



INTRA ARTICULAR DISTAL RADIUS FRACTURES AND FIXED ANGLE VOLAR LOCKING PLATE FIXATION: A PROSPECTIVE STUDY

Dr. Hemeshwar Harshwardhan

Professor, Department Of Orthopaedics, JLN medical college & Hospital , Ajmer , Rajasthan .

Dr. Ashwani Jangir*

Post Graduate Trainee, Department of Orthopaedics, JLN medical college & Hospital , Ajmer *Corresponding Author

ABSTRACT

Background: Intra-articular distal radius fractures still a therapeutic challenge to orthopedic surgeons.

With the advent of locking plates, the fixation of these fractures has been made better, specifically by Fixed Angle Volar Locking Plate. This study investigates the efficacy of these plates using volar approach, functional & radiological outcome evaluated.

Methods: This study was conducted at orthopedic department - JLN medical college & associated hospital Ajmer (Rajasthan). Twenty five patients with closed intra-articular distal radius fractures, with AO TYPE B2, B3, AND C fracture pattern, operated with Fixed Angle Locking Plate fixation using volar approach, were included in the study during the period of July 2018 to September 2019, with a minimum follow up of six months, radiological outcome was analysed (Sarmientos modification of Lindstorm criteria) and functional outcome recorded (Gartland and Werley's demerit scoring system).

Results: With a mean age of 38.4 years and follow up of three months, the range of movement of the wrist was very satisfactory, and the mean grip strength was 85% of the opposite wrist. Functional parameters by Gartland and Werley showed a significant improvement in most of the patients during the follow-up period (68% excellent, 16% good, 16% fair) and Radiological parameters were well maintained (Lindstorm criteria - 60% excellent, 29% good, 7% fair, 4% poor) and The complication rate was less and insignificant.

Conclusions: Primary fixed angle volar plate fixation of intra-articular distal radius fracture provides a stable fixation that effective in anatomic realignment, allows early joint motion, owing to its fixation strength, thereby better functional & radiological outcomes and minimal complication.

KEYWORDS : Fixed Angle Volar Locking plate, Distal radius, Gartland and Werley, Lindstorm criteria, Wrist

INTRODUCTION

Distal radius fracture constituting around 17% of the total skeletal trauma, involving both the elderly and young patients in emergency room¹. Distal end radius fractures, which can be extra or intra-articular. Intra-articular fracture has tendency to loss of reduction , malunion & deformity with conservative treatment². An intra-articular step of more than 2 mm inevitably leads to osteoarthritis and a functional deficit³. Recently, it was clinically proved that intra-articular step-off and radial shortening corrected by surgery had improved patient outcome.⁴

In the past, these fractures were managed with external fixation or a combination of limited open reduction, kirschner wire (K-wire) augmentation, and bone grafting.

Fixed angle volar plates for the fixation of distal radius fractures were introduced by Orbay and Fernandez⁵.

Open reduction and internal fixation (ORIF) using Volar Fixed-Angle plates has also shown to be a valid treatment option for unstable, intra-articular displaced distal radial fractures, more so in osteoporotic bones⁶.

Volar fixed angle locking plates are pre-contoured to the anatomical shape of volar side of the distal radius. The direction of the distal locking screws is fixed by the plate design ensures more consistent correction of displacement and maintenance of reduction.

This study evaluates the functional & radiological outcome of open reduction and internal fixation using fixed angle volar locking plate in the management of intra-articular fracture distal end radius.

METHOD

Twenty five patients with intra-articular distal radial fractures

treated with fixed angle locked volar plating at the institute from July 2018 until September 2019 were included for the study with six months follow up. Closed fracture in skeletally mature patients with modified AO type B2, B3, C with less than three weeks old trauma were included in the study. Patients with open fracture , pathological fracture , fracture associated with neurovascular injury, skeletally immature & medically unfit were excluded .Permission of ethical committee was obtained.

Surgical procedure (Volar approach)-Surgery was performed under appropriate anesthesia i.e. either general anesthesia or axillary or supra clavicular block under tourniquet control. Open reduction and internal fixation was done using modified Henry approach between the flexor carpi radialis and radial artery.

EVALUATION OF OUTCOME

The patients were followed up for minimum of 6 months. Functional (*Gartland & Werley Scale*) and Radiological (*Lindstorm criteria*) reviews were performed.

RESULTS

There were 25 patients treated with fixed angle volar locking plate system in this study. 22 male and 3 female patients with the average age of 38 year (range 20-60) and right side predilection. The patients were followed up for a period of six months. All fractures were closed and classified according to the AO/OTA classification. The AO classification of the study cases indicated that type C2 (meta physeal multi-fragmentary) was maximum in 13 cases (52%), 5 cases C1 (20%), 4 cases C3 (16%), 2 case B3, 1 case B2.

The mean time to union was nine weeks. At the time of final follow-up (six months) the clinical scoring chart was done according to Gartland and Werley scale.

Table1: Functional outcome based on GARTLAND & WERLEY SCALE

Outcome	No. of patient	% of case
Excellent	17 (Mean:1.52, SD: 0.84)	68%
Good	4(Mean:5.75, SD: 1.08)	16%
Fair	4(Mean:10.75,SD: 1.47)	16%
Poor	0	0%

Gartl and and Werley scores in the study, with 68% of patients having good to excellent results.

Table2: Anatomical and radiological evaluation using Sarmientos modification of Lindstorm criteria

Outcome	Loss of Palmer inclination	Radial shortening	Loss of radial deviation	Residual deformity	Mean
Excellent	5 (20%)	18(72%)	17(68%)	20(80%)	60 %
Good	17(68%)	5(20%)	4(16%)	3(12%)	29%
Fair	3(12%)	2(8%)	2(8%)	0	7%
Poor	0		2(8%)	2(8%)	4%

Radiographs and clinical anatomy was analysed as per Sarmientos modification of Lindstorm Criteria. At final follow-up, the mean volar tilt was 10.8°, radial inclination averaged 19.8° and radial length averaged 11 mm with 60 % excellent result.

There were two cases of superficial wound infection that settled well with oral antibiotics. Residual pain, stiffness and deformity were there are about twenty percent of the patients. No case of intra-articular screw placement ,tendon rupture median nerve neuropathy & CRPS was noted.

CASE



Figure 1-Pre op xray



Figure2- Immediate post op xray

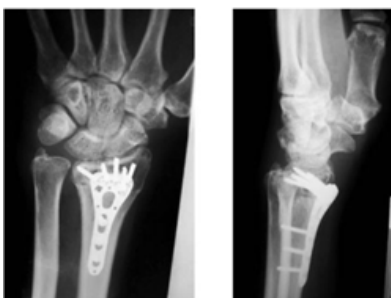


Figure 3-Follow up xray at 6 month



Figure 4- Range of motion at 6 months follow up

DISCUSSION

In treating intra articular distal radial fractures, the main aim is to achieve and maintain anatomic reduction and get satisfactory motion and rehabilitation. The biomechanical results show that locking volar plates provides significantly greater resistance to fracture gap motion compared with standard volar plates in a comminuted distal radius fractures⁷. Fixed-angle volar plates prove stronger under cyclical loading tests and locking screws help in attaining implant stability and in addition, spares the vascularity and periosteum.⁸

Rozental et al reported patients treated with volar fixedangle plating for unstable distal radius fractures, with average follow-up period of 17 months.⁹ The radiological parameters in this study with volar tilt of 6.7 degrees and radial inclination 20 degrees was about in the same range as Rozental et and also by Lueng et al. In most cases effective restoration of anatomic alignment was acquired and maintained, along with functional restoration and rehabilitation.¹⁰ In study by chauvan 91% patients treated with volar locking plate had good to excellent outcomes while in our study 81% had well to excellent outcome.¹²

The overall complication rate in our study was 20%, which is comparable to that reported by Jagodzinski et al in a bicentric study¹¹ on distal radius volar locking plates. They reported a complication rate of 19.6%. In our study, there was no case of screw misplacement because extra care was taken to prevent this complication since it could have resulted in longer fluoroscopy time. No complications related to extensor tendons was observed in this study. Similar conclusion was reached in separate studies by Hakim et al and Othman.^{13,14}

This study was a single centric study with limited number of cases and no control group or other modes of fixation for comparison. Further analysis and work will help to delineate the strategy in distal radius plating to avoid complications and adverse outcomes.

CONCLUSION

Present study documents 84% functional and 89% radiological excellent to good results, suggests that stabilizing the fracture fragments with fixed angle volar locking plate in the management of the intra articular fractures of distal radius, is an effective method to maintain the reduction till union and prevent collapse of the fracture fragments, even when the fracture is grossly comminuted /intra-articular/unstable and limited complication.

So in our opinion, fixed angle volar locking plate for treatment of intra articular fracture distal end radius is good method with excellent outcomes.

REFERENCES:-

1. Court-Brown, Charles M.; Heckman, James D.; McQueen, Margaret M.; Ricci, William M.; (Iii), Paul Tornetta; McKee, Michael D. (2015). Rockwood and Green's fractures in adults. Court-Brown, Charles M., Heckman, James D., McQueen, Margaret M., Ricci, William M., Tornetta, Paul, III., McKee,

- Michael D. (8th ed.). Philadelphia. ISBN 9781451175318. OCLC 893628028.
2. Cherubino P, Bini A, Marcolli D. Management of distal radius fractures: Treatment protocol and functional results. *Injury* 2010; 4: 1120-6.
 3. Frykman G. Fractures of the distal radius including sequelae shoulder-hand-finger syndrome, disturbance in the distal radioulnar joint and impairment of nerve function. A clinical and experimental study. *Acta Orthop Scand J* 1967; 108: 1-124. Melone CP Jr. Open treatment for displaced articular fractures of the distal radius. *Clin orthop* 1986; 202: 103-11. Fernandez DL. Malunion of the distal radius: current approach to management. *Instr Course Lect* 1993; 42: 99-113.
 4. Solgaard S. Function after distal radius fracture. *Acta Orthop Scand* 1988; 59(1):3942.
 5. Orbay J, Fernandez DI: Volar fixation for dorsally displaced fractures of the distal radius: a preliminary report. *J Hand surg* 2002; 27a:205-215
 6. Orbay J, Fernandez DI: Volar fixed-angle plate fixation for unstable distal radius fractures in the elderly patient. *J Hand surg* 2004; 29a:96-102.
 7. Willis AA, Kutsumi K, Zobitz ME, Cooney WF. Internal fixation of dorsally displaced fractures of the distal part of the radius: A biomechanical analysis of volar plate fracture stability. *JBJS Am.* 2006; 88(11):2411-7.
 8. Nana AD, Joshi A, Lichtman DM. Plating of the Distal Radius. *J Am Acad Orthop Surg.* 2005; 13(3):159-71.
 9. Rozenal TD, Blazar PE. Functional outcome and complications after volar plating for dorsally displaced, unstable fractures of the distal radius. *J Hand Surg Am.* 2006; 31:359-65.
 10. Leung F, Zhu L, Ho H, Lu WW, Chow SP. Palmar plate fixation of AO type C2 fracture of distal radius using a locking compression plate—a biomechanical study in a cadaveric model. *J Hand Surg Br.* 2003; 28:263-6.
 11. Jagodzinski NA, Singh T, Norris R, Jones J, Power D. Early results of a variable-angle volar locking plate for distal radius fractures: A bi-centre study. *Orthopaedic Proceedings*; 2012.
 12. Chavhan AN et al. Functional and radiological outcome in distal radius fractures treated with locking compression plate. *Int J Res Med Sci* 2017; 5:574-82.
 13. Hakimi M, Jungbluth P, Windolf J, Wild M. Functional results and complications following locking palmar plating on the distal radius: a retrospective study. *Journal Hand Surg.* 2010; 35(4):283-8.
 14. Othman AY. Fixation of dorsally displaced distal radius fractures with volar plate. *J Trauma* 2009; 66:1416-20.