

## Evaluation of clinical and functional outcome of open reduction and internal fixation with volar plating in Volar Barton's fracture of distal radius.

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### Abstract

#### Introduction.

Distal radius fractures are one of the most common injuries which come to the orthopaedic surgeons. Displaced extra-or intra-articular fractures require anatomical reduction for a good outcome. Historically, these fractures were treated with manipulation and casting, with or without Kirschner (K) wire fixation. Modern plating techniques have been advocated to restore anatomical alignment and allow early mobilisation. Despite the wide variety of treatment options available there is still debate about the best way to treat these fractures.

**Purpose:** A study evaluating the clinical and functional outcome of open reduction and internal fixation with volar plating in Volar Barton's fracture of distal radius.

**Method:** 35 adults patients operated for distal radius Volar Barton's fracture were included and outcomes were assessed using the DASH scoring system.

**Result:** Functional outcome was excellent in 25 (71%), good in 8 (23%) and fair in 2 (5%) according to patient rated DASH score. Patients had no residual deformities or pain. Complication occurred in 5 (14%) cases of which 3 (11%) had joint stiffness, 2 (5%) had superficial infection.

**Conclusion** Notwithstanding a very small sample size and a short follow up, Volar locking plate osteosynthesis at the distal radius signifies a significant improvement in the treatment of distal radial fractures in terms of restoration of the shape and function of the wrist.

**Keywords:** Volar Barton's fracture, open reduction and internal fixation (ORIF), volar plating, distal radius, DASH score

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### I. Introduction

Reliable internal fixation for the comminuted or osteoporotic distal radius fracture finally became available with the introduction of fixed angle fixation implants. These implants function as neutralization devices; they provide distal stability by direct support of the subchondral bone. Distal end radius fractures comprise approx 10-15% of total fractures. Fall on out-stretched hand or road traffic accidents are commonest causes. Malunion of distal end radius fractures is the most common complication which leads to variable deformity, decreased motion at wrist and hand, decreased grip strength due to arthritis<sup>1</sup>.

Articular congruity with restoration of radial inclination, volar tilt and radial length in intra-articular distal end radius fractures decrease complications such as osteoarthritis and stiffness. Early post operative mobilization further aids the functional outcome<sup>2,3</sup>. Subluxation or dislocation of the radiocarpal joint is usually present in intra-articular fractures involving the dorsal or volar rim of the radius. Barton described the fractures of the dorsal rim of radius, so when the volar rim is fractured it is referred to as volar Barton's fracture. Term volar Barton's being considered as an eponym, current literature favours calling it as reverse Barton's fracture<sup>4</sup>. This fracture is also classified as Type 23 B3 in Muller AO classification<sup>12</sup>. Conservative treatment in volar barton fractures leads to instability, stiffness, loss of reduction and late stage osteoarthritis<sup>5</sup>. ORIF with volar plating is being recommended nowadays for volar barton fractures. Volar plating aids in maintenance of reduction and allows early mobilization<sup>6,7</sup>.

### II. Aims And Objectives

The aim of the current study is to evaluate the clinical and functional outcome of Volar Barton's fracture treated with ORIF by volar plating followed by early mobilization. Scoring for evaluation used was Disabilities of the Arm, Shoulder and Hand (DASH)<sup>8</sup> score.

## **Methods**

35 Adult patients with Volar Barton's (Muller AO type 23 B3) distal radius fractures treated at Government Hospital for Bone and Joint Surgery, GMC Srinagar and Associated Hospitals from Oct 2017 to Jan 2020 were included in this study.

## **Inclusion Criteria**

- 1) Age 18 years or older.
- 2) Volar Barton's fracture (Muller AO type 23 B3) of distal radius.
- 3) Patients who are fit for surgery.
- 4) Patients giving informed and written consent.

## **Exclusion Criteria**

- 1) Patients below the age of 18 years.
- 2) Extra-articular and dorsal Barton's fracture of distal radius.
- 3) Patients who were medically unfit.
- 4) Compound or pathological distal radius fracture.

## **Operative protocol**

Modified Henry's approach to distal radius was done in all cases under General anaesthesia/Regional block. Congruent reduction was achieved Volar plate of varying length and screws was applied as per fracture requirement . Post operatively the operated limb was kept elevated for 48 to 72 hours and was monitored clinically for any neurovascular deficit. Broad spectrum antibiotics were administered intravenously for two to five days, active and passive shoulder, elbow, wrist, fingers movements were started from the day of surgery. Above elbow POP slab was given in comminuted, unstable fractures. Protected use of limb was advised throughout the healing phase, but contact sports and lifting heavy weights were prohibited. Physiotherapy to regain movements of wrist, pronation and supination of the forearm were started immediately and consists of active movements and exercises.. Follow-up radiographs of the wrists were taken to assess reduction and bony union Follow up was regularly done at 3 weeks, 6 weeks, 3 months, 6 months, 1 year and 2 years. Functional outcome evaluation was done using DASH score.

## **III. Results**

There were a total of 35 patients included in this study and operated with volar plating Males accounted 14 (40%) and females accounted 21 (60%). Out of 35 cases in the present study mechanism of injury was road traffic accident in 21 (60%) cases and fall in 14 (40%) cases. There was right side predilection of injury owing to 24 (68%) cases were involving right wrist and 11(32%) with left wrist.

Union occurred in all the patients within approx 3 months.

Complications were observed in 5 (14%) of which 3 (8%) had joint stiffness, 2 (5%) had superficial infection which recovered after antibiotics. None of the patient had neurological complications , although one patient complained of decreased sensations over superficial radial nerve distribution which recovered with observation only.

## **Radiological Evaluation and Grip Strength**

Radial length improved from an average of 9mm before the reduction to an average of 11.8 mm at recent follow up. The average Radial length of contralateral side was 13 mm. Radial inclination improved from an average of 17° before the reduction to an average of 20.2° at recent follow up. The average Radial inclination of contralateral side was 23° volar tilt improved from an average of - 4° dorsal tilt before the reduction to an average of 6.5° at recent follow up. The average volar tilt of contralateral side was 11° Articular congruity. The restoration of articular congruity of distal radius was assessed on anteroposterior radiograph and graded according to the congruity of the subchondral line of the distal radius. Grip strength the grip strength on the injured side averaged 85% of that of the uninjured side.

## **Range of Motion**

The range of motion of the wrist and forearm at the latest follow-up has been recorded for all patients. There was mean of 16.4° (range15°-20°) of the radial deviation, 20° degree (range 13°-30°) of ulnar deviation, 65° (range 45°-80°) of dorsiflexion, 61° (range 40°-70°) of palmar flexion, 68° (range 45°-80°) of supination and 71° degree of (range60°-85°) pronation



Modified Henry's Volar Approach to the distal Radius with Volar Plating

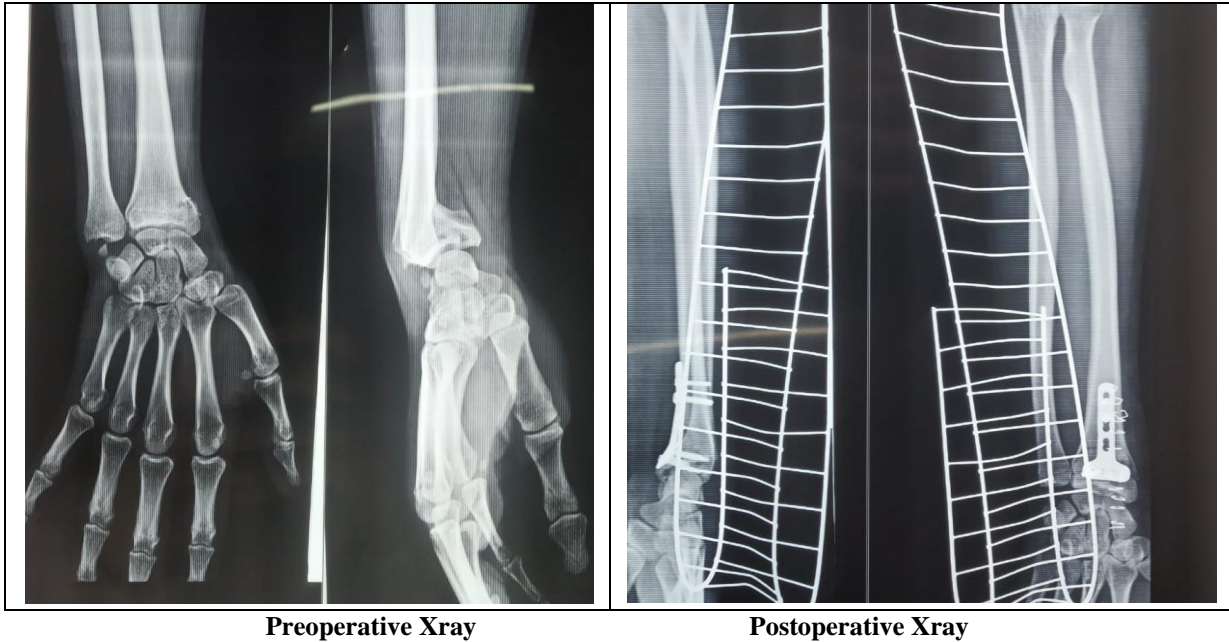
**Case No 1**



**Pre operative xray**

**Postoperative Xray**

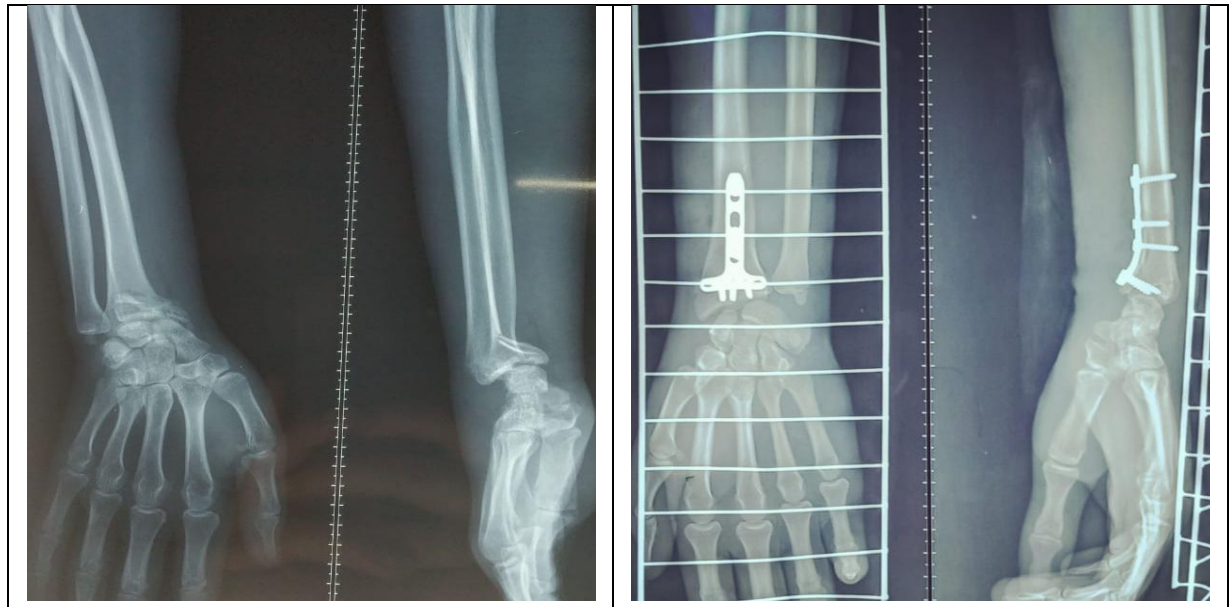
**Case No 2**



**Preoperative Xray**

**Postoperative Xray**

**Case No 3**



**Preoperative Xray**

**Postoperative Xray**

**Variables**

Age in Years	No of Cases	Percentage
21-30	05	14%
31-40	11	32%
41-50	10	28%
51-60	07	20%
61-70	02	6%

Out of 35 patients there was excellent functional outcome in 25 (71%), good in 8 (23%) and fair in 2 (6%) using the DASH scoring system which is tabulated below:

Results	Functional (DASH)	Percentage (%)
Excellent	25	71
Good	8	23
Fair	2	6
Poor	0	0

#### IV. Discussion

Complex articular fractures of the distal radius represent an increasing challenge for surgeons and for the design of new surgical implants. There is extensive work to show that locked volar plates are well tolerated, allow early movement and maintain position even for intra-articular fractures<sup>9,10</sup>

The population in our study were around the same age as previously studied groups treated with locking volar plates<sup>9,10</sup>. The minimum age in our series was 20 yrs. and maximum was 68 yrs with a mean age of 38.83 yrs. Nevertheless, we recognise that patients are actively selected for this surgical intervention based on patient and fracture characteristics. Our findings correlate well with other recent papers by Lozano-Cal-derón and Chung both demonstrating good radiological and clinical results with volar locking fixation of distal radius fractures<sup>11,12</sup>. The various methods to treat this fracture have in the past failed to meet clinical expectations hence the progression from simple manipulation and casting, through pin and plaster, K wiring, external fixation and now ORIF<sup>12,14-16</sup>. The results of treatment in plaster with manipulation from Previous work has shown that patients achieve most of their improvement in range of movement and grip strength by 6 months although they may continue to improve up to around 18 months<sup>16,17</sup>. All of our patients achieved a recovery to over 85% of contralateral grip strength by 6 months and most had achieved over 90% of contralateral grip strength by this time.

None of our patients suffered any extensor tendon or flexor pollicis longus rupture although we had 02 cases of extensor pollucis tendinitis one of which was managed conservatively and one required implant removal. These complications are well described and we believe care should be taken intra-operatively to ensure that the dorsal cortex is reached but not penetrated by the distal locking screws and the pronator quadratus is laid back over the metalwork, tacking it into place where possible<sup>18,19</sup>. Both extensor tendon and flexor pollicis longus rupture have been reported late in the literature and should be vigilantly looked for<sup>19</sup>. Our patients are routinely followed up with physiotherapy and subsequently asked to return to clinic should they have any further problems. Final radiographic examination at union confirmed that the locked volar plate maintained satisfactory position in keeping with previous studies.

It is well established that locked volar plating for distal radius fractures performs well when assessed by surgeon oriented and technical measures of success. Our study confirms that this technique is useful for complex articular injuries and performs well when judged by patient reported outcomes and measures of satisfaction. Despite statistically detectable differences in post-operative palmar flexion and grip strength, patients reported low pain scores and high levels of satisfaction.

Our study has several limitations, the cases were consecutive presentations and the decision to treat with ORIF was taken by the treating surgeon on a case by case basis, this will inevitably lead to a selection bias. Despite this our results are encouraging and add to the growing body of evidence in favour of ORIF for distal radius fractures using a volar locking plate construct<sup>20</sup>.

#### V. Conclusion

Notwithstanding a very small sample size and a short follow up and the following conclusions can be drawn out of the present study. Volar locking plate osteosynthesis at the distal radius signifies a significant improvement in the treatment of distal radial fractures in terms of restoration of the shape and function of the wrist. The technically simple palmar access, with a low rate of complications, allows exact anatomical reduction of the fracture. The multidirectional fixed-angle system we used provides solid support for the joint surface even in osteoporotic bone and allows simple subchondral placement of screws with sustained retention of the outcome of reduction. Secondary correction loss can be avoided by this procedure. Early mobilisation can be achieved and is recommended.

The overall experience with volar fixed angle fixation for the general treatment of unstable distal radius fractures has been favorable, and for this reason the technique has gained widespread acceptance recently. It is an easy to learn, simple, and reproducible procedure that has improved the outcome of this common injury.

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