

## FUNCTIONAL OUTCOMES OF DISTAL RADIUS FRACTURES MANAGED WITH 2.7MM VARIABLE ANGLE VOLAR LOCKING COMPRESSION PLATES

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### ABSTRACT

**Background:** About 15 to 17 % of all fractures presenting to emergency department constitutes the distal radius fracture. Intra-articular fracture of distal radius remains one of the most challenging fractures to be reduced over decades for orthopedic surgeons.

**Objective:** To assess the functional outcomes of 2.7mm variable angle volar locking compression plate using Mayo's wrist score in distal radius fracture patients.

**Methods:** A Cross Sectional Comparative study was conducted in the Department of Orthopedics & Trauma, CMH Rawalpindi from 20<sup>th</sup> October 2020 to 19<sup>th</sup> April 2021. A total of 120 patients with distal radius fracture comprising of AO Classification C1 C2 C3, 19 to 69 years of age of both genders who have undergone surgical procedure were included. Functional outcome of treatment with 2.7mm variable angle volar locking compression plates was calculated using Mayo's wrist score Data was entered in SPSS version 25. Descriptive analysis was done for age. Gender and mayo wrist scoring criteria were presented as frequencies and percentages. To analyze association of the outcome with age and gender chi-square test was applied.

**Results:** Mean age in the study was  $40.34 \pm 8.01$  years. Majority of the patients 71 (59.17%) were between 19 to 40 years of age. Out of 120 patients, 82 (68.33%) were males and 38 (31.67%) were females. 51 (42.50%) patients had excellent functional outcome, 47 (29.17%) had good outcome, 13 (10.83%) had fair outcome and 09 (7.50%) had poor outcome.

**Conclusion:** The functional outcomes of 2.7mm volar locking compression plate using Mayo's wrist score in distal radius fracture is very good.

**Keywords:** intra articular fracture, orthopedics, radius fracture, volar plate

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### INTRODUCTION

About 15 to 17 % of all fractures presenting to emergency department constitutes the distal radius fracture.<sup>1, 2</sup> They are usually as of high energy trauma such road traffic accidents and falls.<sup>3</sup> These

fractures more often complicate with malunion which leads to poor functional and cosmetic outcomes.<sup>1</sup> Distal radius fracture are more likely to be seen in women.<sup>4</sup> 50% of these have intra-articular extension. Intra-articular fracture of distal radius with dorsal or volar angulation remains one of the most challenging fractures to be reduced over decades for orthopedic surgeons.<sup>1,3</sup> There are different modalities for management of distal radius fractures. Stable un displaced fracture are usually managed with plaster of paris casting and splints,

however, unstable distal radius fractures and fractures with intra-articular extensions are managed with surgical approach such as percutaneous pinning with Kirschner wire fixation, open reduction and internal fixation with dorsal and volar locking plates and external fixation.<sup>5,6</sup>

The open reduction and plate osteosynthesis gives direct fracture reduction, stable fracture fixation, early post-operative mobilization and early return to function.<sup>6</sup> Fixation with Volar locking compression plates has least extensor tendon related complications. Most of distal radius fractures with intra articular extension manage with volar locking compression plates gives good to excellent clinical, radiological and functional results.<sup>6</sup> Studies have shown that immediate post-operative reduction achieved with 2.7mm volar locking compression plate remained stable and unchanged throughout the follow up period with acceptable fracture union good functional outcomes at wrist.<sup>1,2</sup> Arjun Ballal in his study conducted in 2016 enrolled 20 patients. He used open reduction and internal fixation with locking compression plate via volar approach in his patients. Five patients showed good scores and 12 had satisfactory results.<sup>1</sup> Pravin Agrawal also demonstrated excellent functional outcome in 60% of his patients according to Mayo scoring.<sup>5</sup> Prem Kotian in his study demonstrated that there was no significant difference in radial shortening, decrease in palmer angulations and loss of radial deviation after three months follow up. Majority of the patients had a good outcome 60% followed by fair 25% and excellent in 15% according to Sarmiento's Modification of Landerstorm Criteria.<sup>2</sup>

Distal radius fractures can lead to long term morbidity like dorsal angulation especially if it involves the dominant hand if not managed well. Hence, we aimed to assess the extent of outcome in patients with distal radius fractures who have undergone a novel approach of internal fixation via 2.7 mm volar plates.

## METHODS

A Cross Sectional Comparative study was conducted in Department of Orthopedics & Trauma, Combined Military Hospital Rawalpindi from 20<sup>th</sup> October 2020 to 19<sup>th</sup> April 2021. Approval was obtained from the Institutional Review Board [Ref No: 96/07/20 (36)]. A total sample of 120 cases was obtained by WHO sample size calculator with 95% confidence level, 5% margin of error and 20% excellent outcome.<sup>7</sup> Non-probability, consecutive sampling technique was applied. Patients with age more than 18 years and less than 70 years, both genders, distal radius fracture comprising of AO Classification C1 C2 C3 closed fractures undergone

surgical intervention were included in the study while exclusion criteria consisted of open comminuted fractures, distal radius fracture with vascular injuries and patient lost to follow up or previously operated. After taking written informed consent from the patients, all those patients meeting the inclusion criteria were enrolled and assessed for outcome of 2.7mm Volar Locking Compression Plates using Mayo's wrist score, calculated at 03, 06, 12 and 24 weeks interval. Mayo's wrist score was classified into Excellent, Good, Satisfactory and Poor results. SPSS version 25 was used to analyze the data entered. Descriptive analysis was run for the quantitative variable like age. The qualitative variables like gender and mayo wrist scoring criteria were presented as frequencies and percentages. Association of functional outcome with age and gender was also assessed by applying chi-square test. P-value <0.05 was considered as significant.

## RESULTS

Age range in this study was from 26 to 55 years with mean age of the 120 patients to be  $40.34 \pm 8.01$  years. Majority of the patients, 71 (59.17%) were between 19 to 40 years of age and 49 (40.83%) patients were between 41 to 69 years. Out of 120 patients, 82 (68.33%) were males and 38 (31.67%) were females with male to female ratio of 2.2:1. Using the Mayo Wrist Scoring Criteria, 51 (42.50%) patients had excellent functional outcome, 47 (39.17%) had good outcome, 13 (10.83%) had fair outcome and 09 (7.50%) had poor outcome. Association of functional outcome using mayo wrist scoring criteria was also evaluated with respect to age groups and gender as shown in Table-1. There was somewhat statistically significant difference observed with gender (p-value = 0.058). However, no statistically significant difference was found with the age (p-value = 0.493). Thus, good functional outcome by Mayo Wrist Scoring Criteria is correlated with gender.

Table-1: Association of Functional Outcome by Mayo Wrist Scoring Criteria with age and gender of the patients by applying chi sq test

Factors	Excellent Functional Outcome		p-value
	Yes	No	
Age (Years)			
19-40	28	43	0.493
41-69	23	26	
Gender			
Male	41	41	0.058
Female	10	28	

## DISCUSSION

Distal radial fracture accounts for a number of patients presenting in accident and emergency department.<sup>8</sup> Previously, plaster casts were the first line treatment for intra-articular fractures of distal radius, resulting in collapse of the fracture fragments leading to radial shortening and angulation causing permanent deformity. In recent years locking plate fixation is being widely used in the treatment of distal radial fractures, restoring the articular surface and alignment of fragments maintains functionality and evades early osteoarthritic changes.<sup>9-11</sup> Certain disadvantages of open reduction include skin scarring, injury to tendons, second surgery to remove the plate, expensive and demands appropriate skills.<sup>12-14</sup> Abdel Wahed et al. compared different designs of locking plates, using fixed angle volar locking plates in 65 patients and variable angle volar locking plates in 48 patients with unstable distal radius fractures. The study concluded that the variable angle system is slightly better in terms of function and radiographic outcomes.<sup>15</sup> The present study was conducted to assess the functional outcomes of 2.7mm volar locking compression plate using Mayo's wrist score in distal radius fracture. 51 (42.50%) patients had excellent functional outcome, 47 (29.17%) had good outcome, 13 (10.83%) had fair outcome and 09 (7.50%) had poor outcome. In contrast to these results, Arjun Ballal revealed that only one patient showed excellent Mayo wrist score while five had good outcome, 12 were fair and only two patients showed poor result after open reduction and internal fixation with locking compression plate via volar approach.<sup>1</sup> A study by Pravin Agrawal included a small sample size of 30 patients. The function was assessed by Mayo score and radiological assessment was done by Liderstorm Classification. In accordance with our results, there were 60% of the patients showed excellent results and only 6.7% showed poor functional outcome. According to Liderstrom scoring, 53.3% of patients had excellent results.<sup>5</sup> Lakshman K et al. operated 30 patients of distal radial fracture with open reduction and internal fixation with volar locking compression plate. Gartland and Werley demerit scoring was used to assess functionality. Similar to our findings, the study demonstrated that about half of the patients (47%) showed excellent functional outcome.<sup>16</sup> A study by Shashidhara et al. surgically managed 20 cases with distal radius fracture using volar rim variable angle locking plates and demonstrated that 65% cases showed excellent results like the present study.<sup>17</sup> Another study compared the outcomes of

volar locking plate for distal radial fracture in elderly and younger patients. The study concluded that this surgical procedure is safe and effective mode of treatment in elderly but early complications may occur as compared to younger patients.<sup>18</sup> Another study demonstrated that after volar plate fixation of the distal radial fracture, the immobilized wrist for 2 or 6 weeks do not show any significant difference in the range of motion.<sup>19</sup> Egol et al. conducted a randomized control trial comparing the external fixation and locked volar plates. It was concluded that the early range of motion and radiological outcome was improved with locked plating, however the actual difference was of little clinical significance. Furthermore, the rate of complications was similar between the two methods but, there was a greater chance of second surgery in case of the plating group. Despite these results, their study showed no evidence of dominance of one methodology over the other.<sup>20</sup>

In another study by Ali MN et al on 43 patients, the final functional scoring showed excellent results in 13 patients.<sup>21</sup> Long-term results mainly depend upon the degree of arthrosis of the wrist.<sup>22</sup> The limitation of the study includes a small sample size and a single center study. Further longitudinal studies with larger sample size are recommended.

**CONCLUSION:** This study concluded that functional outcomes of 2.7mm variable angle volar locking compression plate using Mayo's wrist score in distal radius fracture is very good. Results support the further usage of this technique in patients for earliest possible restoration of their normal activities, decrease in duration of morbidity and psychosocial impact due to the disability.

## CONFLICT OF INTEREST

There is no conflict of interest among the authors

## ETHICAL REVIEW BOARD APPROVAL

The study was approved from Institutional Review Board/Ethical Committee of, Combined Military Hospital, Rawalpindi via reference No. 96/07/20 (36) dated August 17, 2020.

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#### AUTHOR'S CONTRIBUTIONS

- HU:** Concept Design, Data collection  
**HUDH:** Manuscript writing, Statistical analysis  
**MT:** Manuscript writing, Critical Review  
**BAA:** Manuscript writing Proof Reading