

A Comparative Study of Displaced Distal Radius Fracture Treated With K Wire Vs Volar Locking Plate Fixation

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ABSTRACT

Aim: To establish which type of fixation namely k wire fixation or volar locking plate fixation for displaced distal radial fracture is better regarding the functional outcome of patients over short term follow up of 3 months

Method: A prospective study was conducted at Shalamar hospital in department of Orthopedic between 2015-2017. The patients were received from the emergency department of hospital and inclusion and exclusion criteria were made during selection for study. A total of 60 patients were selected who were all older than 60 years of age. They were divided into two groups of 30 each. One group was treated with k wire fixation and was labelled as group A and other was treated with the volar locking plate and was labelled as group B.

Results: In our study volar locking plate did not show any significant better functional results of patient's satisfaction i.e pain, swelling, the range of motion at wrist at 1, 3, 6 and 12 weeks and power grip at 6 and 12 weeks follow up. In same criteria of patients and doctors satisfaction volar locking plate showed superior scores and in others, k wire fixation showed superior scores. The results of volar locking plate were inferior to k wire fixation at above mentioned follow-ups on the criteria of patient's satisfaction of pain. Swelling, stiffness at wrist at these follow-ups however locking plate results were better for power grip at 6 and 12 weeks postoperatively.

Conclusion: In our study volar locking plate and k wire fixation didn't show any superior results as compared to each other both functionally and radiological in all parameters in short term follow up of 1,3, 6 and 12 weeks. Three parameters namely pain, swelling and stiffness at the wrist, k wire fixation showed superior results but in fourth parameter namely power grip, volar locking plate showed better results. For the parameter of postoperative reduction of fracture according to Medoff criteria of radiological reduction of distal radial fractures, volar locking plate showed better results in short term follow-ups of 1, 3, 6 and 12 weeks.

Keywords: Distal radius fracture, K wire, volar locking, plate fixation

INTRODUCTION

Historically distal radius fractures were considered as part of wrist dislocation in the Hippocratic era. It is the most common fracture that constitutes 1/6 of all fractures¹. Fracture of the distal radius is a 2nd most common fracture in old age. It has a bimodal peak with a fracture in young adults 5-15 due to high energy trauma and a second peak inpatient over 60 years due to low energy trauma².

There is a direct relationship between osteoporosis and reduced bone mineral density and fracture of the distal radius. Patients with the fracture of the distal radius are at higher risk of fracture of neck of femur and vice versa³. With increasing age, the number of distal radius fractures and hence of the cost of treating such fractures is expected to increase⁴. The American Academy of orthopaedic surgeon advised surgical reconstruction for fracture with post reduction radial shortening greater than 3 mm, dorsal tilt > 10 degrees or intra articular displacement or step off greater than 2 mm⁵. However intraarticular step off more than 1 mm has been shown to co-relate with the development of arthritis⁶. Internal fixation with locking compression plate is most commonly used method for treating displaced distal radius fractures followed closely by percutaneous pinning with k wire⁷.

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MATERIALS AND METHODS

We conducted a prospective study from the patients diagnosed with distal radius fracture at Shalamar hospital between 2015-2017 after approval from Ethical Committee.

Inclusion criteria

- Distal radial extra articular fracture (A.O Classification A1 & A2)
- Distal radial intra articular fracture (A.O Classification B1 B2 B3)
- Distal radial intrarticular fracture (A.O Classification C1 and C2)
- All patients above the age of 60 years.
- Close fractures
- Intact distal neurovascular status

Exclusion criteria:

- Patients below 60 years of age
- Open fractures
- Complex multi fragmented fractures of the distal radius (A.O Classification C3)
- Patients having ipsilateral fractures in upper or lower limb
- Polytrauma patient with multiple fractures
- Patients with a concomitant disease like a renal or hepatic failure, or suffering from endocrine disorder.
- Patient having concomitant ulnar fractures

Randomization: Randomization was done by asking the patients to put his emergency slips/ OPD slips in boxes labelled A and B at his own choice. Box A was reserved for

fixation with k wire and box B was reserved for ORIF (Open reduction internal fixation) with volar locking compression plate.

A total number of 60 patients were included in the study. In the emergency department, all fractures of the distal radius were treated with analgesia and volar slab. After expiry of 48-72 hours depending on swelling, the decision was made according to randomization for fixation. Verbal and written informed consent was taken and the procedure to be done was explained to patients. Risks and benefits of each procedure were also explained in detail. In the emergency department, a primary reduction was done giving a patient a hematoma block at the fracture site. After primary reduction patient was given a back slab and was shifted toward for ORIF with either k wire or volar locking plate according to randomization criteria.

Postoperatively acceptable reduction criteria were based on Medoff measurements for acceptability of reduction in distal radial fractures⁸.

After surgery patient was asked for follow-up at one week, 3 weeks, 6weeks and then after 3 months. Patients were encouraged to a range of motion exercises from day 1 of surgery in both cases. At 10 days stitches were taken out. The patient was accessed for pain, swelling at hand, the range of motion at the wrist, power grip (patient's satisfaction) and radiological measurement (doctors satisfaction) were done according to Medoff criteria of acceptability of reduction (doctor's satisfaction) at 1, 3, 6 and 12 weeks. At each follow up a score was given according to the established scoring system in our study which is mentioned below.

Both groups of patients with K wire fixation and ORIF with locking compression plate were supported by below elbow Volar slabs for wound care. Patients were encouraged to remove volar slab daily for 15-20 minutes for dressing and to perform the range of motion exercises from day one. After removal of stitches volar slab for locking compression plate was discarded permanently but in K-wire, it was kept and the patient was advised to continue his routine of the range of motion exercises daily for 15-20 minutes. After 4 weeks volar slab for K-wire patients was also discarded permanently and wrist brace was given and range of motion exercises and wrist

strengthening exercises were started. For both k wire and volar locking plate, patient X-rays were taken at every follow-up visit to evaluate radiological parameters. For both groups of patients reduction and fixation was done under GA and tourniquet.

In K-wire fixation, the wires were passed over the dorsal aspect of the distal radius and into bone across the opposite cortex. Volar locking plate was used using volar Henry's approach. The numbers of screws to be used were decided by the surgeon in according with fracture configuration. Power grip was measured with Jamar dynamometer (model SH 5001, Saehan corporation Masan, South Korea). The statistical analysis was done using SPSS for window version 15.0.

Statistical evaluation: The difference of age and gender was evaluated by Chi-square test and difference in pain, swelling and range of motion at the wrist, power grip and radiological evaluation was done using student t-test. P, 0.5 was set as statically significant with a 95% confidence interval. Out of 60 patients who participated in the study 21 were male and 39 were females. All were above 60 years of age. There was no statistically significant difference with both groups regarding age as all patients were above 60 years of age and follow up time period was fixed at 1, 3, 6 and 12 weeks but gender showed a significant statistical difference. Out of these 60 cases, 10 had type A1, 9 had A2, 12 had B1, 12 had B2, 8 had C1, and 9 had C2 fractures according to AO classification. Verbal pain intensity score and scoring system for measurement of swelling is shown below. Clinical outcome for patients and doctor's satisfaction are also tabulated below with values and P score.

RESULTS

Verbal pain intensity score used

Pain Score

- 0 No pain
- 1 Mild pain
- 2 Moderate pain
- 3 Severe pain
- 4 Very severe pain
- 5 Worst possible pain

Grading of Swelling used

Time	K wire				Volar locking plate			
	1 week n=30	3 week n=30	6 week n=30	3 months n=30	1 week n=30	3 week n=30	6 week n=30	3 months n=30
Pain	3 patients severe pain, 18 moderate pain, 4 mild pain, 0 patient no pain	2 severe pain, 15 moderate pain, 7 mild pain, 3 patient no pain	1 patient severe pain, 10 moderate pain, 10 mild pain, 9 patient no pain	0 patient severe pain, 1 patient moderate pain, 7 patient mild pain, 22 patients no pain	7 patients severe pain, 14 moderate pain, 4 patient mild pain, 0 patient no pain	4 patients severe pain, 14 moderate pain, 7 mild pain, 5 patient no pain	2 server pain, 10 moderate pain, 13 mild pain, 5 patient no pain	1 patient server pain, 7 moderate pain, 10 mild pain, 7 patient no pain
Pain score	49	43	33	9	53	47	39	27

- 0: No swelling,
- 1: Mild swelling (2mm or less pitting),
- 2: Moderate swelling (2-4 mm pitting),
- 3: Severe swelling (4-6 mm pitting),
- 4: Very severe swelling (6-8 mm pitting)

Time	K wire				Volar locking plate			
	1 week n=30	3 week n=30	6 week n=30	3 months n=30	1 week n=30	3 week n=30	6 week n=30	3 months n=30
No of pts								
Swelling	8 patients severe swelling, 15 moderate swelling, 7 mild swelling	3 patients severe swelling, 22 patients moderate swelling, 4 mild swelling,	3 patient severe swelling, 10 moderate swelling, 17 mild swelling,	0 patient severe swelling, 3 patient moderate swelling, 13 patient mild swelling, 14 patients no swelling	15 patients severe swelling, 9 moderate swelling, 6 patient mild swelling,	13 patients severe swelling, 12 moderate swelling, 5 mild swelling,	8 patients server swelling, 16 patients moderate swelling, 6 patients mild swelling,	6 patients server swelling, 14 patients moderate swelling, 3 patients mild swelling, 7 patient no swelling
swelling score	61	57	46	33	69	68	62	49

Time	K wire				Volar locking plate			
	1 week n=30	3 week n=30	6 week n=30	3 months n=30	1 week n=30	3 week n=30	6 week n=30	3 months n=30
No of patients								
ROM Flexion/extension	110 ⁰ Average	135 Average	150 Average	170 Average	90 Average	110 Average	130 Average	150 Average
ROM Supination, pronation	120 Average	138 Average	150 Average	170 Average	100 Average	120 Average	140 Average	140 Average

K wire		Volar Locking plate		
No. of patients	30 patients	30 patients	30 patients	30 patients
Power grip	At 6 weeks	At 12 weeks	At 6 weeks	At 12 weeks
	46	60	58	68

Radiological score comparison at 3 months

Parameters	K wire	Volar locking plate
Radial inclination in degree	18	22
Radial height in mm	7	10
Radial tilt in degree	Minus 1	5 degree
Ulnar variance in mm	2	1
Articular step off in mm	2	1

DISCUSSION

Before our study already known to understand about distal radial fracture and its treatment were distal radial fractures are extremely common and a large proportion of this patients required surgical intervention⁴. K wire has long been a known treatment in which metal wires with pointed end are passed across the fracture sites⁹. This technique is superseded by volar locking plate as volar locking plate is considered to be superior surgical technique as compared to k wiring¹⁰.

Usually, DASH score is used to measure disability of arm, shoulder and hand (DASH) which includes 30 questions to the answered by the patients to evaluate and score parameters of pain, swelling, the range of motion at wrist and power grip.

DASH score is meant to access the clinical and functional outcome of the patients at different time periods. DASH score is cumbersome, inconvenient to both doctors and patients but in our study we used score for 4 parameters namely pain perceived by patients at each visit, swelling on the operated wrist and hand at each visit measured by doctor, range of motion at wrist namely flexion / extension and pronation / supination by patient at each visit measured by doctor, power grip measured by doctor and 5th parameter of range of accuracy in reduction of fracture by evaluating his X-rays and accurately measuring the

corrections after surgery by using Goniometer. Our scoring system is far simpler and more practical to assess patient clinically and radiologically.

In our study k wiring of distal radius were found to result in better functional outcome in 3 out of 4 parameters namely pain, swelling, range of motion at wrist at 1, 3, 6 and 12 weeks postoperatively but in the 4th parameter namely power grip which could only reliably be measured at 6 weeks and 12 weeks postoperatively, (because before that period postoperative pain and swelling at wrist and hand prevented accurate measurement of power grip), it was found that patient who underwent a volar locking plate of distal radial fracture had better functional outcome than k wire at both time periods of 6 and 12 weeks.

The parameters of the accuracy of reduction of fracture by measuring radiological parameters according to Medoff criteria of reduction, functional outcome of volar locking plate were better than k wire in all values of radiological landmarks as described by Medoff. However anatomical reduction leads to better clinical and functional outcome at long term is debatable.

Limitation of study: The limitation of our study was that it did not take into account the post-operative complications like the post-operative implant and wound infection, the incidence of regional complex pain disorder for both groups, the incidence of a carpal tunnel syndrome in both groups postoperatively.

Out study also lacked in the low number of patients and follow up time period was short. Similialary our study also had its limitation in not including younger age group who got distal radius fractures.

CONCLUSION

There are studies which conclude that Volar locking plate is significantly better than K-wire fixation for distal radial fracture but many studies did not show any significantly better results of one over the other over short or long term follow-ups.

In our study volar locking plate and k wire fixation didn't show any superior results as compared to each other both functionally and radiological in all parameters in short term follow up of 1,3, 6 and 12 weeks. Three parameters namely pain, swelling and stiffness at the wrist, k wire fixation showed superior results but in fourth parameter namely power grip, volar locking plate showed better results. For the parameter of postoperative reduction of fracture according to Medoff criteria of radiological reduction of distal radial fractures, volar locking plate showed better results in short term follow-ups of 1, 3, 6 and 12 weeks.

After 12 weeks whether any implant had better results is still to be established. Still more studies are required with a different configuration of fracture pattern of distal radius especially more complex and the comminuted fracture to determine functional and radiological function at these short term follow-ups or even at later follow-ups of six months, 1 year or even later.

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