

VOLAR LOCKING PLATE OSTEOSYNTHESIS IN DISTAL END RADIUS FRACTURES

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ABSTRACT

BACKGROUND

Distal end Radius fractures account for about 20% of all the fracture treated in emergency department of Kosi & Seemanchal area in Bihar. The majority of osteoporotic fractures occur as a result of fall from standing height on outstretched hand while in young patients, distal end radius fractures are seen secondary to RTA & sports activities. We conducted a study of a small group to evaluate the functional outcome of ORIF & volar locking plate fixation done for distal end radius fractures after one year.

MATERIALS AND METHODS

Records of 19 men and 41 women aged 17 to 78 years who underwent volar locking plate fixation for distal radial fractures were reviewed. According to AO-Classification of Distal End Radius fractures. 2 Patients had A2 Type of fracture, 3 had A3 Type, both B2 & B3 had 4 cases each, 15 of C1 Type, 21 of C2 type and 11 Of C3 Type. Functional outcome was assessed by using "Demerit point rating system" of Gartland & Werley. In all the patients at their final follow-up visit at 12 months.

RESULTS

Out of all these 60 patients, 9 cases had 10 complications, 2 cases developed Grade (I) Arthritis, 2 cases developed Grade (II) arthritis, 1 case developed superficial skin infection with medium nerve compression symptoms, 2 cases developed superficial skin infection which was resolved by continuous dressing on alternate days & 5 cases developed median nerve compression symptoms in which for 2 cases symptoms resolved with time, in rest 3 cases carpal Tunnel Decompression was done. Overall 63.3% result were excellent, 23.3% were good & 13.3% fair outcomes. The residual deformity was 0.70 the subjective score was 1.47 the objective score was 1.70, the total demerit score was as per modification Garland & Werley scoring groups (Mean values was 3.67). In all the cases, stainless steel plate was used.

CONCLUSION

In distal end radius fractures open reduction and internal fixation with volar locking compression plate followed by early rehabilitation gives good functional outcome and less complications. Hence it is considered to be one of the treatment of choice in distal end radius fractures.

KEYWORDS

Radius Fractures, Treatment Outcome, Volar plate, Wrist Injuries.

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BACKGROUND

Distal end Radius fractures accounts for about 20% of all the fracture treated in emergency department of Kosi &

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Seemanchal area in Bihar. Probably distal end radius fractures have an incidence of 1 in 10,000 people involving 74% of forearm and 16% of skeletal fractures.¹ Distal end radius fractures are associated with osteoporosis more common in women as rapid increase in incidence after menopause. The majority of osteoporotic fractures occur as a result of fall from standing height on outstretched hand while in young patients. Distal end radius fractures is seen secondary to RTA & sports activities.^{2,3,4}

There are various patterns of distal end radius fractures known as Colle's, volar Barton or Smith's fractures depending on the pattern of fracture & its involvement with Radio-Carpal joint surfaces & Distal-Radio ulnar joint & direction of the displaced fragments of fracture.^{5,6,7,8,9}

To find out in medical literature the best way to treat Distal End Radius fractures has become a myth, controversy & confusion is seen everywhere. The optimal treatment for Distal End Radius remains controversial.^{10,11} various modalities of treatment form Distal End Radius fracture include closed Reduction & cast, CREF with K-wire & cast, External Fixator, External Fixator with K-wire, Open Reduction & Internal fixation using a volar LCP which gives rigid anatomical fixation followed by early rehabilitation.¹² Patient who had displaced comminuted intra-articular Distal End Radius fractures & was treated with closed method of external fixation, wires or cast usually had unsatisfying results.^{4,5,12,13,14-17,18,19,20-22}

Incongruity of articular surface is seen is closed treatment after fracture healing. On comparison of volar & dorsal plating volar plate avoids tendinopathy that is associated with dorsal plate. Our study reviewed the 2-years functional & radiological outcome in patients of Distal End Radius fractures treated with volar Locking Comparison plate.

Aims and Objectives

To study the functional outcome of intra-articular comminuted & displaced, Distal End Radius fractures treated with open reduction and internal fixation with volar locking compression plate in 60 patients.

MATERIALS AND METHODS

Inclusion Criteria

1. Patients were from Age Group of 18-78 years.
2. Reported within 30 days of injury.
3. Clinical & radiological evidence of intra-articular comminuted & displaced Distal End Radius fractures.

Exclusion Criteria

1. Less than 18 years of age & more than 78 years.
2. Patients already with deformities.
3. All cases of compound fracture.
4. Isolated radial-styloid fracture.
5. Patients undergoing radiotherapy or chemotherapy treatment.
6. Rheumatoid Arthritis.

Prospective study and retrospective study was done of 60 patients that included 41 females and 19 males with intra-articular comminuted & displaced, Distal End Radius fractures in M.G.M. Medical College & L.S.K. Hospital, Kishanganj.

Fractures were Classified as per AO-Classification of Distal End Radius Fractures.

A	Extraarticular Fractures
A1	Ulna Fracture Radius Intact
A2	Radius, simple and impacted
A3	Radius, multifragmentary
B	Partial articular fracture of radius
B1	Sagittal
B2	Coronal, dorsal rim
B3	Coronal, palmar rim

C	Complete Articular Fracture of Radius
C1	Articular simple, metaphyseal simple
C2	Articular simple, metaphyseal multifragmentary
C3	Articular multifragmentary

Table 1. A.O. Classification

Treatment Method	AO Classification	Number of Patients
Internal fixation with volar LCP system. (30 pts.)	A2	2
	A3	3
	B2	4
	B3	4
	C1	15
	C2	21
	C3	11

Table 2. Selection of Treatment

2 Patients had A2 Type of fracture, 3 had A3 Type, both B2 & B3 had 4 cases each, 15 of C1 Type, 21 of C2 type and 11 of C3 Type. Radiographs that were taken just after injury were assessed to define the extend of intra-articular incongruity & was graded by Knirk & Jupiter method. In all the cases, stainless steel Locking compression plate was used. The size of plate depended on surgeon's choice. All surgeries were done by volar Approach either under general anesthesia, brachial block or elbow block.

Steps of Surgery

Procedure-

- Make an 8-cm incision over the forearm between the radial artery and the flexor carpi radialis. Carry the incision to the sheath of the flexor carpi radialis. Open the sheath and incise the forearm deep fascia to expose the flexor pollicis longus.
- Place an index finger into the wound and gently sweep the flexor pollicis longus ulnarly.
- Make an L-shaped incision over the radial styloid along the radial border of the radius to expose the pronator quadratus, and use a Freer elevator to elevate it from the radius. The entire fracture line across the distal radius is now fully exposed.
- Insert a Freer elevator or small osteotome into the fracture line to serve as a lever to reduce the fracture. Insert the elevator or osteotome across the fracture line all the way to the dorsal cortex to allow disimpaction and reduction of the distal fragment.
- Disimpact and reduce the fracture through capsuloligamentotaxis achieved by an assistant for through finger traction. After successful fracture reduction, position the volar plate under fluoroscopic guidance and insert a screw into the oblong or gliding hole first to allow proximal-distal adjustment.
- Confirm proper placement of the volar plate with mini-Carm fluoroscopy. If necessary, shift the plate proximally or distally to provide the best placement for the distal screws.
- Use a 2.0-mm drill bit to drill the distal holes. Measure the holes for screw length and insert smooth locking screws. Use a screw that is 2 mm shorter than the measured length to avoid having a prominent distal

screw perforate the dorsal cortex; typically, 20- to 22-mm screws are optimal, except for screws directed into the radial styloid, which are significantly shorter.

- Once the first screw is inserted, distal traction on the fingers can be released because the fracture usually is appropriately reduced and fixed.
- After placement of the distal screws, place the remaining proximal screws.

Post operatively wrist was bandaged for 11 days. Active wrist flexion extension/pronation/supination were started after 2 days of surgery. Patient was also encouraged for active shoulder & elbow exercises & active finger movements on 12th day all sutures were removed & physiotherapy exercises were started after 2 weeks to attain maximum range of movement. Patient were advised not to do any heavy pulling/pushing/ weight lifting or any other type of strengthening work.

Patients were monitored for function of Extensor pollicis longus & signs of carpal tunnel syndrome.

Functional outcome was assessed by using "Demerit point rating system" of Gartland & Werley. In all the patients at their final follow-up visit. Patients were followed up at 6 weeks, 3 months, 6 months, 9 months, & 12 months. The main evaluation depended on the following range of motion which was considered as the minimal criteria for normal function; Dorsiflexion 45° palmar flexion 30°, Radial & ulnar deviation 15° Pronation 50 & supination 50°. Patients were also evaluated for carpal Instability patterns & radio-ulnar instability or pain.

RESULTS AND OBSERVATIONS

All 60 patients with Distal End Radius fracture were classified according to AO Type – A2 (n=2), A3 (n=3), B2 (n=4), B3 (n=4), C1 (n=15), C2 (n=21), C3 (n=11). out of all these 60 patients 9 cases had 10 complications, 2 cases developed Grade (I) Arthritis, 2 cases developed Grade (II) arthritis, 1 case developed superficial skin infection with medium nerve compression symptoms, 2 cases developed superficial skin

infection which was resolved by continuous dressing on alternate days & 5 cases developed median nerve compression symptoms in which for 2 cases symptoms resolved with time, in rest 3 cases carpal Tunnel Decompression was done. In none of the cases implant removal was needed due to infection. There were no patients with tender injuries & Volkmann's Ischaemic Contracture. None of the cases developed early dystrophy or any finger stiffness. The complications rate for C2 & C3 type fractures were higher.

The absence or presence of Ulna-styloid fracture union process did not affect the final result. Even in cases of non-union of Ulna-styloid final outcome was good all the Distal End Radius fracture united at an average of 12 weeks of operation. All patients reported that they were able to perform their daily duties after the fractures were healed Regardless of the grade of injury no patient considered the sequel of the injury a disability that needed any modification for his/her work.

(Overall 63.3% result were excellent, 23.3% were good & 13.3% fair outcomes). The residual deformity was 0.70 the subjective score was 1.47 the objective score was 1.70, the total demerit score was as per modification Garland & Werley scoring groups (Mean values was 3.67).

Result	Plating	Percentage
Excellent	19	63.3%
Good	7	23.3%
Fair	4	13.3%
Poor	0	0.0%

Table 3. Follow-up Duration, Radiological Grade of Arthritis, Degree of Volar Tilt &

Treatment	Follow up (Months)	Arthritis Grade	Volar Tilt Degree	Radial Angle Degree
Plating	15.33	0.10	3.76	17.00

Table 4. Radial Angle; in Different Treatment Modalities

Treatment	Residual Deformity	Subjective	Objective	Complications	Total Demerit Score
Plating	0.70	1.47	1.70	0.60	3.67

Table 5. Modified Gartland and Werley Scoring Groups (Mean value)

DISCUSSION

In our prospective study of 60 patients of Distal End Radius fracture was treated with Volar Locking Compression Plate of stainless steel. In order to take both subjective parameters & objective evaluation the demerit point system was used over functional scoring system so that the complications associated with the treatment like arthritic pain, poor finger function & the complications were, assessed through demerit point system. Our study showed that functional outcome is very much dependent upon anatomical restoration of Distal End Radius. In present series results were excellent in 63.3% good in 23.3% & fair in 13.3% patients. Younger patients recovered more quickly than those of age more than 55 years. In our opinion, all Distal End Radius fractures in which alignment of the

articular surface could not be obtained by closed reduction regardless of their anonymous designation, restoration of the anatomy of articular surface is needed to avoid the sequale of post-traumatic arthritis. Patient aged more than 60 years, osteoporosis may prevent attaining goal in some patients. Most comminuted fractures which had resulted from high energy trauma do not give very good results. On the basis of our experience we agree with Knirk & Jupiter that in Distal End Radius fracture with intra articular in congruity of 2 mm or more or reoccurs after closed reduction & K-wire fixation are at a higher risk for post-traumatic arthritis compared to the one who has no incongruity. Knirk & Jupiter reported in an intra- articular fracture of Distal End Radius, the patient who were treated with ORIF with volar Locking Compression plate has good results by the criteria

of Gartland and Werley. This was completely different to another study of 24 patients who had intra-articular incongruity which was not corrected only 10 of them had satisfactory clinical result rest 14 suffered from arthritis at follow-up as per radiological evidence.

For fixation of Distal End Radius fracture volar Locking Compression plate has found to be very reliable, the distal screws are locked with the plate which stabilise the screw against lateral movement & resist loosening. The proximal screw fixes the plate very strongly to cortical bone. Some complications may arise after ORIF & plating, those are stiffness, median nerve symptoms, complex regional pain syndrome, arthritis, superficial skin infections, tendon injuries, Volkmann's skin contracture. In our series 2 patients suffered from grade 1 arthritis 2 patients suffered from grade 2 arthritis, 3 cases have superficial skin infection which resolved with dressing, 5 Patients suffered from medium nerve symptoms out of which 2 cases resolved spontaneously with time, for rest of the 3-carpal tunnel decompression was done. There was no other complication noted. Plate was covered by pronator Quadratus so flexor tendons were shielded.

In our study, the cases of delayed compression neuropathy and delayed rupture of tendons was not seen. The study had limitations as it was done with a small group of 60 patients in whom surgery was performed by different surgeons. A larger study with more no of patients can be done in future.

CONCLUSION

The treatment goal for Distal End Radius fracture is restoration of the anatomy of wrist joint and fully functional recovery of wrist with early mobilization. Functional outcome of treatment varies from person to person & depends upon patients age, type of fracture, displacement, stability, reducibility & articular incongruity of fractures. In some severely injured patients, old age patients, reduction of intra-articular incongruity may not be possible. So, they should be informed about post-traumatic arthritis in advance.

Volar locking compression plate fixation with early mobilization is a safe & effective treatment for Distal End Radius fractures which has low rate of implant related infection.

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