

A Comparative Study of Distal End Radius Fractures Managed with Bridging External Fixator with Kirschner Wires versus Volar Plating

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Abstract

Introduction: Despite being one of the most common fractures encountered in practice, 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.

Materials and Methods: This study is a randomized comparative prospective study. It was conducted in Department of Orthopedics, GMERS Medical College & Hospital Vadodara from September 2023 to June 2024 on 78 patients undergoing Distal end radius fracture surgery.

Results: On comparison of functional outcome between external fixator and vlcw with cooney's score for type C fractures with chi square test p value was 0.4386, which was statistically significant.

Conclusion: Treatment of Type C distal end radius fractures fixation with volar plate and screw system is a superior method to maintain the reduction till union and prevent the collapse of the fracture fragments, even in grossly comminuted, unstable and osteoporotic bones as compared with external fixator augmented with K – wires.

Keywords: Distal End Radius Fracture.

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Introduction

Distal radius fractures are one of the most common injuries encountered in Orthopedic practice. They make up 8%–15% of all bony injuries in adults[1]. 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[2].

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.[3]

Until a few decades ago, distal radius fractures were often casually regarded as Colle's fractures. With better understanding of the various fracture types, classifications such as Frykman's, Melone's, 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[4]. Non-displaced or reducible but stable extra and intra-articular fractures can also be treated with casting. Unstable reducible extra-articular fractures are commonly treated with reduction and often supplemented with extra or intra-focal pinning. Extra-articular fractures that are irreducible, intraarticular fractures and fractures for demanding patients who require early mobilization, are

commonly treated with plating (more often with volar plating), external fixation or pinning [5-8]

Closed reduction and cast immobilization has been the principal mode of management of distal radius fractures but it often led to fracture malunion and subluxation or dislocation of distal Radioulnar joint, hence resulting in poor functional, radiographic and cosmetic results[9]. The residual worse deformity of wrist adversely affected wrist motion and hand function, thereby interfering with the mechanical advantage of the extrinsic hand musculature[10]. It also causes pain, limitation of forearm motion, and decreased grip strength as a result of arthrosis of the radiocarpal and distal Radioulnar joints[11].

Fractures of distal end of radius continue to pose a therapeutic challenge. The external fixator is a versatile tool in the treatment of intra-articular and extra-articular fractures of distal radius[12]. Volar locking compression plating is a safe and effective treatment for unstable fractures of the dorsal distal radius[13]. 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.

Materials and Methods

Study Area: This study is a randomized comparative prospective study. It was conducted in Department of Orthopedics, Gmers Medical College & Hospital, Vadodara from September 2023 to June 2024.

Study Population consists of Patients with Distal Radius Fractures satisfying inclusion criteria admitted in indoor ward of Department of Orthopedics. All patients satisfying inclusion criteria were evaluated clinically and radiologically. blood investigations were carried out in order to evaluate fitness for anesthesia.

Criteria of Selection of Patients

Inclusion Criteria

1. Closed fractures

2. Patient of Distal Radius fracture either AO type B (partial intra-articular) and type C (complete intra-articular)

Exclusion Criteria

1. Patients of AO Type A (Extra-Articular Fractures)
2. Paediatric age group
3. Open fractures
4. Patients with psychiatric illness
5. Patient unfit for surgery
6. Patients with associated neurovascular injury
7. Patients with polytrauma injuries

Patients were randomized equally into two groups of 38 patients each in Volar Plating and External Fixation group based on consecutive allotment system.

Those who met the inclusion criteria were recruited into the study. After explaining the procedure and methodology of the research and obtaining written informed consent. Preoperative Evaluation was done with Standard radiographs in Anteroposterior and Lateral views were taken for confirmation of the diagnosis and also to classify the fracture according to the AO's classification.

Radiological assessment was done using the Sarmiento modification of the Lindstrom criteria and complications were recorded if any at 0,6,12,24 weeks.

Functional assessment was done using Cooney's Modification of Green O'Brien scoring system and DASH Scoring system at 6,12 & 24 weeks.

Results

In this randomized prospective study, 78 Patient were operated for Distal end radius fracture fixation.

Patient's age ranged from 18 to 65 years. Mean age was 37.3 years. 58% Patients were male and 42% Female. Out of 78 patients 45(59%) Sustained fracture injury after roadside accident and rest (41%) had fall on outstretched hand.

Radiological assessment

Table 1: Radiological Outcome of External Fixator Group in AO Type B (Partial Intra-Articular) Fractures

Result	Palmar Tilt	Radial Shortening	Radial Inclination	Residual Deformity
Excellent	7	6	6	5
Good	6	9	6	11
Fair	5	2	4	2
Poor	1	1	1	0

Table 2: Radiological Outcome of External Fixator Group in AO Type C (Complete Intra-Articular) Fractures

Result	Palmar Tilt	Radial Shortening	Radial Inclination	Residual Deformity
Excellent	2	3	2	3
Good	6	4	8	7
Fair	9	8	6	7
Poor	1	3	2	1

Table 3: Radiological Outcome of Volar LCP Group in AO Type B (Partial Intra-Articular) Fractures

Result	Palmar Tilt	Radial Shortening	Radial Inclination	Residual Deformity
Excellent	6	6	8	8
Good	10	11	9	12
Fair	4	4	3	1
Poor	1	0	1	0

Table 4: Radiological Outcome of Volar LCP Group in AO Type C (Complete Intra-Articular) Fractures

Result	Palmar Tilt	Radial Shortening	Radial Inclination	Residual Deformity
Excellent	8	9	5	7
Good	5	4	9	6
Fair	3	4	4	3
Poor	1	0	0	1

Table 5: Radiological Outcome for AO Type B Fractures According to Sarmiento Modification of the Lindstrom Criteria

	EXT Fixator with K-Wire Group	Volar LCP Group
Excellent	24	28
Good	32	42
Fair And Poor	16	14

On applying Chi-Square test to compare the radiological outcome for AO type B fractures, p-value was 0.645818. suggesting result was not significant. ($p < 0.05$). This denotes that there no significant difference in the radiological outcome of modality of fixation of distal radius Partial Intraarticular fractures by Volar LCP and External Fixator.

Table 6: Radiological Outcome for AO Type C Fractures According to Sarmiento Modification of the Lindstrom Criteria

	EXT Fixator with K-Wire Group	Volar LCP Group
Excellent	10	29
Good	25	24
Fair And Poor	37	16

On applying Chi-Square Test to compare the radiological outcome for AO type C fractures, p-value was 0.645818. suggesting result was not significant. ($p < 0.05$). This denotes that there no significant difference in the radiological outcome of modality of fixation of distal radius Partial Intraarticular fractures by Volar LCP and External Fixator. However Volar LCP Had much better scores compared to External fixation.

Functional Assement

Table 7: Comparison of Functional Outcome between External Fixator and VLCP with Cooney's Score For AO Type B Fractures

	EXT fixator with K-wire group	Volar LCP group
Excellent (90 – 100)	9	8
Good (80- 89)	5	10
Fair (65 – 79)	3	3
Poor (less than 65)	1	0

On applying Chi-Square Test to compare the Functional outcome for AO type B fractures, p-value was 0.519674. suggesting result was not significant. ($p < 0.05$). This denotes that there no significant difference in the Functional outcome of modality of fixation of distal radius Partial Intraarticular fractures by Volar LCP and External Fixator.

Table 8: Comparison of Functional Outcome between External Fixator and VLCP with Cooney's Score for AO Type C Fractures

	EXT Fixator with K-Wire Group	Volar LCP Group
Excellent (90 – 100)	3	4
Good (80- 89)	6	10
Fair (65 – 79)	8	2
Poor (Less Than 65)	1	1

The chi-square statistic is 4.0617. The p-value is 0.043866. The result is significant at $p < 0.05$. This denotes that there is significant difference in the functional outcome of modality of fixation of distal radius complete intraarticular fractures by Volar LCP and External fixator. Volar Plating has shown superior results in the Cooney's Modification of Green O' Brien Score

Functional Outcome According to Dash Score

In Patients of AO Type B (Partial Articular fractures) the Mean DASH scores after 6 months of surgery in patients treated with External Fixator was 19.4 and in Volar Plating group it was 17.3.

On comparing the two groups via Unpaired T Test for Independent Means the T Value was 1.35282 and P value was 0.184108. The result was not significant at $P < 0.05$.

In Patients of AO Type C (Complete Intra-articular fractures) the Mean DASH scores after 6 months of surgery in patients treated with External Fixator was 18.4 and in Volar Plating group it was 16.9.

On comparing the two groups via Unpaired T Test for Independent Means the T Value was 0.854 and P value was 0.39614. The result was not significant at $P < 0.05$.

Table 9: Complications Associated with the Study

Complications	External Fixator Group	Volar LCP Group
Reflex Sympathetic Dystrophy	Nil	1
Pin Tract & Wound Infection	2	1
Malunion	3	1
Wrist Stiffness	3	2

Discussion

In the last few decades there is a consistent increase in the average age of the population in India 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 ulnar variance and the increased complexity of the fractures, which could be a result of higher energy trauma, makes distal radius fractures complicated to treat. Fractures of the distal radius are currently the most prevalent osteoporotic fracture. There are many treatment options for these injuries.

During the last decade there 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 distal radius fractures 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 distal radius fracture.

However, comminuted and displaced intra-articular distal radius fractures 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.

Table 10: Mode on Injury

Studies	RTA	FOOSH
Mark J Richard et al[14]	23	47
Louis Catalano et al[15]	10	67
Georg Gradl et al[16]	70	30
Our study	57	43

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 and 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

Distal Radius Fracture's using External Fixator & K-wires and Open reduction with Volar Locking Plate. We evaluated our results and compared them with those obtained by various studies.

Age Distribution

Table 11: Age Distribution

Studies	Minimum age (Y)	Maximum Age (Y)	Average age(Y)
Mark J Richard et al[14]	16	66	50
Louis Catalano et al[15]	17	42	30
Georg Gradl et al[16]	18	88	63
Our study	18	65	37

In our study, Distal Radius fracture was more common in the second to third decade with an average of 37.3 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.

Gender Distribution

Table 12: Gender Distribution

Studies	Male(%)	Female(%)
Mark J Richard et al	48	52
Louis Catalano et al	67	33
Georg Gradl et al	13	87
Our study	57	43

Our study had a male preponderance with 57% male patients and 43% female patients and is comparable with the studies. Increased incidence in males is probably due to their involvement in outdoor activities and riding vehicles

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.

Mode of Injury: Our study has 57% patients presented injury in RTA.

Complication

Table 13: Complications

Studies	Complication %
Marc J. Richard et al[14]	26%
Louis Catalano et al[15]	30%
Georg Gradl et al[16]	19%
Our study	13%

We encountered a complication rate of 13%, mostly due to pin tract infections in the external fixator group, which were treated by antibiotics. Stiffness in wrist joint patients for which underwent physiotherapy and one patient with complex regional pain syndrome. The other studies

encountered simple post operative complications. Late complication like arthritis could not be assessed as it needed a long term of follow up than the set time.

Functional Outcome

Table 14: Functional Outcome

Studies	Excellent	Good	Fair	Poor
Marc J Richard et al[14]	63	20	17	0
Louis Catalano et al[15]	44	12	44	0
Georg Gradl et al[16]	15	15	8	4
Our study	33	43	21	3

Conclusions

Treatment of Type C distal end radius fractures fixation with volar plate and screw system is a

superior method to maintain the reduction till union and prevent the collapse of the fracture fragments, even in grossly comminuted, unstable and

osteoporotic bones; as compared with external fixator augmented with K – wires. However, in AO Type B (partial intraarticular fractures) fractures, Volar LCP and K- wire augmented External fixator provide equivocal results and none is proved superior.

Ligamentotaxis by external fixation provided favourable results in younger age group and in partial intra-articular type of distal radius fractures and requires atleast 4 cortical purchases on each side for effective stability.

According to the results obtained in a very short-term study of ours, both the methods of fixation for Distal end radius fractures with External Fixation with K wires and Volar Plating gave good results. However Volar Plating seems to be a better option in Osteoporotic, unstable, irreducible fractures.

Limitation: Larger number of sample size or a multicentric study with Longer duration of study would have been more conclusive with respect to the conducted study.

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