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Early Assessment of Treatment Results Surgery of Distal Radius Fracture with Volar Plate Fixation at Highland Region General Hospital

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Abstract: *Distal radial fracture is the most common fracture seen in the emergency department, with over 640.000 such fractures occurring each year in the United States. The volar locking plating system has become increasingly popular as a fixation technique in the United States[1-2] because the best treatment for an inadequately reduced fracture of distal radius whit the volar exposure gives wide access to the distal part of the radius, thus facilitating the reduction of the fracture fragments for patients undergoing open reduction and internal fixation. But in the Highland region general Hospital, there are not reviews postoperative whit volar plate of fracture distal radius. Objects: to anatomical outcome, early assessment of treatment results surgery of distal radius fracture with use of the volar plating system.* ***Methods****: Highland region general Hospital in the department of Orthopaedics, BMT, Đaklak, Vietnam, conducted for a period of 1 year from May 2020 to April 2021.* ***Results****: Out of 31 patients, the study showed mean age of incidence to be (40.55±13.45) years in age group ranging from 18-65years. In our study we found that the injuries were result of accidental in a motorcycle, the commonest mode of injury (58.06%), fall (25.81%), sport- related (3.23%) and others injuries (12.90%). Male constituted the majority of study (64.52%). The reside in countryside the majority population (90.32%). Radiologic of the 31 patients, 12 (38.70%) had AO type A fractures, 12 (38.70%) had type B fractures, and 7 (22.58%) had type C fractures. All DRFs and all of the 2 ulnar styloid fractures united. Anatomical results postoperative by Max Scheck; excellent 24 (77.32%), good 6 (19.35%), poor 1 (3.23%).*

Key Words: *fracture, distal radius, internal fixation, volar plate.*

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I. Introduction

Distal radial fracture is the most common fracture seen in the emergency department, with over 640,000 such fractures occurring each year in the United States. The volar locking plating system has become increasingly popular as a fixation technique in the United States[1], Distal radius fracture is the most common fracture of the upper extremity, with an annual incidence of 2 to 4 per 1.000 persons.) The annual incidence of distal radius fracture is increasing in elderly population, due to an increase in life expectancy, as well as in young population, due to sports activities. Approximately 60.000 distal radius fractures occur annually in Korea[6], and the residual lifetime risk is about 21.7% for women aged 50 years[6]. In Vietnam is a country in Asia, slow development, especially in Daklak province, which is in the Central Highlands, rural areas, poorly educated people, mainly moving by motorcycle. Various treatment options are available for distal radius fractures. Stable distal radius fractures can be successfully treated by conservative methods, such as splinting or casting. However, some cases of unstable distal radius fractures and displaced intra-articular fractures require surgical treatment. Surgical options for the treatment of distal radius fractures include percutaneous pinning, internal fixation, and external fixation. Among these methods, the use of internal fixation using a volar locking plating system is the most common. At present, volar plate is generally used in the treatment of unstable distal radius fracture because of its advantages and the advancements presented with plate fixation systems. The purpose of study the present retrospective was anatomical radiographic results of open reduction and internal fixation of such fractures. Others of variables, such as the age of patient, sex, reside, sustained, occupation, fracture type…

II. Materials And Methods

Study setting: Highland region general Hospital in the department of Orthopaedics, BMT, Đaklak, Vietnam
Study design: Randomized, Described controlled.
Study period: Study conducted for a period of 1 year from May 2020 to April 2021.

Study population: Patient with distal radius fractures who attended emergency, department of Orthopaedics, Highland region general Hospital during study period after initial manipulation in the casualty if deemed to be unstable were included if following inclusion criteria were fulfilled.

Inclusion criteria: Those who has given consent for the operation and the study after proper explanation regarding the study and at least 18 years of age with unstable distal radius fractures were included in our study. Fractures were deemed unstable if they had displaced after initial treatment with closed reduction and splinting, or if three of the following criteria as described by Mathews et al[7] were met - dorsal angulation of $>20^0$, Radial inclination $< 10^0$, an intra-articular fracture (step or gap >2mm), an associated ulnar styloid fracture.

Exclusion criteria: Fractures with neurovascular injury, non displaced fracture, pathological fracture**,** fractures with immature skeleton**,** distal radius fracture extending to the shaft of the radius, polytrauma, fractures with incomplete follow up.

Sampling design: Patients are choosen from the group who has given consent for the study and fulfilled inclusion criteria. Randomization was done with volar plate fixation used for 31 cases.

Surgical technique: The patients was operated under regional or general anesthesia and antibiotic prophylaxis was given 30minute-1 hour before induction of anesthesia. Patient was placed in the supine position with hand supported on hand table and affected limb was prepared with 10% betadine solution & draped. A tourniquet was applied to the upper arm as proximal as possible.

Surgical approach for volar plate fixation: The incision was by Henry volar approach. The skin incision was centred over the FCR tendon and of approximately, a volar approach with an 8-cm zigzag skin incision along the radial side of the flexor carpi radialis (FCR) tendon was used. After splitting the forearm fascia, the FCR tendon, flexor tendons, and median nerve were retracted to the ulnar side, and the pronator quadratus muscle was detached from the radius. Reduction was performed under direct vision and confirmed with an image intensifier, and the bone was fixed temporarily with Kirschner wires. Then, the plate was inserted, and fixed using a 2.7-mm cortical screw in the gliding hole. Correct positioning was verified using an image intensifier. The distal portion of the plate was fixed to the radius using 2.4-mm locking screws, and the proximal portion was fixed to the radius using 2.7-mm locking screws. After placement of the plate, the detached pronator quadratus muscle was re-attached with absorbable sutures. After wound closure, Ulnar styloid fracture, DRUJ was fixation by K wire. Postoperatively, a compressive dressing and a splint were applied.

Postoperative management: Postoperatively, the limb was placed into a bulky dressing, postoperative active finger movements were encouraged. Suture removal was done on the 10 day and then they are discharge. Ulnar styloid fracture, DRUJ was fixation by K wire, for K wires were removed after 4 weeks.

Data management and statistical analysis: Data was checked for completeness and consistency. Data were entered and analysed using SPSS V.20 for window. Unpaired student t-test is used for physical and radiographic measurement. p value of < 0.05 was considered statistically significant.

III. Results

31 patients with fracture distal end of radius who met the inclusion criteria were included in the study, out of which 31 were described, randomized, treated by opened reduction fixation, treated by volar plate.

1. Age distribution:

Table 1: showing age distribution of the patients in different groups.

Age in years	No of patients	percentages
18- 40 years	14	45.16
41-60 years	15	48.39
>60 years	2	6.45
Total	31	100.00

2. Sex distribution:

Table 2: Sex distribution of the patients

Sex of the patients	No of patients	Percentages
Male	9	35.48
Female	22	64.52
Total	31	100.00

3. Side of involvement

Table 3: Showing Side of involvement:

Gender	No of patients	Percentage
Right	17	54.84
Left	14	45.16
Total	31	100.00

4. Mode of injury:

Table no 4: showing Mode of injury:

Mode of injury	No of patients	Percentage
Motorcycle	18	58.06
Accidental Fall	8	25.81
Working accident	4	12.90
Sporting	1	3.23
Total	31	100.00

5. AO classification :

Table no 5: Showing distribution of fracture according to AO classification.

Type	No of patients	Percentage
A (Extra articular)	12	38.70
B (Partial articular)	12	38.70
C (Complete articular)	7	22.58
Total	31	100.00

6. Time interval between injury and surgery:

Table no 6: Showing distribution of surgical lag time

Surgical lag time	No of patients	Percentage
< 8 hours	2	6.45
8-24 hours	0	00.00
>24 hours	29	93.55
Total	31	100.00

7. Closed reduction:

Table no 7: Closed reduction

Closed reduction	No of patients	Percentage
Yes	11	35.48
No	20	64.52
Total	31	100.00

8. Duration of surgery:

Table no 8: Showing timing of duration of surgery

Duration	The shortest	The longest	Mean(average)
Minutes (Mean)	45	90	63.23±11.30

9. Combined surgical:

Table no 9: Showing combined of surgery

Surgical	No of patients	Percentage
Volar plate	23	75.19
Volar plate and K wire	8	24.81
Total	31	100.00

10. Duration timing in hospital:

Table no 10: Showing timing in hospital

Duration timing	The shortest	The longest	Mean(average)
Day	2	9	5.84±1.64

11. Radiological assessment postoperative: described by Scheck

Table no 11: Anatomical Results

Results	No. of patients	Percentage
Excellent	24	77.32
Good	6	19.35
Poor	1	3.23
Total	31	100.00

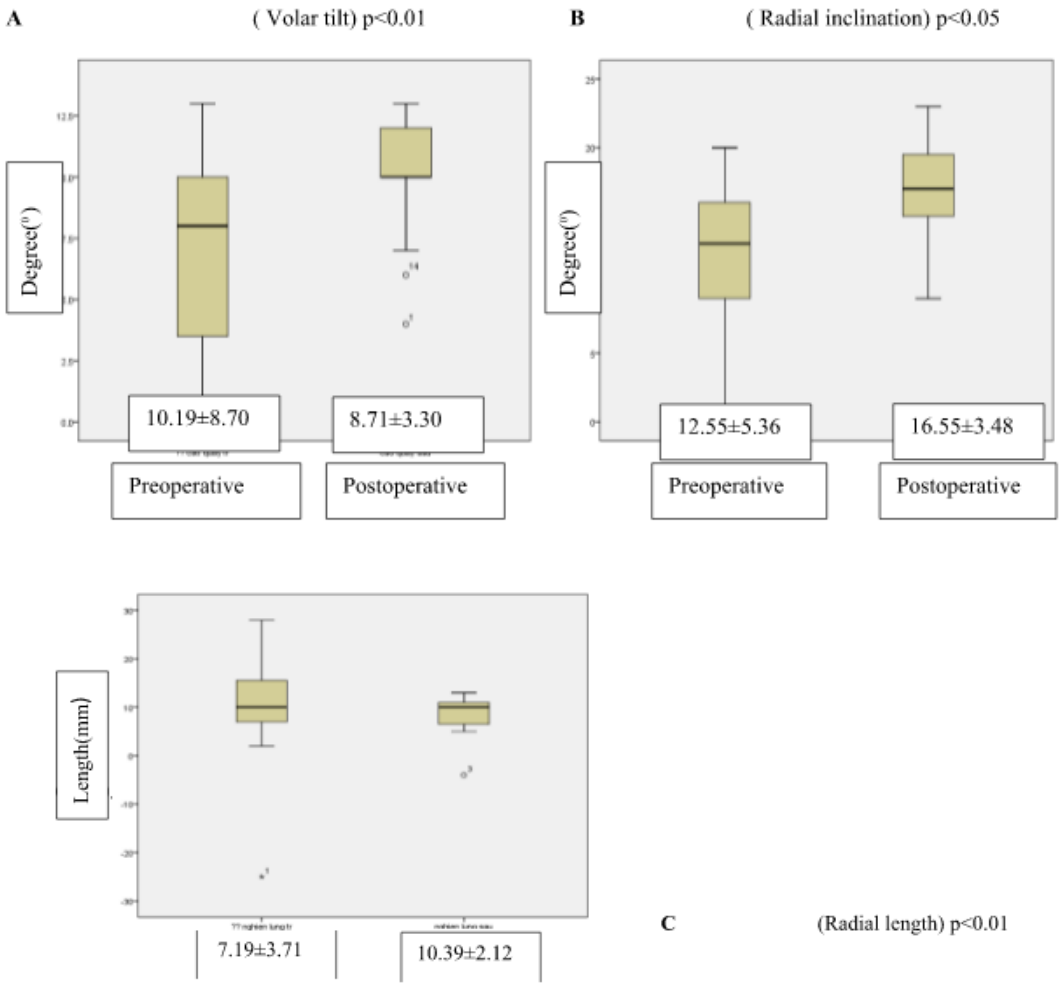

Fig.1. Changes of radiology parameters. (**A**) Volar tilt. (**B**) Radial inclination. (**C**). Radial length.

12. Complications: There was no intra-operative or immediate postoperative complication. But radiology outcomes; two patients screw intra-articular, two case is step off of above 2mm surface. There were no case of infection, complex regional pain syndrome, tendon rupture, nerve, else others.

IV. Discussion

Internal fixation of the distal radius has become increasingly popular over the past decade. Displaced intra-articular fractures are treated preferably by open reduction and internal fixation because the restoration of articular anatomy is the most critical factor in obtaining a good functional result. Loss of radial height or inability to restore and maintain physiologic radial tilt or length requires surgical treatment. Furthermore intra-articular step off and gap displacements also may be indications for surgical treatment. Making a decision regarding the appropriate surgical approach for open reduction and internal fixation sometimes is based on the direction of fragment displacement.

Fixed-angle volar plating represents a valuable treatment modality for the most frequent types of unstable fractures of the distal radius. Conventional method of reduction and cast treatment for distal radius fracture has resulted in unsatisfactory anatomical and functional results, varying degree of deformity and disability with secondary loss of reduction during on going treatment. In our study, the overall mean age for all patients was 40.55 ±13.45 years .The age group of 41 to 60 years comprised the highest no of patients (48.39%). Jupiter et al[5] reported that the mean age of the patients were 43 years in patients undergoing, SudipDeb et al[11] the study showed mean age of incidiene to be 44.5±11.94 years. Patients are prone for fracture because they are the main motorcycle population of the society. In our study, males constituted a majority portion of the patients undergoing plating (64.52%) and while females constituted 35.48% of the study. Fujitani et al[3] reported that 36% of the patients were males and 64% were females. Gong et al[4], from his study findings, reported that 27.58% males, while were females 72.42%, it may be because of increase incidence of osteoporosis in elderly females which makes them vulnerable to fractures. It was observed in our study that patients undergoing had injury on the left side 45.16 while 54.84% patients had injury on the right side. Kim et al[6] reported that in

patients undergoing wiring, 45.65% patients had injury on the right side and 54.35% patients had injury on the left side. In our study road traffic accident was main mode of injury (58.06%) cases followed accidental fall (25.81%). Jupiter et al[5] also reported as a main mode of injury followed by road traffic accident no of patients 29 our of 49 patients, accidental fall 12 patients. In our study we got AO type A fracture constituted higher no of patients (38.70%) followed by type B fractures (38.70%), type C (22.58%). Kim et al [6] also reported the same 43.47% cases of Type A fracture in their studies. In Gong et al [4] also found maximum cases in extra reticular 41%, type B were 10%, type C were 48%. The time to operation from the date since injury for all fractures our study before 8 hours were 2 cases (6.45%). In our study, The mean duration of the operation was 63.23±11.30 minutes (rang, 45-90 minutes). Jupiter et al showed 83 minutes (rang, 30-175 minutes). In our study, there was no intra operative and immediate postoperative complication. Ruch et al[9] reported that in patients who underwent plating, 5.8% had neurological injury, 2.9% had tendon injury. In our study showed radiologic outcomes by max Scheck results Excellent (77.32%), Good (19.35%), Poor (3.23%). The average preoperative volar tilt was 10.19±8.70^{o} (rang, -25^{o} to 28^{o}), the immediate postoperative volar tilt was 8.71° ± 3.30° (range, -4° to 13°). The preoperative radial inclination was 12.55° ± 5.36° (range, 0° to 20°), the immediate postoperative radial inclination was 16.55° ± 3.48° (range, 9° to 23°), preoperative radial length was 7.19 ± 3.71 mm (range, 0 to 13 mm), the immediate postoperative radial length was 10.39 ± 2.12 mm (range, 4 to 13 mm), Kim et al[6], the preoperative volar tilt was -8.0° ± 16.3° (range, -47.4° to 34.2°), the immediate postoperative volar tilt was 8.5° ± 2.8° (range, 1.2° to 13.7°), and the final follow-up volar tilt was 8.4° ± 2.7° (range, 1.2° to 13.4°). The preoperative radial inclination was 16.3° ± 6.2° (range, 2.5° to 27.9°), the immediate postoperative radial inclination was 22.4° ± 2.3° (range, 17.7° to 26.4°), and the final follow-up radial inclination was 22.2° ± 2.3° (range, 17.7° to 26.3°). Preoperative radial length was 8.3 ± 3.2 mm (range, 1.6 to 14.8 mm), the immediate postoperative radial length was 11.3 ± 1.6 mm (range, 8.7 to 14.2 mm).

It is our opinion that highly functioning patients, would benefit from plate fixation with the advantage of early return to independent function on the other hand we suggest that patients those who have good supporting system can be treated with less expensive implants with equal functional outcomes. Our study suffered from several limitations including: The sample size was small, a multicentric trial with larger sample size would be more informative, blinding of the patients, the surgeons or the reviewers was not possible, our study was hospital based many distal radius fractures which were being managed conservatively in the community could not be reached.

V. Conclusion

The multifragmented nature of the articular surface necessitated the use of additional implants to supplement the volar T plate in patients. The surgeon should be prepared to use an additional K wire consisting of the styloid process.

Open reduction and internal fixation with a volar plate are excellent clinical and radiographic results in patients with distal radial fractures in early follow up period. ORIF with volar plate provide better radiological outcomes with more stable fixation thus lesser degree of loss of reduction. It had better radiographic outcome. Unstable intra-articular radius fractures that cannot be reduced or held reduced with pinning should be treated with plate systems.

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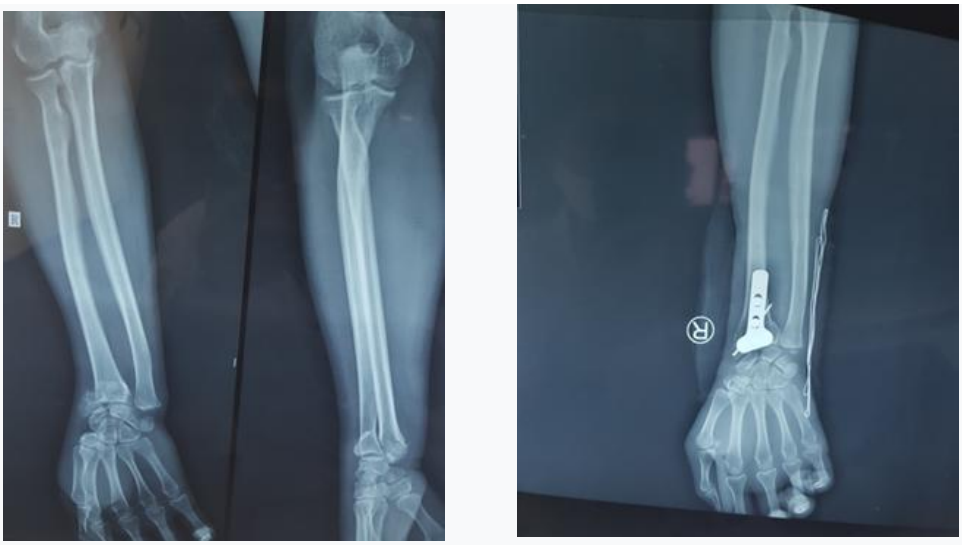

Figure no 1: Showing some of the pre and postoperative x-rays AP and Lateral view

Figure no 2: Showing some of the malunion reduction by casting

Figure no 3: Showing some of the pre and postoperative x-rays AP and Lateral view