



“FUNCTIONAL OUTCOME OF BICOLUMNAR DISTAL END RADIUS FRACTURES TREATED BY VOLAR LOCKING PLATE”

<b>Dr. Harish. K</b>	Associate Professor
<b>Dr. Ashoka Rakshith</b>	Assistant Professor
<b>Dr. P Sai Ranga Reddy</b>	Junior Resident
<b>Dr. Ravi M Daddimani</b>	Professor
<b>Dr. Naveen D*</b>	Junior Resident *Corresponding Author

**ABSTRACT**

**Introduction:** Distal end radius fractures are one the foremost common injuries of the upper extremity. Greatest prevalence was noticed elderly women who fall on their outstretched hand and young men involved in impact injuries. **Materials And Methods:** This is a prospective study conducted in the Department of Orthopedics, Adichunchanagiri Institute of Medical Sciences, B.G.NAGARA after obtaining ethical clearance. This study consisted of 20 adult patients of either sex visiting outpatient department of the hospital/ casualty diagnosed to have distal end radius fractures with the involvement of radial and intermediate columns. Patients satisfying inclusion criteria were included in the study during the period from February 2021 to August 2022 **Results:** In present study 20 cases there were 12 males and 08 females with average age of presentation was 41.5 years, there was a predominance of right sided fractures when compared to the left. Mean duration between admission and surgery was 3.2 days, the mean duration of complete radiological union was 6.6 weeks. We have achieved excellent results in 50% of cases, good results in 25%, fair results 25%, and no poor results. Complications like Stitch abscess, stiffness, reduced range of motion, Persistent pain syndrome seen in 4 (20%) cases **Conclusion:** This present study shows that volar locking plate is a better technique in view of shorter operative time, less hardware, reduction in blood loss, less tendon irritation, lesser risk of neuromuscular injury. However this is a short term study with small sample size, needs long term follow up to predict further outcome.

**KEYWORDS :** distal end radius fracture, vload locking plate, union ,plating, range of movements

**INTRODUCTION**

Distal end radius fractures are one the foremost common injuries of the upper extremity. Greatest prevalence among elderly women who fall on their outstretched hand and young men involved in impact injuries. Management of those injuries have evolved from closed reduction and casting to percutaneous pinning and open reduction internal fixation, because the importance of achieving and maintaining the anatomic reduction has become a necessity for good functional outcome [1] . In 1996, Rikli and Regazzoni [2] presented the THREE COLUMN THEORY of fractures of the distal end of radius ; the radial column, the intermediate column and the medial or the ulnar column [3]. Later volar locking plates have emerged as a way to avert complications associated with dorsal plating in the surgical management of distal end radius fractures. More authors agree that volar locked plates achieves stable fixation and allows for early postoperative wrist range of movements.

**MATERIALS AND METHODS:**

This is a prospective study conducted in the Department of Orthopedics, Adichunchanagiri Institute of Medical Sciences, B.G.NAGARA after obtaining ethical clearance. This study consisted of 20 adult patients of either sex visiting outpatient department of the hospital/ casualty diagnosed to have distal end radius fractures with the involvement of radial and intermediate columns. Patients satisfying inclusion criteria were included in the study during the period from February 2021 to August 2022.

**RESULTS:**

In present study 20 cases there were 12 males and 08 females with average age of presentation was 41.5 years, there was a predominance of right sided fractures when compared to the left. Mean duration between admission and surgery was 3.2

days, the mean duration of complete radiological union was 6.6 weeks. We have achieved excellent results in 50% of cases, good results in 25%, fair results 25%, and no poor results. Complications like Stitch abscess, stiffness, reduced range of motion, Persistent pain syndrome seen in 4 (20%) cases

**Inclusion Criteria**

1. All closed fractures of distal end radius (bi columnar fracture)
2. Distal end radius fractures in skeletally mature patients

**Exclusion Criteria**

- 1) Type I, II, III open fractures ( GUSTILO ANDERSON)
- 2) All pathological fractures
- 3) All malunited fractures of distal end radius
- 4) Concomitant segmental fractures of single or both bones forearm

**Operative Procedure:**

All procedures were performed under general or regional anaesthesia (supra clavicular or inter scalene block). Our standard practice was performed under sterile aseptic precautions of local parts preparation and draping. Routinely preoperative prophylactic intravenous cefotaxime was administered for all patients. Tourniquet was used in 20 patients and hemostasis was achieved in all patients before closing the surgical wound. All the patients were approached by standard volar approach for distal radius .The standard modified Henry’s volar approach was undertaken to fix the fragments of the distal radius. In cases where the radial column fragment was initially approached, the plane between the radial artery and the flexor carpi radialis was used. For the intermediate column fragment under the lunate facet, plane between the flexor carpi radialis tendon and the median nerve was used. The distal and lateral borders of pronator

quadratus were erased and retracted ulnar ward. Open reduction was performed using intra focal leverage, traction, and temporary fixation with Kirschner wires followed by definitive fixation with the implants of choice. The reduction of both the distal radius were confirmed with the image intensifier during the fixation and ensured before closure of the surgical site.

**Sample Size And Statistical Analysis**

**Sample Size :**

The sample size was calculated with a 95% confidence interval and a 10% margin of error was 30. Sample size is 20

Statistical analysis: Data will be entered into MS Excel and analyzed using SPSS. Data (descriptive statistics) will be expressed in mean and proportions. To test the significance, Chi square test will be used.  $p < 0.05$  will be taken as significant.

**RESULTS**

Comparison of Radial length, Palmar tilt and Articular step-off A comparison of radial length among the subjects showed that the mean  $\pm$  standard deviation was,  $10.17 \pm 0.75$ mm . Hence when independent t test was applied, a p value of 0.513235 was found which is not statistically significant, thereby indicating no significant difference among the subjects in terms of radial length of subjects.

When Palmar tilt was compared between subjects, the mean and standard deviation was,  $9.20 \pm 0.94$  and t test showed a p value of 0.691233, which was not statistically hence no difference among the subjects when it came to difference in palmar tilt in study subjects. A comparison between the subjects between on articular step off using chi-square test showed no statistically significant difference among the subjects in this procedure

**Table - 1 Comparison Between Radiological Parameters Among The Subjects**

Variables	Minimum	Maximum	Mean	Standard Deviation	Normal Values	P Values
RADIAL LENGTH(mm) - ORIF+VLP	9	11	10.17	0.75	12	0.513235
PALMAR TILT(degrees) - ORIF+VLP	8	11	9.20	0.94	11	0.691233
ARTICULAR STEP-OFF (mm)- ORIF+VLP	VALUE	NO.OF PATIENTS	PERCENTAGE	-	-	0.4062
-	0	18	90	-	0	
-	1	2	10	-	0	
TOTAL	20	100				

**Comparison of Radial length, Palmar tilt and Articular step-off**

A comparison of radial length among the subjects showed that the mean  $\pm$  standard deviation was,  $10.17 \pm 0.75$ mm . Hence when independent t test was applied, a p value of 0.513235 was found which is not statistically significant, thereby indicating no significant difference among the subjects in terms of radial length of subjects.

When Palmar tilt was compared between subjects, the mean and standard deviation was,  $9.20 \pm 0.94$  and t test showed a p value of 0.691233, which was not statistically hence no difference among the subjects when it came to difference in palmar tilt in study subjects. A comparison between the subjects between on articular step off using chi-square test showed no statistically significant difference among the

subjects in this procedure

**Table -2 Comparison Of Range Of Movements Among The Subjects**

Range Of Movements	Minimum	Maximum	Mean	Standard Deviation	Minimal Range Of Motion For Normal Function	P Value
PALMAR FLEXION (ORIF+VLP)	30	80	66.03	16.13	30	0.743
DORSIFLEXION (ORIF+VLP)	40	85	70.33	10.47	45	0.627
RADIAL DEVIATION (ORIF+VLP)	10	20	16.63	3.32	15	0.82
ULNAR DEVIATION (ORIF+VLP)	15	35	26.03	5.76	15	0.93
SUPINATION (ORIF+VLP)	40	85	70.62	11.65	50	0.855
PRONATION (ORIF+VLP)	45	75	63.65	10.89	50	0.58

As evident in the above table, there were minimal subjects who had extremes of all movements analysed, i.e majority of the subjects had a movement that was within normal range with minimal outliers. Palmar Flexion, Dorsiflexion, Radial Deviation, Ulnar Deviation, Supination and Pronation was compared among the subjects and found that there was no statistical difference among the subjects, they were comparable and similar in outcome with respect to these range of movements

**Analysis of Results using GARTLAND AND WERLEY scoring system**

Out of 20 patients operated by ORIF+VLP, 10 patients had Excellent results, 5 patients had good results and 5 patient had fair results

PROCEDURE	EXCELLENT	GOOD	FAIR	POOR
ORIF+VLP	10	5	5	0



Image 1: Preop X Ray -ap View



Image 2 : Preop X Ray- Lateral View



Image 3- Immediate Post Op X Ray Following Surgical Fixation



Image 4- Follow Up X Ray After 6 Months



**Image 5- Range Of Movements Achieved In Patient After 6 Months**

#### DISCUSSION:

The rise of intra articular distal radius fractures and its various presentations of complexity in even younger individuals are predominantly due to high energy trauma especially road traffic accidents.

Kavin Khatri [4] (2015) reported a overall complication rate of 21.7%, two patients had superficial skin infection , one patient had hypertrophic scar ,one patient had Carpal Tunnel Syndrome and one patient had screw misplacement which was asymptomatic during follow up. There were no cases of screw misplacement or implant failure or refixation in our study.

Four complications (20%) were observed in this study. Two being Stiffness and Reduced Range of Movements, one developed Stitch abscess and other one developed Persistent pain. There was no case of screw break-out. Five out of ten patients had slight DeQuervain's tendonitis-like symptoms caused by the radial plate, and benefited from implant removal in Matthias Jacobi et al study [5] .

The average mean age of our study is comparable to the one by Anakwe et al [6] who had an average age of 48 years Our study's male predisposition of 60 % is comparable to Jupiter et al [7] which was 60%. The higher incidence among the males could be attributed to a highly active work group with a higher involvement in high energy trauma and high velocity injuries of RTA

In our study right side was involved in 22 of the 40 study cases. Our study's equally dominant right-side predisposition of 55 % is comparable to John K Bradway et al [8] which was 50%.

The average radiographic parameters in Peter Tang et al study [9] were as follows: 23.6 degrees of radial inclination, 12.4 mm of radial height, 0.5 mm of ulnar variance, and 13.2 degrees of volar tilt. The average motion, represented as a percentage compared with the contralateral side, include 91% of flexion, 83% of extension, 95% of pronation, 93% of supination, 61% of radial deviation, and 78% of ulnar deviation.

Helmerhorst GT Kloen study [10] shows mean 11.3 mm , mean Volar tilt of 11 degrees and mean Radial inclination of 20 degrees. Matthias Jacobi study shows mean range of motion during follow up of his patients -Dorsiflexion 49 degrees, Palmar Dorsiflexion of 39 degrees , Pronation of 75 degrees and Supination of 75 degrees. The present study shows mean radial height of 10.17 mm (ORIF+VLP), mean volar tilt of 9.20 degrees (ORIF+VLP) , at 6 months follow up. The average range of motion during follow up of our patients were as follows- Dorsiflexion of 66 degrees (ORIF+VLP), Palmar Dorsiflexion of 70 degrees (ORIF+VLP) , Pronation of 63 degrees (ORIF+VLP), Supination of 70 degrees (ORIF+VLP). In Halmerhorst, kloen study [10] one patient complained

about numbness and tingling in the median nerve distribution for which he was evaluated clinically [no electromyography (EMG)] by a neurologist. During the revision osteosynthesis of his wrist (3 weeks after the initial internal fixation), he also underwent a carpal tunnel release. His nerve symptoms improved postoperatively. After 18 months, the patient underwent a proximal row carpectomy and capitate prosthesis procedure, performed by a plastic surgeon. Another patient had painful wrist and went for a second opinion where hardware removal was done.

#### CONCLUSION:

Use of volar locking plate provide fair to excellent results and is effective in the correction and maintenance of distal radius anatomy. Joint motions and daily functioning is recovered in a shorter time. This present study shows that volar locking plate is a better technique in view of shorter operative time, less hardware, reduction in blood loss, less tendon irritation, lesser risk of neuromuscular injury, early union, early range of movements . However this is a short term study with small sample size, needs long term follow up to predict further outcome.

#### REFERENCES

- Garner MR, Schottel PC, Thacher RR, Warner SJ, Lorich DG. Dual radial styloid and volar plating for unstable fractures of the distal radius. *Am J Orthop (Belle Mead NJ)* [Internet]. 2018;47(3). Available from: <http://dx.doi.org/10.12788/ajo.2018.0020>
- Rikli DA, Regazzoni P Fractures of the distal end of the radius treated by internal fixation and early function. A preliminary report of 20 cases. *J Bone Joint Surg Br.* 1996;78(4):588-92.
- Yang Y, Yin Q, Li D, Rui Y, Wu Y, Ding Y, et al. A new classification and its value evaluation for intermediate column fractures of the distal radius. *J Orthop Surg Res.* 2018;13(1):221
- Helmerhorst GT, Kloen P Orthogonal plating of intra-articular distal radius fractures with an associated radial column fracture via a single volar approach. *Injury.* 2012 Aug;43(8):1307-12. doi: 10.1016/j.injury.2012.04.022. Epub 2012 May 29. PMID: 22648016.
- Jacobi M, Wahl P, Kohut G. Repositioning and stabilization of the radial styloid process in comminuted fractures of the distal radius using a single approach: the radio-volar double plating technique. *J Orthop Surg Res.* 2010 Aug 11;5:55. doi: 10.1186/1749-799X-5-55. PMID: 20701799; PMCID: PMC2925339.
- Anakwe R, Khan L, Cook R, McEachan J. Locked volar plating for complex distal radius fractures: Patient reported outcomes and satisfaction. *J Orthop Surg Res.* 2010;5(1):51
- Jupiter JB, Fernandez DL. Comparative classification for fractures of the distal end of the radius. *J Hand Surg Am.* 1997 Jul;22(4):563-71. doi: 10.1016/S0363-5023(97)80110-4. PMID: 9260608.
- Bradway JK, Amadio PC, Cooney WP. Open reduction and internal fixation of displaced, comminuted intra-articular fractures of the distal end of the radius. *J Bone Joint Surg Am.* 1989 Jul;71(6):839-47. PMID: 2745480.
- Pope D, Tang P Carpal Tunnel Syndrome and Distal Radius Fractures. *Hand Clin.* 2018 Feb;34(1):27-32. doi: 10.1016/j.hcl.2017.09.003. PMID: 29169594.
- Helmerhorst GT, Kloen P Orthogonal plating of intra-articular distal radius fractures with an associated radial column fracture via a single volar approach. *Injury.* 2012 Aug;43(8):1307-12. doi: 10.1016/j.injury.2012.04.022. Epub 2012 May 29. PMID: 22648016.