

Comparison Between Percutaneous Fixation using Kirschner Wires with Volar Locking Plate Fixation in Adults with Dorsally Displaced Fracture of Distal Radius

Sohail Rehman¹, Baqir Hussain¹, Naeem Ullah¹, Yousaf Gul²

Department of Orthopedic B, Lady Reading Hospital¹, Peshawar, Mufti Mehmood Memorial Gomal Medical College², Dera Ismail Khan.

Abstract

Background: The Volar Locking Plate Fixation (VLPF) is getting more preference among orthopedic surgeons for the treatment of distal radius fractures. Its management is overall very controversial.

Objective: To compare two generally used surgical methods for Dorsally Displaced Fracture of Distal Radius in adults i.e. Percutaneous Fixation (using Kirschner Wires) and VLPF.

Study type, settings & duration: This was a randomized control trial study was conducted in Lady Reading Hospital, Peshawar from April 2018 to January 2019.

Methodology: A total of 78 adults were distributed into two groups of 39 each. Patients in Group A fractures were fixed by percutaneous k-wire fixation while in Group B fractures were fixed by VLPF. After surgery, patients were followed up in the outpatient department as per protocol. Patients were assessed by using the Disability of Arm, shoulder, and Hand (DASH) score. Data were analyzed using SPSS version 21.

Results: Out of 78 patients with distal radius fractures, there were 27 (70%) males and 12 (30%) females in Group A, while there were 28 (72%) males and 11 (28%) females in Group B. The mean DASH score among the two groups was found to be 11.86 ± 5.96 in group A and 18.24 ± 8.02 in group B. Stratification of mean DASH score with age, gender, body mass index, and laterality showed significant differences between Groups A and B ($p < 0.05$) for each category division of these parameters.

Conclusion: The Volar locking plate was found to give a considerably high DASH score compared to Kirschner wire fixation in the present study population.

Key words: Volar locking plate, kirschner wire fixation, dash score, distal radius, fracture, treatment.

Introduction

The distal part of the radius is extremely sensitive to fracture and it is a very common medical issue among the aged population.¹ It has been observed that in Western countries, 6% of women aged 80 year have sustained a distal radius

fracture, and by the age of 90 year, the fracture rate increases to 9%.² In older patients, distal radius fractures are low-energy fractures associated with osteoporosis.³

There are various controversies surrounding the treatment methods for these fractures. With several fracture fragments, these fractures are defined as associative or communicated.⁴ Traditionally, the distal fracture was treated by cast immobilization (CI) and closed reduction, especially in older patients.⁵ Other conventional treatments like bridging fixators connecting directly with skeletal external fixation (BrEF), Kirschner wires percutaneous fixation method (PKF), and nonbridging fixators with external fixation (non-BrEF) have very promising functional results.⁶ The volar locking plating system (VLPS) gives equally good results both in elderly and young patients and is the most popular treatment method for distal radius fractures.⁷

Corresponding Author:

Sohail Rehman

Department of Orthopedic B

Lady Reading Hospital, Peshawar

Email: drsohailrehman26@gmail.com

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Authors Contribution

SR conceptualized the project. SR, BH & NU did the data collection. YG did the literature search. BH & NU performed the statistical analysis. Drafting, revision & writing of manuscript were also done by SR & BH.

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There has been short evidence regarding the surgical procedure and this fracture-related treatment. However, the prominently used surgical methods used to treat this fracture (distal radius fracture) are locking plate fixation and Kirschner wire fixation.⁸

In the Kirschner wire fixation technique, metal wires having sharp points have been designed around the affected fractured site and passed through the skin while in the volar locking technique, a fixed angle screw plate is directed and connected to the joining bone.⁹

In the present study, a comparison of the surgical procedures of Kirschner wire fixation was carried out with volar locking plate fixation. The basic aim of this study was to compare the mean disability of arm, shoulder, and hand (DASH) scores in patients undergoing locking plate fixation and Kirschner wire fixation for the management of patients with dorsally displaced fracture of distal radius.

Methodology

This was a 9-month cross over study carried out among 78 adults with an age of 16 to 70 years from April 2018 to January 2019. The study was carried out in Lady Reading Hospital, Department of Orthopedic Surgery, Peshawar. After obtaining formal approval of the study from the local ethics committee, departmental consent was also taken from the head of the department of the orthopedic unit of Lady Reading Hospital. Informed written consent was taken from each study participating patients, and the purpose of the study was explained to them. Patients were randomly allocated to groups A & B using blocked randomization by creating permuted groups. two groups were made of 39 each. Patients in Group A underwent fixation of fractures by percutaneous K-wire fixation while volar locking plate fixation (VLPP) was used for patients in Group B. Both fixation phenomenon was observed under standard aseptic technique. General anesthesia was used for both surgeries by a single surgical team. Patients were shifted to post-surgical wards after surgery and later discharged based on the report when patients were vitally stable and fit to join daily activities. Patients were asked to maintain follow-up after three months of surgery in the outpatient department. A questionnaire including the DASH scale was used to collect data. Data was analyzed using SPSS version 21.

The ethical approval was obtained from the Institutional Research and Ethics Board of Postgraduate Medical Institute, Lady Reading Hospital, Peshawar vide letter no. 4673.

Results

A total of 78 patients with distal radius fractures were studied. In group A, 16 (41%) patients were in the age range of 16-30 years, 14 (36%) were 31-50 years and 9 (23%) were 51-70 years. The study showed that the mean age of the study population was 49 ± 12.08 years. In Group B, 16 (41%) study subjects were in the 16-30 years age range, 13 (33%) were in the age range of 31-50 years, and 10 (26%) were in the age range of 51-70 years. It was found that 47 ± 11.61 years was the mean age of this study group. The gender distribution of Group A showed 27 (70%) male subjects and 12 (30%) female subjects while in Group B, male subjects were 28 (72%) and female subjects were 11 (28%). The results showed that 26 (67%) study subjects with BMI ≤ 25 Kg/m² and BMI > 25 Kg/m² were observed among 13 (34%) study subjects. Mean BMI was 25 ± 12.08 Kg/m² where as in Group B 25 (64%) patients had BMI ≤ 25 Kg/m² and 14 (36%) patients had BMI > 25 Kg/m². The mean BMI was 26 ± 11.61 Kg/m². Also in Group A, 21 (54%) patients had fractures of dorsally displaced distal radius on the right side while 18 (46%) patients had this fracture on the left side. In Group B, 23 (59%) patients had a fracture on the right side while 16 (41%) were on the left side. (Table-1).

Table 1: Demographic distribution of study participants. (n=78)

Demographic Variable	Division/ Categories	Group A (%)	Group B (%)
Age	16-30 years	16 (41)	16 (41)
	31-50 years	14 (36)	13 (33)
	51-70 years	9 (23)	10 (26)
	Total	39 (100)	39 (100)
	Mean and SD	49 ± 12.08	47 ± 11.61
Gender	Male	27 (70)	28 (72)
	Female	12 (30)	11 (28)
	Total	39 (100)	39 (100)
BMI	≤ 25 Kg/m ²	26 (67)	25 (64)
	> 25 Kg/m ²	13 (34)	14 (36)
	Total	39 (100)	39 (100)
	Mean and SD of BMI	25 ± 12.08	26 ± 11.61
	Mean and SD of Weight	80 Kg ± 8.08	82 Kg ± 9.61
Laterality (side)	Mean and SD of Height	1.4 meters ± 0.77	1.5 meters ± 0.53
	Right	21 (54)	23 (59)
	Left	18 (46)	16 (41)
	Total	39 (100)	39 (100)

Group A: Kirschner wire fixation
Group B: Volar locking plate fixation

Table 2: Comparison of group A and B for mean DASH score.

Mean DASH Score	Group A	Group B	p Value
Mean and SD	11.86±5.96	18.24±8.02	0.0002

Group A: Kirschner wire fixation

Group B: Volar locking plate fixation

Table 3: Mean DASH score w.r.t age, gender, BMI and Laterality. (n=78)

Demographic Variable	Division/ Categories	Group A (Mean± SD)	Group B (Mean± SD)	p value
Age	16-30 years	12.05± 6.12	19.04± 9.27	0.0002
	31-50 years	12.17± 6.37	19.11± 9.19	0.0002
	51-70 years	11.98± 5.98	18.34± 8.34	0.0002
Gender	Male	11.53± 5.31	18.30± 8.16	0.0001
	Female	11.47± 5.46	18.34± 8.27	0.0001
BMI	≤ 25 Kg/m ²	11.93± 5.62	18.25± 8.15	0.0002
	> 25 Kg/m ²	11.88± 5.59	18.33± 8.21	0.0001
Laterality (side)	Right	11.82± 5.90	18.10± 8.09	0.0002
	Left	11.80± 5.83	18.17± 8.10	0.0002

Group A: Kirschner wire fixation

Group B: Volar locking plate fixation

The mean DASH score among the two groups was analyzed where the mean DASH score in Group A was 11.86±5.96 while in Group B this score was 18.24±8.02 (Table-2). Stratification of Mean DASH score with age, gender, BMI, and laterality showed a significant difference between these two groups ($p < 0.05$) for each category division of these parameters (Table-3).

Discussion

Fracture of distal radius has been considered as one of the most common fractures in old age, representing about 17% of all the skeletal fractures.¹⁰ It accounts for approximately 75% of all forearm fractures.² The fractures and associated complications of the distal radius are the frequent types of injuries in the wrist region commonly dealt with by orthopedic surgeons while handling trauma patients. The fractures of the distal radius are categorized into stable (without significant shortening of bone) and minimal. These fractures can be treated in a supportive way or with a recently designed splint with air-bladder support.³ Few studies conducted locally that represent the true

picture of fracture of distal radius and treatment outcome.¹¹⁻¹³

Our study shows that the mean age in Group A was 49±12.08 years while in Group B, it was 47±11.61 years. The mean DASH score in Group A was 11.86±5.96 while the mean DASH score in Group B was 18.24±8.02.

A study conducted by Franceschi F et al¹⁴ presented similar results which noted that volar plating provided significantly better results of DASH as compared to other methods like KW (18.1±7.8 vs. 12.8± 6.4) at 3 months follow-up. The difference was statistically significant ($P=0.026$).¹⁴ A study carried out by Chaudhry H et al¹⁵ presented a similar pattern of results for this treatment.

In another study conducted by Zong SL,¹⁶ it was found that ORIF with VLPP showed some low level of postoperative complication and DASH scores¹³ at a lower level thus lowering the risk for postoperative superficial infection compared to other methods. Current study also showed similar pattern of findings. In another study conducted by Costa ML¹⁷, it was observed that there is no significant difference between these two methods of plating. The mean DASH score of the K-wire was 16.2±17.9 and was relatively higher than Volar plating (13.0±15.6) but not to the significance level ($p = 0.051$).

Similarly, Brennan SA¹⁸ had reported volar plate as a treatment method having mostly superior radiological outcomes but lacks significant evidence that it has some significant results.

There was a significant difference in the mean value of the DASH score of both fixation methods such as volar locking plate fixation and Kirschner wire fixation for management of dorsally displaced fracture of distal radius. The Volar locking plate was found with a considerably high DASH score compared to Kirschner wire fixation in the present study population. This study provided that the DASH score of the Volar locking plate studied on the present study population is in accordance with the success rate of the volar locking plate used in western countries to treat distal radius fracture.

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