and intravenous antibiotics were given to all patients preoperatively. Consent for surgery was taken and patients were operated after preanesthetic checkup.

Radiographic Examination

Standard radiographs in AP and Lateral views were taken for confirmation of the diagnosis and also to classify the fracture according to the Frykman's classification.

Surgical Procedures

The duration from the date of injury to the date of operation ranged from 1 -10 days. Anesthesia: Regional (Axillary block) or general anesthesia.

Position and Touriquet :Patient was positioned in supine on operating table. Affected limb was elevated for 2-3 minutes and exanguinated. Then a mid arm pneumatic tourniquet was applied and limb was placed on a side arm board. Forearm and hand were thoroughly scrubbed, painted and draped.

Closed Reduction And External Fixation

Implants

The static external fixator consisted of

- 3.5 mm schanz screws for the radius 2 in number.
- 2.5 mm schanz screws for the second metacarpal 2 in number.
- Aesulap clamps 4 in number.
- 4mm connecting rods 2 in number. And Kirschner wires of varying size.

Instruments

- 1.5 mm drill bit and 2.5 mm drill bit.
- Hand drill / power drill.
- T- handle and spanner (8-9) size.

Post-Operative Care And Rehabilitation

Post-operative pain and inflammation were managed using anti inflammatory analgesics, Diclofenac Injection 50mg twice daily. Intravenous antibiotics Cefotaxime 1gm twice daily for 5 days followed by oral antibiotics like Cefixime 200mg twice a day for 5 days. Affected limb was kept elevated and asked to perform active finger movements, elbow and shoulder movements from day one. Dressings were changed on day 3. Immediate post operative X-rays were taken in both PA and Lateral views. The reduction of the fracture was confirmed.

Patients treated with EF, the pin sites were cleaned with povidone iodine on alternate days. Patients were discharged after 10 days postoperatively. Patient followed up after 15 days for pain, swelling, pin tract infection, pin loosening and stiffness in fingers, elbow or shoulder. On followup at 6th week, the fracture union was assessed clinically by absence of tenderness and radiologically by bridging callus formation. Then the external fixation and K wires, if any were removed under general anesthesia or on out patient basis in minor operation theater. Patients were advised not to lift heavy weights for further 4 – 6 weeks.

For patients treated with ORIF, after the surgery operated limb was supported with a below elbow anterior splint. Wound was inspected 3rd day post operatively, Sutures removed on 10th day. Splints were removed and crape bandage applied. Patients advised not to lift heavy weights. After discharge all patients were reviewed weekly for first 6 weeks and assessed for pain at fracture site, loosening of pins for EF patients and any signs of infection. Wrist range of movements were recorded and any deformity was assessed.

Radiographic assessment

Check X-rays were taken at 6 weeks to assess consolidation or collapse at the fracture site and to note any displacement. Fractures,

which healed by 4-6 months without any operative procedure were considered as delayed union. Fractures which did not unite after 6 months or those necessitating additional surgical procedure were considered as non union.

Mal union was defined as more than 5mm radial shortening, more than 15° of volar tilt or more than 10° dorsal tilt ,and more than 4mm of radial shift. Arthritic changes were graded according to the system described by Knirk and Jupiter.Regular follow up of patients was done at 6 , 12 and 24 weeks. Results were assessed using the Green O'Brien scoring system and complications were recorded if any.

Results

This study is a Randomized prospective case control study, which was conducted at Vydehi Institute of Medical Sciences and Research Centre, Bangalore and included 60 patients who presented with Fracture of the Distal End of Radius to Department of orthopaedics, who met the pre set criteria and gave an informed consent between the time period January 2015 to June 2016. The following observations were made and the available data is analyzed as follows.

Table 1: Age Distribution

Age in Years	External Fixator	Orif+Plating
21 – 30 years	15	13
31 – 40 years	6	7
41 – 50 years	7	8
51 – 60 years	2	2
Total	30	30

In our case series study of 60 caes , the mean age group in External Fixator was 26.48 years and in ORIF with Plating group was 25.24 years .The p value by chi square test was >0.05 not significant .the average age group was 20-29 years with 28 of the 60 cases studied.

Table 2: Gender Distribution

Sex	External Fixator	Orif+Plating
Male	16	18
Female	14	12
Total	30	30

Male patients are more affected than Female, The p value was >0.05 (not significant)

Table 3:Side of Fracture

Side	External Fixator	Orif + Plating
Left	12	13
Right	18	17
Total	30	30

Right Side is more common in both the groups, p = 0.890 (not significant)

Table 4:Mode of Injury

Mode of Injury	External Fixator	Orif+Plating
Road Traffic Accident	17	17
Fall on outstretched hand	11	13
Assault	2	0

Fall on outstretched hand was the most common mode of injury, p>0.05 (not significant)

Table 5: Type of Fracture

Frykmans	External Fixator	Orif+Plating
Type I	3	2
Type II	2	0
Type III	10	4
Type IV	4	3
Type V	5	8
Type VI	1	5
Type VII	5	7
Type VIII	0	1
Total	30	30

Type III,V,VII appears to be most common presentation, p>0.05 (not significant)

Table 6: Functional Outcome

Results	Orif+Plating	External Fixator
Excellent	10	9
Good	12	11
Fair	7	8
Poor	1	2
Total	30	30

ORIF with Plating showed better results compared to External Fixator

Table 7:Complications

Coplications	External Fixator	Orif+Plating
Wrist stiffness	4	1
Pin Tract Infection	2	0
Complex Regional Pain Syndrome	1	0
Nil Complications	23	29

Patients treated with ORIF with plating showed less complications compared to EF group



Fig 1: Pre & Post Operative Images

Discussion

In the last century there is a progressive increase in the average age of the population in industrialized nations, and it is logical to see a rise in the prevalence of distal radius fractures. This added to the bone characteristics of this aging population group and a collapse in three dimensions leading to loss of radial inclination, radial height, palmar tilt and increase in ulna variance and the increased complexity of the fractures, which could be a result of higher energy trauma, makes distal radius fractures complicated to treated. Fractures of the distal radius are currently the most prevalent osteoporotic fracture. There are many treatment options for these injuries. During the last decade has been a shift in the strategy for treating unstable distal radius fractures toward internal fixation and volar locking plate fixation. The total number of surgical treatments has also increased over this period. Several studies have demonstrated that open reduction internal fixation is superior to external fixation. Surgical fixation of DRF enables patients to resume daily activity earlier and more independently. Thus, there has been a trend toward more aggressive fracture fixation in patients with a DRF. However, comminuted and displaced intra-articular DRFs make anatomic reduction and stable fixation difficult and often lead to poor functional outcomes. Closed or limited open reduction with percutaneous pinning and external fixation, which has traditionally

been used in unstable intra-articular fractures, does not always lead to anatomic reductions and can result in residual instability with secondary displacement. Volar plates have gained popularity because of their low complication rates and high stability in osteoporotic bone without joint distraction. However, fractures with distal articular fragments that are too small or comminuted may not allow fragment reduction and stable fixation with open reduction. Several studies have shown that even open reduction internal fixation fails to produce anatomic reductions in some complex fractures. The present study was undertaken to assess the functional outcome of operative management of DRF's using External fixation and Open reduction with Volar Locking Plate and screws. We evaluated our results and compared them with those obtained by various studies utilizing different modalities of treatment. Our analysis is as follows.

Age Distribution

In our study, Distal Radius fracture was more common in the second to third decade with an average of 35.26 years. Most of the intra articular, comminuted unstable fractures requiring operative management occurred in young individuals are due to high energy trauma such as road traffic accidents. Fractures occurring in older individuals are due to trivial fall and because of the osteoporotic nature of the bones. They are more common in females.

Table 8: Related studies

Studies	Minimum age in yrs	Maximum Age in yrs	Average age in yrs
Jesse B. Jupiter et al[8]	16	76	42
Louis Catalano et al[9]	17	42	30
Harish Kapoor et al[10]	30	51	39
Roh et al[11]	50	70	55
Our study	21	60	35.26

Gender Distribution

Our study had a male preponderance with 57 % male patients and 43 % female patients and is comparable with the following studies.

Table 9: Gender distribution

Studies	Males %	Females %
Jesse B. Jupiter et al[8]	60	40
Louis Catalano et al[9]	67	33
Harish Kapoor et al[10]	72	28
Roh et al[11]	66	33
Our study	57	43

Increased incidence in males is probably due to their involvement in outdoor activities and riding vehicles

Involved Fracture Side

The right side was involved more in our study comprising 59 %

Right wrist being the dominant wrist is involved more than left.

Mode of injury

Our study has 57 % patients presented injury in RTA

Roh et al[11] study reported only that there patients presented to Emergency but no mention of the mode of injury. We reported RTA is the more common mode of injury, nevertheless elderly patients and female patients sustained injury more commonly on falling on outstretched hand, due to the osteoporotic nature of the bone.

Type of Fracture

Based on Frykman's classification we had 35% Type III & IV, 31% Type V & VI, 22% Type VII & VIII. 12% of Type I & II.

The other studies have included specifically only two categories. And comparable to them as there was similar setup in other distribution.

Type of Fixation

In our study we had 50% patients treated with both ORIF and EF methods. The study conducted by Kapoor,[10] had equal distribution of patients treated with closed reduction and immobilization with cast, ORIF with plating and EF. Where as study conducted by Jupiter case study had underwent more of ORIF with VLP. We encountered a complication rate of 13%, out of which were due to pin tract infections, which were treated by antibiotics, Stiffness in wrist joint patients, underwent physiotherapy and one patient with complex regional pain syndrome. The other studies encountered simple post op complications. Late complication like arthritis could not be assessed as it needed a long term of follow up than the set time. Kapoor [10] has also done plaster mobilization in his studies, their results were not included for comparison. Roh et al[11] use the Michigan hand questionnaire score and reported 81 score in VP group and 79 IN EF group. In our study the results were good in both the methods of treatments with few late complications in the external fixation group which were statistically not significant. Although there were no significant differences in grip strength, motion, or functional scores between the VP and EF groups at 12 months, the VP group showed superior short-term results for functional recovery. The VP group showed superior radiological outcome in terms of the ulnar variance, but this outcome had no effect on functional outcomes at 12 months. The results suggest that EF treatment is associated with delayed functional recovery up to 3 months after distal radius surgery. In the current study, VP fixation had an overall decreased incidence of complications compared with external fixation. Distal radius fractures represent the most common osteoporosis-related injury in the upper extremity. Patients with a DRF have a higher incidence of underlying osteoporosis and osteoporosis has been associated with increased fracture severity and a higher incidence of early instability. Study limitations include the fact that there were no follow-up data on functional outcomes beyond 12 months after surgery although some improvement in motion and grip strength could be anticipated.

Conclusion

After analyzing the observations and looking at the results of our study in 60 patients with distal radius fracture treated with External

Fixation and open reduction with Volar locking plate we conclude the following.

- Distal radius fractures are more common in the second and third decade of life with Male preponderance due to their involvement in outdoor activities and riding motor vehicles.
- Common mode of injury in distal radius fracture is Road traffic accidents. And in elderly is fall on outstretched hand which is predisposed to injury due to the osteoporotic nature of bone.
- Open Reduction with Volar locking Plate provided stable anatomical construct, Restoration of anatomy, early mobilization, Complications were minimal and presented on follow up were wrist stiffness.
- External Fixation provide stable fixation in par with open reduction and plating but had more complications such as wrist stiffness and pin tract infections, delayed healing.

The conclusions were based on this short term study hence both cannot be compared and needs long term study.

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