



RESULTS OF VOLAR PLATING IN DISTAL END RADIUS FRACTURES IN ADULTS

Orthopedics

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ABSTRACT

BACKGROUND: Fractures of lower end radius are the most common fractures of the upper extremity. The volar plate system has been shown to be reliable for the fixation of distal radius fractures. As open reduction and volar plating ensures more consistent correction of displacement and maintenance of reduction, this prospective study evaluates the anatomical and functional outcome of open reduction and plate fixation in the management of fracture distal end radius.

METHOD: In this prospective study of 40 patients with distal end radius fractures were evaluated pre operatively and post operatively at the end of first, fourth, sixth week, 3 months and then once in 3 months up to 12 months.

RESULTS: Forty patients, 88% anatomical and 93% functional, had excellent to good results suggesting that stabilizing the fracture fragments with volar plate and screws in the management of the fractures of distal radius, is an effective method to maintain the reduction till union.

CONCLUSION: This study concludes that open reduction and internal fixation with volar plating has excellent functional outcome with minimal complications. The procedure is applicable for all types of Frykman fractures in young patients with a good bone stock as well as in elderly osteoporotic patients.

KEYWORDS

VolarPlating, Distal Radius Fractures, distal end radius.

INTRODUCTION

Distal radius fractures remain an injury that fosters considerable interest and debate. Interest in distal radius fractures stems not only from its high incidence but also from developing understanding of outcome variables and influence of technology in evaluation and treatment. Following a distal radial fracture, the attainment and maintenance of anatomical reduction of the articular surface is crucial to the preservation of wrist function¹. The degree to which articular step-off, gapping between fragments, and radial shortening can be improved with surgery correlates strongly with improved outcome. Hence, a treatment method that is more likely to achieve these goals will result in better function. The volar approach is less disruptive to the nearby tendon than the dorsal approach, because there is more space available for the plate on the volar surface of distal radius.

Early rehabilitation is possible with the new design, the distal screws are locked to the plate, which stabilizes the screw against lateral movement(toggle) and resists loosening. This provides additional strength to the fixation by constructing a scaffold under the distal radial articular surface. The proximal diaphyseal screws fix the plate strongly to thick cortical bone, completing this stable form of fixation².

As open reduction and volar plating ensures more consistent correction of displacement and maintenance of reduction, this study evaluates the anatomical and functional outcome of open reduction and plate fixation in the management of fracture distal end radius.

MATERIALS AND METHODS

40 patients with distal radius fractures of the treated at our institute between April 2016 and March 2018 were included in the study. Patients with distal radius fractures of wrist who were more than 18 years with closed fractures who were willing for treatment and who had given informed written consent were included in the study.

Patients more than 18 years of age, medically unfit cases, compound fractures, pathological fracture, previously operated & non-functional wrist and patients with local tissue condition making surgery inadvisable were excluded from the study.

The standard volar approach was undertaken to fix distal radius fracture using volar buttress or locking plate and screws. The ulnar styloid fracture was managed expectantly. The movement of wrist was restricted in slab for 10 days after surgery. After 10 days, slab was removed and crepe bandage applied and active motion of the wrist

consisting of wrist movements, supination, pronation, finger grip were started.

They were followed up at the end of one, four, six weeks, 3 months and then once in 3 months up to 12 months. During follow-up visits AP and lateral x-rays were taken and patients were instructed about the exercises of the elbow, digits and shoulder.

Patients were assessed, which includes objective grading of function and deformity, comparison of final and initial radiograph (Fig 1). Objective examination included inspection of the wrist for deformity, tenderness, abnormal mobility of the distal radio-ulnar joint, measurement of the range of movements and grip strength.

The subjective, objective and radiographic findings were quantified by Lidstrom's system and Demerit point system. The outcome of each fracture has been graded as excellent, good, fair or poor

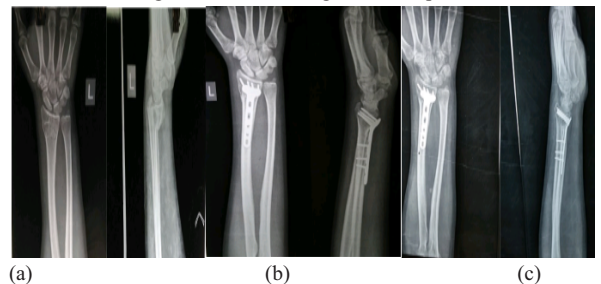


Fig 1: (a) pre op xray, (b) 2 months post op xray, (c) 6 months post op xray

RESULTS

40 patients with distal end radius were enrolled in the study and were treated by volar plating system. The analysis of results showed The mean age of the patients was 39.6 years(range 19-67 years). There were 26 male patients (65%) and 14 female patients (35%) in the study.

ANATOMICAL EVALUATION

Residual dorsal tilt: The dorsal tilt (from a neutral of 0 degrees) of the distal radial articular surface varied from 4° to 28°. The dorsal tilt decreased from an average of 14° before the reduction to an average of 0.7° at the most recent follow up evaluation.

Postoperatively the dorsal tilt could be corrected to the anatomical palmar tilt or at least a neutral angle in 34 patients (85%) while in 6 patients (15%) the dorsal tilt could not be restored even to a neutral angle.

Out of these 6 patients, 2 had Frykman Type I fracture, 2 had Type III fracture while one had Frykman Type IV fracture and one had Frykman Type VII fracture. At the final follow up, two patients (5%) had some loss of correction of dorsal tilt. These patients had a comminuted intra-articular fractures (Type IV and VII).

In 95% of the patients the correction of tilt achieved at surgery was maintained till healing.

RADIAL LENGTH

The radial shortening varied from 4mm to 27 mm. It decreased from an average of 12 mm before the reduction to an average of 0.7 mm postoperatively and to 0.8 mm at the most recent follow up.

In 1 patient (3%) there was 5 mm of collapse of radial length from the immediate postoperative to the final follow up period. This patient had comminuted fracture Frykman Type VI.

97% of the fractures maintained their postoperative radial length till union.

RADIAL ANGLE

The loss of radial inclination varied from 0° to 24° . (Avg 13°) it was reduced to an average of 1° at the final follow up.

In 2 patients (5%) there was loss 3° to 4° of correction of radial inclination. These 2 patients had comminuted intra articular fractures.

CLINICAL AND FUNCTIONAL EVALUATION

Residual deformity: Prominent Ulnar Styloid – 5 patients (12%) Residual Dorsal Tilt – 4 patients (10%) Radial Deviation of hand – 0 patients (0%) 5 patients (12.5%) developed complications, however, 35 patients (88.5%) were free from complications.

Anatomical score of healed fracture: The scoring was done according to the Sarmiento's modification of Lidstrom Criteria.

Anatomically 25 patients (63%) had excellent restoration of anatomy, 10 patients (25%) had good restoration, 3 had fair (7%) and 2 had poor (5%) restoration of anatomy. Thus 88% patients had excellent to good alignment of fragments and good reduction could not be achieved in 12% patients resulting in fair or poor results.

Functional end result of healed fracture: The scoring of healed fracture was done according to the Demerit Point System of Gartland and Werley with Sarmiento et al modification. Functionally 24 patients (60%) had excellent, 13 good (33%) and 3 patients had fair (7%) restoration of functions. Poor function correlated with residual displacement and poor patient compliance.

The ratio of grip strength of affected hand to normal hand was measured by a standard dynamometer. 24 patients (60%) had excellent grip strength, 11 patients (27.5%) had good grip strength while in 2 patients grip strength measurement was not possible due to bilateral wrist involvement.

Table 1: Objective evaluation

OBJECTIVE EVALUATION	NO. OF PATIENTS
Loss of Dorsiflexion (<45°)	1
Loss of Palmarflexion (<30°)	2
Loss of Ulnar Deviation (<15°)	1
Loss of Radial Deviation (<15°)	1
Loss of Supination (<50°)	1
Loss of Pronation (<50°)	1
Loss of Circumduction	2
Pain at DRUJ	2
Grip Strength <60% of opposite side	1

Table 2: Complications

COMPLICATION	NO. OF PATIENTS
Reflex Sympathetic Dystrophy	1
Joint Stiffness	2
Paraesthesia in the distribution of Radial Nerve	1
Impingement of tendons	0
Median Nerve Complications	0
Osteoarthritis of the wrist joint	1

DISCUSSION

In 1814, Abraham Colles outlined the treatment of his choice for distal end radius Fracture¹. Since then there have been numerous studies to outline the ideal treatment for different fracture types. In this study of 40 patients the mean age of the patients was 39.6 years (range 19-67 years) with male predominance.

Chung et al.² in his study observed mean age of 48.9yrs with male predominance. Chung K C et al in his study of 161 patients reported flexion of wrist in the injured side 86% of the contralateral side.

Leung et al.³ conducted a randomized control trial in 137 patients with intra-articular distal radius fracture and compared between external fixation augmented with nails and internal plate fixation of the fractures. At an average of 24 months of follow up period, they reported that the results of plate fixation group were significantly better than the augmented external fixation group. In our prospective study, volar approach for plate fixation in DER fractures also had better functional outcome as well as better alignment of fracture fragments after a 12 month of follow up period.

Figl M et al.⁴ studied on volar fixed angle plate osteosynthesis of unstable DER fracture with a 12 months follow up in 80 patients. At the time of final follow up, 60 patients (75%) had no radial shortening, 20 patients (25%) had a mean radial shortening by 1.8 mm compared to contralateral side. Radial tilt was average 22° volar tilt was average 6°. Grip strength was 65% of contralateral side.

Othman AY⁵ conducted a study on fixation of dorsally displaced distal radius fracture with volar plate. 16 patients were included in the study .88% of fractures were rated as good or excellent according to Gartland and werley scoring system.

Gruber G et al.⁶ also reported good or excellent results in more than 90% patients after volar plate fixation.

Dillingham C et al.⁷ reported that supination and pronation returned more quickly than flexion or extension. Supination and pronation was 92% of the uninjured wrist after 3 months. Flexion improved between 3 to 6 months and all wrist ROM improved till 1 year. In the present study, supination and pronation were both around 90% of uninjured wrist after 3 months. At the time of final follow up there was Loss of Dorsiflexion in 1, Loss of Palmar Flexion (<30°) in 2 patients, Loss of Ulnar Deviation (<15°) in 1, Loss of Radial Deviation (<15°) in 1, Loss of Supination (<50°) in 1, Loss of Pronation (<50°) in 1 and Loss of Circumduction in 2 patients. 35 out of 40 cases, showed excellent to good grip strength after a follow up of 1 year.

Lee YS et al.⁸ conducted a retrospective study to compare the clinical outcome of volar locking plating (VLP) and percutaneous K-wire (PKW) fixation for treatment of displaced colles type DER fracture in patients between 50 to 70 years. The results had shown better functional end results with VLP Gogna et al.⁹ conducted a study on osteosynthesis with volar fixed angle locking plates in dorsally comminuted fractures of DER. Final assessment was done as per Demerit point system, which showed 79% (n=26) excellent results, 18% (n=6) good and fair in 3% (n=1). 3 patients had loss of reduction but none had tendon irritation or rupture or non-union at the end of one year of follow up. In the present study, Demerit point system yielded excellent functional end results in 60% (n=24) cases, good in 33% (n=13) cases and fair in 7% (n=3). Residual dorsal tilt was seen in 10% (n=4), none of the cases showed any radial deviation of hand or tendon irritation or rupture or non-union of fracture fragments at the final follow up after one year.

Kamano M et al.¹⁰ in his study the complications as follows: 1 case developed RSD, 1 case had mild superficial skin infection.

Rozenal TD et al.11 in his study in reported 44% infection rate. In our study,out of 40 patients, 5%(n=2) cases developed superficial skin infection at the operated site which was managed conservatively. 5 patients developed postoperative complications.

Arora R et al.12 in his study reported complication rate of 27%(n=31). 57% of complication was due to flexor and extensor tendon irritation which included rupture of FPL tendon in 2 cases,rupture of EPL tendon in 2 cases,4 cases with extensor tendon tenosynovitis, 9 cases of flexor tendon tenosynovitis, 3 case with carpal tunnel syndrome,5 cases with RSD, loosening of single screw in 2 cases, delayed union in 3 cases, intraoperative intra-articular screw displacement in 1 patient. In our prospective study, none developed any tendon irritation or rupture but in 1 case there was radial nerve paresthesia and 1 patient developed RSD.

Prommersberger KJ et al13 evaluated non-union after reconstruction surgery of distal radius fracture in 23 patients and reported that open fractures, severe contamination, infection, tissue interposition, devascularization of bone ends and pathologic lesions are risk factors for non-union. In present study, inspite of development of superficial skin infection in 5%(n=2) cases, no case was reported to have non-union of fracture.

CONCLUSION

This study suggests that stabilizing the fracture fragments with volar plate and screws in the management of the 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/ or the bone is osteoporotic.

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