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**Research Article**

# Clinical And Functional Outcome of Associated with Volar Locking Plate of Distal Radius Fracture

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**Abstract:** ***Introduction:*** Distal radial fractures are treated with a variety of techniques. ORIF is indicated to address the unstable distal radius fractures and those with articular incongruity that cannot be anatomically reduced and maintained through other techniques. The patients can be mobilized early and potentially reducing wrist stiffness. ***Objective:*** To assess the clinical and functional outcome of fracture distal radius treated with volar locking plate and to observe the complications associated with volar locking plate of distal radius. ***Methods:*** This cross-sectional study was carried out at Department of Orthopedic Surgery, BSM Medical University, Dhaka, Bangladesh from December 2013 to December 2014. In this study 50 patients with distal radius fractures and were operated with a volar locking compression plate using a volar Modified Henry's approach. The patients were regularly followed up at six weeks, three months and six months, one year following the surgery and were evaluated clinically and radiologically. Final outcome was evaluated by QUICK DASH evaluation questionnaire. ***Results:*** There are 20 males and 30 females with an average age of 41.2 years. At the end of one year the functional outcome based on Quick DASH score was excellent in 80% of the patients and while good outcomes were noted among 20% of patients, no Poor results. A total of four complications, 2 cases of stiffness and 2 cases of extensor pollicis longus tendon irritation occurred. ***Conclusion:*** A satisfactory functional and radiological outcome can be obtained for a great majority of patients with most of the distal radius fractures including complex intra-articular fractures by using a volar locking plate fixation and the overall complication rate was low.
**Keywords:** Distal radius fractures, Unstable fractures, LCP, Volar approach.

## INTRODUCTION

Fractures of lower end of radius are the most common fractures of the upper extremity, constituting about 17% of all fractures and 75% of all forearm fractures [1]. It occurs in the middle aged and elderly womencommonly. Intraarticular involvement is one of the complex patterns and constitutes about 25% of such injuries [2]. It has got the bimodal distribution with increased incidence in old age due to osteoporosis and in the young population due to high-velocity injuries and outdoor activities [3]. Being the intraarticular, fracture of distal radius accurate reduction and stabilization is the challenge for these complicated injuries despite the controversies in treatment and rehabilitation of these injuries [4]. Volar/dorsal tilt, radial inclination, ulnar variance, and intraarticular step-off are the important factors to assess the severity of the injury and decide on the optimum treatment option for the fracture [5]. It also occurs in young men who are injured at high speeds. Patients with distal radius fractures are likely to suffer from many complications, and failure to treat can lead to permanent disability. Therefore, treatment methods are constantly being improved, and the most appropriate treatment must be selected each time. Distal radius fractures are treated with various techniques, including closed manipulation, POP cast reduction and percutaneous pinning, and ligamentous external and internal fixation. ORIF is indicated for the treatment of unstable distal radius fractures and fractures with joint malalignment. Closed manipulation and ligamentous reduction can be achieved and maintained with percutaneous pinning. Although various surgical techniques have been described in the literature, currently ORIF with volar locking compression plates is used to treat distal radius fractures, resulting in good reduction and immediate stability. Problems with dorsal fixed-angle plates have led to the use of volar fixed-angle plates for dorsal fractures. Given the high frequency of distal radius fractures and the limited data

available regarding optimal treatment, this study was performed to evaluate the functional assessment of subradial fractures treated with volar locking plate fixation followed by early wrist mobilization.

## METHODS AND MATERIALS

This cross-sectional study was carried out at Department of Orthopedic Surgery, BSM Medical University, Dhaka, Bangladesh from December 2013 to December 2014. In this study 50 patients, treated for unstable distal radius fractures using volar locking plate in our institution who fulfilled inclusion criteria are taken. The patients were regularly followed up at six weeks, three months and six months, one year following the surgery and were evaluated clinically and radiologically. Final outcome was evaluated by QUICK DASH evaluation questionnaire.

**Inclusion criteria**: 1. Adults with more than 18 years of age. 2. Patients presenting with Frykman's classification. 3. Patients an aesthetically fit for surgery.
**Exclusion criteria**: 1. Skeletally immature patients. 2. Stable extra articular fractures. 3. Compound fractures. 4. Patients with associated injuries in the same fore arm.

There were 30 males and 20 females between the age group of 18-70 years. 35 patients had right side involvement and 15 had left side involvement. Of the 50 cases injury occurred due to road traffic accident in 30 patients and fall on out stretched hand in 20 patients. All patients selected for the study were admitted and examined according to protocol. The selected patients were briefed about the nature of the study and a written informed consent was obtained. The information such as sex, age, details of injury, duration and progression were obtained through an interview. Patients are subjected to clinical as well as local examination. These findings were recorded on predesigned and pretested proforma. Any emergency management if required was done and the patients were evaluated with respect to the pre-operative investigations. Standard radiographs in AP and lateral views are taken for the diagnosis and to know the type of fracture. The fracture fragments were analysed. The involvement of radio-carpal and distal radioulnar joints was assessed and classified according to the Frykman's classification.

**Surgical procedure**: The duration from the date of injury to date of operation ranged from 2-5 days.

**Procedure**

All cases are managed with a volar locking compression plate using a volar Modified Henry's approach. The incision for volar plating of the distal radius fractures is performed through the distal extent of the modified Henry's approach. An incision was made between the flexor carpi radialis (FCR) tendon and the radial artery. This interval is developed, exposing the flexor pollicis longus (FPL) muscle at the proximal end of the wound and the pronator quadratus muscle distally. The radial artery is carefully retracted radially and the tendons of the flexor carpi radialis (FCR) radially and flexor pollicis longus (FPL) ulnar side. (figure 1- A, B).

The pronator quadratus muscle is divided at its most radial aspect. Any elevation of the muscle of the Flexor Polices Longus should be done at its radial aspect, as it receives its innervation from anterior interosseous nerve from its ulnar side. Pronator quadratus is divided and elevated, the fracture is visualized, and reduction maneuvers can be accomplished under direct vision. The final position of the plate was confirmed using fluoroscopy. Pronator quadratus was used at the time of closure, to cover, the implants that were applied to the anterior surface of the radius. Once stable fixation was achieved and hemostasis secured, the wound was closed in layers and sterile dressing was applied. The tourniquet was removed and capillary refilling was checked in the fingers. The operated limb was supported with a below elbow POP slab with the wrist in neutral position.

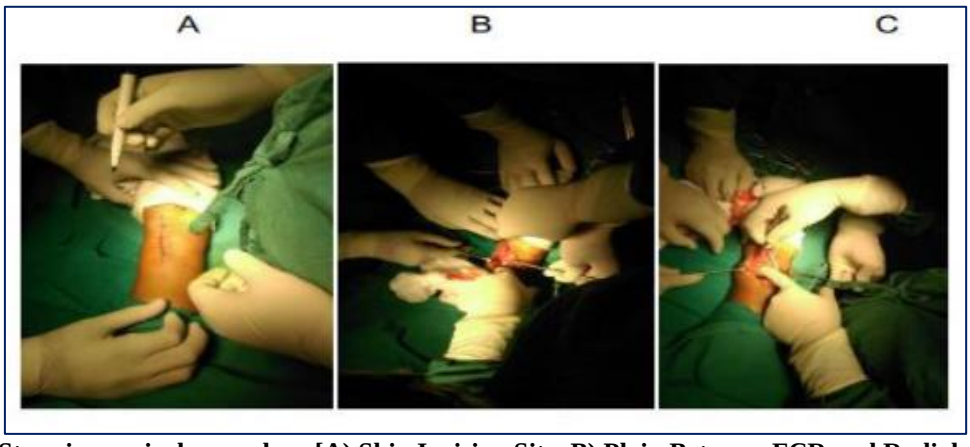


**Figure 1: Steps in surgical procedure [A) Skin Incision Site, B) Plain Between FCR and Radial Artery, C) Fracture Reduction]**


**Figure 2: Pre & post op x-rays**

**Post-operative care, follow up**

Follow-up of patients was done at six weeks, three months and six months, one year following the surgery. Assessment: For all subjects, radiographs were performed at the end of six weeks, three months and six months, one-year follow-up. Patients are evaluated based on the following parameters at the time of discharge and all the four follow up.

**Range of motion**

Wrist - Flexion, extension, supination, pronation, ulnar deviation and radial deviation Elbow - Flexion, extension, supination and pronation. Final outcome was evaluated by QUICK DASH[3]evaluation questionnaire which consists of 11 items to measure physical function and symptoms in Upper limb musculoskeletal disorders

**RESULTS**

A total of 50 cases who sustained fractures of lower end of radius were included in the study. There are 30 males and 20 females with an average age of 41.2 years. At the end of one year the functional outcome based on Quick DASH score was excellent in 80% of the patients and while good outcomes were noted among 20% of patients, no Poor results. A total of four complications, 2 cases of stiffness and 2 cases of extensor pollicis longus tendon irritation occurred.

**Table1: Incidence of Distal Radius Fractures in Different Age Groups**

| Age in years | No of Cases | Percentage |
|---|---|---|
| 18 – 30 | 10 | 20 |
| 31 – 40 | 17 | 34 |
| 41 – 50 | 12 | 24 |
| 51 – 60 | 10 | 20 |
| 61 – 70 | 1 | 2 |

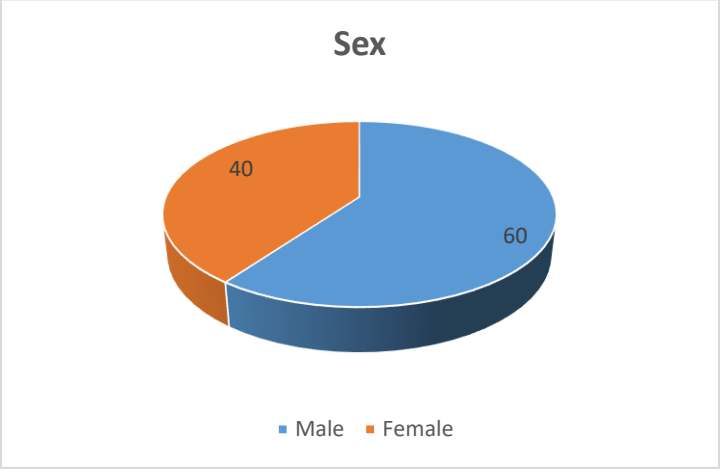


**Fig 1: Sex Incidence**

**Table 2: Side of Involvement**

| Side | No of Cases | Percentage |
|---|---|---|
| Right | 35 | 70 |
| Left | 15 | 30 |

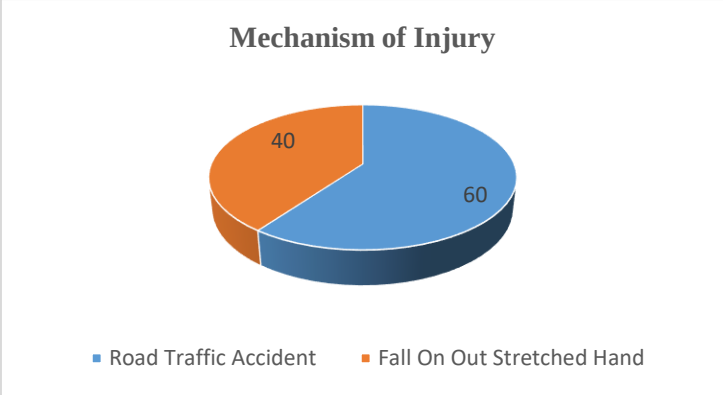


**Fig 2: Mode of Injury**

**Table 3: Type of Fracture According to Frykman's Classification**

| Type | No of Cases | Percentage |
|---|---|---|
| I | 5 | 10 |
| II | 1 | 2 |
| III | 13 | 26 |
| IV | 7 | 14 |
| V | 11 | 22 |
| VI | 2 | 4 |
| VII | 8 | 16 |
| VIII | 3 | 6 |

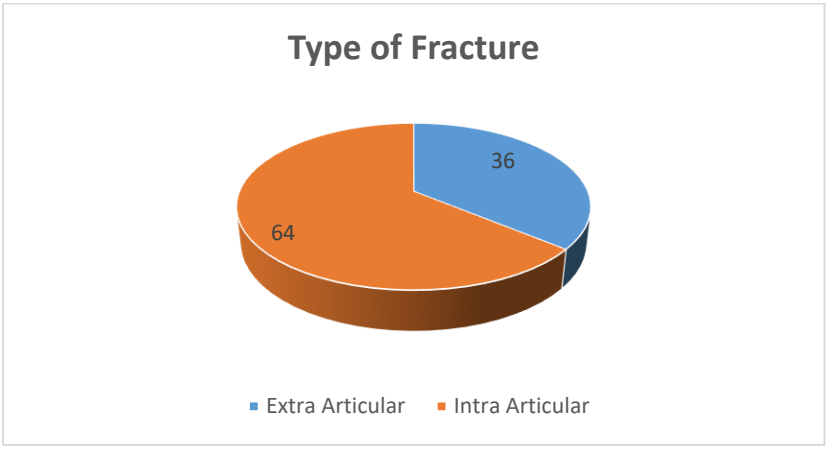


**Fig 3: Extra Articular and Intra Articular Fracture**

**Table 4: Time Since Injury, Fracture Union and Quick Dash Score**

| Duration | No of Cases | Percentage |
|---|---|---|
| 1 – 5 Days | 46 | 92 |
| 6 – 10 Days | 4 | 8 |
| **Time Of Union** | | |
| 2 – 3 Months | 36 | 72 |
| 3 – 4 Months | 10 | 20 |
| 4 – 6 Months | 4 | 8 |
| **Score** | | |
| ≤25 | 40 | 80 |
| 26 To 50 | 10 | 20 |
| 51 To 75 | - | - |
| Total | 50 | 100 |

## DISCUSSION

The distal end of the radius fractures is the most common fractures being treated, presenting to the emergency department. Though it is prevalent in the old age population due to osteoporosis, it's also more commonly present in the young population due to high-

velocity injuries [3]. Multiple opinions are there in terms of treatment of distal radial fractures from the conservative, that is, closed reduction and cast application to open reduction and internal fixation if the anatomical reduction and alignment is not achieved by the conservative means [6]. Distal radius fractures are the most common fractures of the upper extremity. The main goal of treatment is to restore anatomical integrity and maintain interarticular integrity and radial length. The main goal in the treatment of this injury is to achieve good reduction and immediate stabilization to achieve anatomical fracture union, rapidly restore hand function, and avoid complications. The development of locking plates allows fixation of fractures with displacement in any direction through a volar approach, with the implant placed on the tension side of the fracture. Locking plates achieve stability by reducing the compressive forces acting on the bone. This prevents compression of the periosteum and compromise of the blood supply, facilitating fracture healing. In unstable intra-articular fractures of the distal radius, when open reduction is required, closed methods are often unable to restore the integrity of the wrist joint and maintain radial length. This study was conducted to observe the functional outcomes of surgical treatment of distal radius fractures with volar locking plate fixation. The results of this study were compared with those of several other studies that used different treatment methods. In present study the average age is 41.2 years which is comparable with other studies done by Kilic A et al [7], Chung KC et al [8], Lozano-Calderon sa, et al [9] and Anakwe E et al [10] who reported an average age of 45 years, 48.9 years ,51 years and 48 years respectively. In present study the reduction achieved in terms of radial inclination, volar tilt and radial length is as follows: the average radial inclination preoperatively was 7.76±5.8 degrees, the average postoperative radial inclination was 18.2±3.3degrees. The average radial inclination achieved was 10.44 degrees. Mean volar tilt was17.1±7.82degrees and mean postoperative volar tilt was 6.95±4.54degrees, the total correction achieved was 19.63±7.56degrees. The higher degree of correction achieved was due to the fact that the dorsal tilt was expressed in negative value and hence the correction achieved was greater than the normal range (0-11degrees). Mean radial length 3.66±1.79mm was observed preoperatively with an immediate postoperative radial length of 9.08±1.65mm, we achieved a mean correction of 6.15±2.66mm during the surgical procedure The results are comparable with the studies done by K. Egol et al [11], Tamara D et al [12], Marco Rizzo. Brain A. Katt. Joshua T and others [13]. The mean range of motion achieved in our study was as follows palmar flexion of 77±3.10degrees, dorsiflexion of 71.5±3.17degrees, radial deviation of 18.16±5degrees, ulnar deviation of 32.60±4 degrees, supination of 73.75±4.07degrees, pronation of 69.41±3.33degrees. These results were taken at 1 year postoperatively and were compared with the normal side. The results can be compared with studies done by Tamara D et al [12] and Marco Rizzo.et al [13]. In our study stiffness and extensor pollicis longus tendon irritation were the most common complications (6.6 %) seen, similar when compared to that of studies conducted by Rohit Arora et al [14] and Yukichi Zenke et al [15].

## CONCLUSION

Finally, we examined the functional outcomes of locking volar compression plates and found improved range of motion and radiographic results at 3, 6 months, and 1 year follow-up. Thus, this study demonstrates that by using good surgical technique, including proper plate positioning, proper screw insertion and avoidance of over-tipping, and appropriate patient selection, most distal radius fractures (including complex intra-articular fractures) can be treated in the vast majority of patients with distal radius fractures (including complex intra-articular fractures) with volar locking plate fixation and can achieve satisfactory functional and radiographic outcomes.

Conflict of Interest: None.
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