



Functional Outcome of Variable Angle Volar Locking Compression Plates in Distal End Radius Fractures

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Abstract

Introduction: Fractures at the distal end of the radius are highly prevalent globally, constituting about one-sixth of all fractures. Earlier, closed reduction and cast application was treatment of choice irrespective of the type of fracture and the column involved resulting in malunion and wrist stiffness, due to this the fixed angle locking compression plates were devised which had a fixed angle construct for the distal locking screws not allowing for fragment specific fixation, leading to

development of the variable angle locking compression plates.

Objective: The objective of the study was to evaluate functional outcome of wrist associated with variable angle volar locking compression plate in distal end radius fractures.

Methods: With ethical approval, the patients with fracture of distal end radius were included in study as per inclusion and exculsion criteria. They were operated by fixing the fracture with Variable Angle Volar Locking Compression Plates (VAVLCP). All patients

were followed up post operatively as per study protocol for 1 year and functional outcome was assessed using Modified Mayo Wrist Score (MMWS).

Results: 27 patients were included in the study and followed up for a period of 1 year. The extent of ROM at wrist joint was noted. And patients were asked to answer the Modified mayo wrist score questionnaire at the end of one year and outcomes were calculated accordingly. 70.37% patients had excellent results and 18.52% patients had good results, while 11.11% patients had fair results. Complications like wrist stiffness (3.2%), infection (3.2%) were seen.

Conclusion: Use of variable angle locking compression plates in distal radius fractures provide fair to excellent results and are effective in the correction and maintenance of distal radius anatomy. Hence Variable angle volar locking compression plate is useful and better implant in fixing unstable and comminuted intraarticular distal radius fractures with fragment specific fixation.

Keywords: Distal end radius fractures, variable angle volar locking compression plates, Modified Mayo Wrist Score (MMWS), Functional Outcome.

Introduction

Distal end radius fractures are one of the most common fractures either due to fall or trauma and mainly in post-menopausal females due to osteoporosis. As the day to day activities involve movements around wrist joint, the anatomic fixation and restoration of near normal range of motion at wrist joint is necessary.

Earlier, closed reduction with ligamentotaxis and cast application was employed for all the distal end radius fractures irrespective of the type of fracture and column involvement leading to malunion, wrist stiffness, arthritis and persistent pain. Though closed reduction

and cast application is useful in extra articular fractures with help of correct reduction maneuvers, reduction with help of either closed reduction and cast application or percutaneous K wire in cases of intra articular fractures has not shown good outcomes thereby leading to development of fixed angle locking compression plates(LCP) for these type of fractures. The fixed angle LCP help in holding the reduction and stabilizing the fracture in reduced position, these plates help in maintaining the anatomic reduction of the fracture and prevents it from displacement.

Though the results are better when compared to other modalities of the treatment, the fixed angle LCP was not successful in holding the required fracture fragment in complex multifragmentary fractures due to its fixed angle construct. This led to development of variable angle locking compression plate. The purpose of our study was to assess the functional outcome of wrist of distal end radius fracture treated with variable angle volar locking compression plates.

Materials and Methods

Total of 27 patients with distal end radius fracture treated with variable angle volar locking compression plate in tertiary care hospital after institutional Ethical approval and obtaining informed consent from patient. Adult Individuals with extra articular and intra articular fractures in Distal Radius were included. Individuals with pathological fractures (excluding osteoporosis), skeletally immature, with active infections or open fractures and those with severe head and spinal cord injuries (paresis and plegia) and associated neurovascular injuries which may interfere with our rehabilitation protocol were excluded.

Fractures were classified according to AO classification, and surgical planning was done. Informed consent was taken from patient for surgery.

Under regional or general anaesthesia, open reduction and internal fixation with 2.7mm variable angle volar locking compression plate was done using modified Henry approach. Postoperatively, limb was kept elevated and immobilized using a below elbow slab.

Post-operative AP and lateral x-rays were taken and patients were encouraged to do active finger movements and wrist physiotherapy was started 4 weeks post-

Result

Table 1: Patient’s demographic details and profile

Age	48 years
Gender	
Male	18
Female	9
Affected side	
Right	11
Left	16
Mode of injury	
Road traffic accident	16
Domestic fall	11
Fracture type AO	
A ₂	2
A ₃	2
B ₁	3
B ₂	3
B ₃	7
C ₁	3
C ₂	5
C ₃	2

surgery. All cases were followed up at 6 weeks,3 months,6 months,12 months’ post-surgery. Final functional outcome was assessed using Modified Mayo Wrist Score(MMWS) at 1 year after surgery.

Statistical analysis

All data was collected as per study protocol. Continuous variables in different groups with mean values were compared using paired t-test with statistical difference defined as 5 percent (P<0.05). All statistical analysis was performed using IBM SPSS Statistics for windows.

Graph 1: Evaluation of results

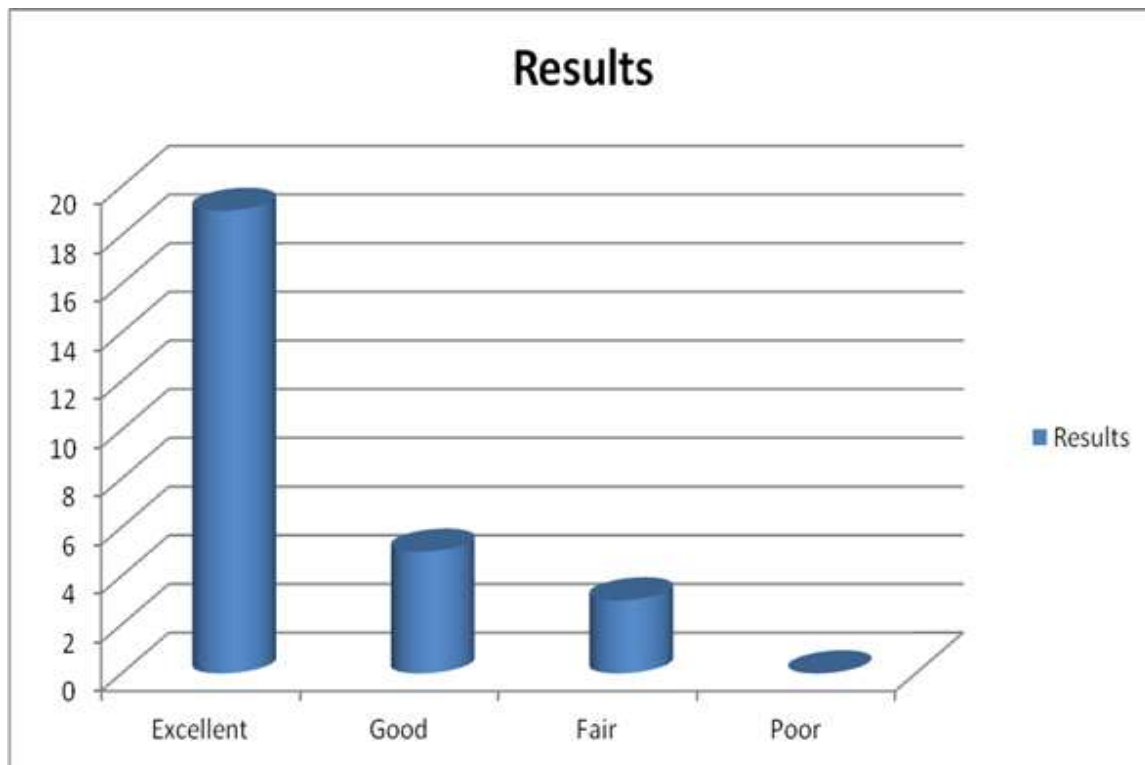


Table 2: Results v/s outcome

Outcome	Results						P Value
	Excellent		Good		Fair		
	Mean	SD	Mean	SD	Mean	SD	
Dorsiflexion	83.68	3.67	78	2.74	73.33	2.89	<0.0001*
Palmarflexion	81.84	3.80	75	3.54	71.67	2.89	<0.0001*
Radial deviation	19.21	3.01	16	2.23	13.33	2.89	0.0052*
Ulnar deviation	30	6.87	26	4.18	21.67	2.89	<0.0001*
Supination	84.74	3.9	78	2.74	73.33	2.89	<0.0001*
Pronation	82.1	2.54	77	2.74	73.33	5.77	<0.0001*

* P value <0.05 denotes significance.

In our study, the majority of patients had dorsiflexion up to 80° (40.7%), palmarflexion up to 80° (37.04%), radial deviation up to 20° (48.14%), ulnar deviation up to 30° (29.6%), supination up to 80° (33.3%) and pronation of 80° (51.9%). Functional outcome with respect to modified mayo wrist score were significant (P < 0.05)

for all the functional outcomes of the surgery which has been summarized and represented in Table 2.

Complications

In our study of 27 patients, two patients developed complications. One developed superficial skin infection which settled with regular dressings and antibiotics, while the other one initially developed stiffness due to noncompliance to physiotherapy which produced fair

results after getting admitted and undergoing aggressive physiotherapy.

Discussion

In our prospective study of 27 patients for whom variable angle volar locking compression plating was done for distal radius fractures, 11 patients had right side involvement, 16 patients had left side involvement, with mean age group being 48 years. Majority of the fractures were AO B3 type (7 patients) followed by AO C2 type (5 patients). Functional outcome was assessed using MMWS score. 19 patients produced excellent results, 5 patients produced good results, 3 patients with fair results.

Recent advancements in managing distal radial fractures have been shaped by an enhanced understanding of radial anatomy, patient preferences, and innovative fixation Methods.

Locking plates are now preferred, especially in cases of osteoporosis or complex fractures. The volar approach has gained popularity in recent times.

The variable-angle volar locking compression plate (VAVLCP) marks significant leap forward in the treatment of bad comminuted fractures. These plates offer increased versatility in screw placement, enabling surgeons to precisely position subchondral screws for better fracture fragment stabilization.

Our study results have been compared with various other research findings across different parameters as follows,

In our study, AO classification system was used. We observed that A2 and A3 fractures accounted for 7.4% each, B1 and B2 fractures each Represented 11.11%, B3 fractures constituted 25.93%, C1 fractures made up 11.11%, C2 Fractures were 18.52%, and C3 fractures accounted for 7.4%. Comparing our findings with Other

studies, Anakwe et al. (2010)¹⁴ reported different distributions: 4 C1 cases, 8 C2 cases, 9 C3 cases. Studies done by Sanjay A et al. (2012)¹⁵ shows 1 A1 case, 5 A2 cases, 7 A3 cases, 7 B2 cases, 3 B3 cases, 1 C2 case and 1 C3 case. Studies by Kavin et al. (2016)¹⁶ showed 4 A3 cases, 9 C2 cases, and 10 C3 cases. Studies by William JM et al. (2012)¹⁷ showed 15 A3 cases, 5 B3 cases, and 45 C3 cases. We found that the most of our fracture fall into the B3 and C2 categories.

In our research, we encountered two complications (7.4%). One patient developed an Infection at the surgical site, while another experienced wrist stiffness due to non-compliance with our physiotherapy protocol. In comparison, studies by Anakwe et al. (2010)¹⁴ showed 4.8% complications, studies by Sanjay A et al. (2012)¹⁵ showed a 4% complications, studies by Kavin et al. (2016)¹⁶ showed 21.7% complications, and studies by William JM et al. (2012)¹⁷ showed 7.69% complications.

In research study done by us outcomes varied, with 70.37% of cases categorised as excellent, 18.52% categorized as good, and 11.11% as fair, with no instances of poor results. Patients with excellent outcomes resumed normal activities without pain and maintained normal movements often starting physiotherapy earlier.

Those with good outcomes experienced no pain and near normal movements. Those with fair outcomes included residual issues like mild deformity with pain along with limitation of movements.

In comparison with other studies, Anakwe et al. (2010)¹⁴ utilized clinical examinations, measuring grip Strength of the affected wrist along with radiographs, patient rated wrist evaluation scoring, reporting 95% results. Studies by Sanjay A et al. (2012)¹⁵ used the

MMWS, revealing 100% achieving excellent results after one year. Studies by William JM et al. (2012)¹⁷ achieving 100% excellent results.

Our research investigation results mirror those of Kavin et al. (2016)¹⁶, who reported 65% excellent and 35% good results, offering a similar perspective on treatment efficacy.

Conclusion

In this prospective study of 27 patients, the variable angle volar locking compression plates were found to be effective in complex intra-articular fractures. These plates were helpful in holding all the 3 columns of fracture with the available 15 degree of freedom for screw placement facilitating anatomic reduction and early mobilization.

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Fair Result

Legend Figures



Excellent Result



Good Result