



FUNCTIONAL OUTCOME OF SURGICAL MANAGEMENT OF FRACTURES OF DISTAL END RADIUS WITH BUTTRESS PLATE

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ABSTRACT

Fundamental goal treatment of distal radial fractures is restoration of normal or near normal alignment and articular congruity. Twenty patients with fractures of distal radius were selected who were admitted in Government Medical College, Kurnool between September 2018 and September 2020. Patients were treated with open reduction and internal fixation with volar plate through a volar approach and followed up till functional recovery and assessed clinico radiologically. The study comprised of 14 male and 6 female patients aged from 23 to 62 years with mean age of 39.80 years The follow up ranged from 9 to 18 months. Using the demerit scoring system of Gartland and Werley, we had 50% excellent, 40% good, 10% fair and none poor results. In carefully selected patients even in the face of osteoporosis, fixation of fractures of distal end of radius with a volar plate has satisfactory outcome

KEYWORDS : Distal radius;; Open reduction;Internal fixation; Volar plate,

INTRODUCTION

Fractures of distal end radius are most common fractures of the upper extremity, encountered in practice and constitute 17% of all fractures and 75% of all forearm fractures¹ Close reduction cast and immobilization has been the mainstay of treatment of these fractures but malunion of fracture and subluxation/dislocation of distal radioulnar joint resulting in poor functional and cosmetic results is the usual outcome². The residual deformity of wrist adversely affects wrist motion and hand function by interfering with the mechanical advantage of the extrinsic hand musculature.³The current trend of management for irreducible compression fractures of the joint surface (C3 fractures, or pilon fractures of the distal radius) has shifted from bridging external fixation, pins, and bone grafting to open reduction and stable internal fixation and functional after-treatment.

Many studies show that the long-term functional results are equivalent, but the earlier functional results favor open reduction and internal fixation (ORIF) over external fixation. Instability of the DRUJ is recognized as a poor prognostic factor in the management of distal radius fractures²¹ However, recent studies²² have shown that if the distal radius fractures are anatomically reduced and rigidly fixed with locking plates, no significant difference is noted in the final outcome between patients with and without ulnar styloid fractures, despite the location of the fractures and the degree of displacement. As open reduction and internal fixation with buttress plate ensures more consistent correction of displacement and maintainance of reduction, this study evaluates the anatomical and functional outcome of open reduction and plate fixation in the management of fracture distal end radius.

OBJECTIVES

- 1) To assess the role of open reduction and Buttress plate fixation followed by early mobilization of wrist joint in the management of fracture distal end radius.
- 2) To assess the functional results.

REVIEW OF LITERATURE

Cooney WP et al. (1980) studied the complications of Colles fractures in 565 patients treated from 1968-1975 and divided the complications into 9 groups of which the largest were the neuropathies and the next common was post-traumatic arthrosis⁵. **Jesse B Jupiter, et al. (1996)** retrospectively reviewed the results of operative treatment of 49 volar, intra-articular fractures of the distal end of the radius. They graded their results according to the system described by Gartland and Werley and the modified system of Green and O'Brien. Two factors were found to have a significant association with a fair or poor outcome: evidence of osteoarthritis on the most recent follow-up radiographs and reversal of the normal volar tilt of the distal end of the radius.⁷ **Louis W Catalano III, et al. (1997)** did a retrospective study. They felt that treatment and prognosis for a simple extra-articular fracture cannot be compared with those for acromioclavicular intra-articular fracture; and extra-articular or non-comminuted intra-articular fractures have generally been associated with good results²⁷.

Wong KK, et al. (2005) concluded that Volar locking compression plating is a safe and effective treatment for unstable fractures of the dorsal distal radius⁹. **Strohm PC (2007)** analysed weather locking, 3.5 mm Palmar T-Plate the implant of choice for displaced distal radius fractures. He concluded that 3.5 mm T-LCP is a good implant for the stabilization of displaced distal radius fractures if the fragments are not too small for the 3.5 mm screws. **Pichon H (2008)** Treated about 24 cases for dorsally displaced distal radius fracture with Volar fixed angle plate LCP 3mm. He concluded that when used on the anterior aspect of the radius, the locking compression plate provides satisfactory treatment for fractures of the distal radius with posterior displacement. **Fok MW et al. (2013)** did a multicentered, retrospective study involving three hospitals situated in Spain, Switzerland, and the United States in the period between January 2000 and March 2006, 97 patients with 101 intra-articular distal radius fractures and concluded that irrespective of the direction and amount of initial displacement, a great majority of intra-articular fractures of the distal radius can be managed with a fixed-angle volar plate through a single volar approach¹⁰.

METHODOLOGY

Twenty adult patients with distal radial fractures treated at Government Medical College, Kurnool between September 2018 and September 2020. under the Department of Orthopaedics, were included in this study.

INCLUSION CRITERIA

- Age group: 18 years and above
- Male and female patients.
- Fracture distal end radius within 5 cms of distal articular surface
- Type 1 compound fractures
- Consent to participate in the study

EXCLUSION CRITERIA

- Patients with comorbid conditions preventing surgical intervention
- Patients with local tissue condition making the surgery inadvisable
- Patients aged below 18 years
- Pathological fractures
- Type 2 and 3 compound fractures

Standard radiographs in PA and lateral views were taken for confirmation of the diagnosis and also to know the type of fracture. Oblique views were also taken in a few patients who had complex comminuted fractures. The fracture fragments were analysed and involvement of radiocarpal and distal radioulnar joints were assessed and classified according to the Frykman's and AO classification. The duration from the date of injury to date of operation ranged from 2-8 days (average 3.70 days). The patient was placed supine on the operating table. Then a mid-arm pneumatic tourniquet was applied and the limb was placed on a side arm board.

PROCEDURE All cases are treated with a volar plate using a volar Henry approach.

INSTRUMENTS AND IMPLANTS USED

- Ellis T-plates of varying length
- 3.5 mm drill bit and sleeve system
- Hand drill / power drill
- Tap for 3.5 mm cortical screws and 3.5 mm depth gauge
- Hexagonal screw driver for 3.5 mm cortical screws

Technique

The incision for volar fixation of the distal radius is typically performed through the distal extent of the Henry approach. An incision is made between the flexor carpi radialis (FCR) tendon and the radial artery. The radial artery is carefully retracted radially, while the tendons of the FCR and FPL are retracted ulnarly. The pronator quadratus is divided at its most radial aspect, leaving a small cuff of muscle for later reattachment. Any elevation of the muscle of the FPL should be performed at its most radial aspect, as it receives its innervation from the anterior interosseous nerve on its ulnar side. After the pronator quadratus has been divided and elevated, the fracture is readily visualized, and reduction maneuvers can be accomplished under direct vision. After exposure and debridement of the fracture site, the fracture is reduced and provisionally fixed under fluoroscopy with K-wires, reduction forceps or suture fixation. Reduction aids should be placed so as not to interfere with placement of the plate.

The appropriate plate is selected following fracture reduction. First, a standard cortical screw was applied to the most distal oval hole of the volar limb of the plate in order to temporarily secure the plate to the proximal fragment. This allowed concomitant proximal and distal plate adjustment. After fixing the distal fragment with subchondral screws, radial length was gained, when necessary, by pushing the plate distally. The first standard screw can be either left in situ or exchanged with another screw; the oval hole is a combination hole designed for locking head screw placement at the distal end and standard screw placement at the proximal end of the same hole.

The optimal placement of the distal screws is important: they must be inserted at the radial styloid, beneath the lunate facet, and near the sigmoid notch. The distal screws can be of either monocortical or bicortical engagement. More volar tilt can be achieved during distal screw placement when the wrist is volarly flexed as much as possible by an assistant. Radial length can be further improved by pushing the whole plating system distally while using the oval plate hole and screw as a glide. The final position of the plate was confirmed using fluoroscopy. Once stable fixation was achieved and hemostasis secured, the wound was closed in layers and sterile compression dressing was applied. The tourniquet was removed and capillary refilling was checked in the fingers. The operated limb was supported with an anterior below elbow POP slab with the wrist in neutral position.



Fracture reduced and plate fixed

RESULTS

The age of the patients ranged from 23-65 years with an average of 39.8 years. Out of total 20 patients, 14 (70 percent) were males and 6 (30 percent) female. Out of total 20 patients, right side (dominant wrist) was involved in 13 (65 percent) patients and the left side was involved in 7 (35 percent) patients. Out of total respondents, 13 (65 percent) patients were met with road traffic accidents and 7 (35 percent) patients fall on their outstretched hand. Out of 20 cases, 5 (25 percent) of the fractures were of Type I Frykman's classification, 3 (15 percent) of Type II, 8 (40 percent) of Type III, 3 (15 percent) of Type IV, and 1 (5 percent) of Type VIII. There were no cases of Type V, VI and VII fractures 90 percent of the fractures were of closed type and 10 percent

were open type I of Gustilo and Anderson Classification. 40 percent of the fractures were of extra articular type and 60 were Intra articular fractures. Out of 20 patients, 16 (80 percent) had union within 2-3 months and 3 (15 percent) had union in 3-4 months. There was 1 (5 percent) case of delayed union. 20 (100 percent) patients had dorsiflexion within the normal functional range (minimum 45°), 20 (100 percent) had palmar flexion within the normal functional range (minimum 30°), 20 (100%) had pronation within the normal functional range (minimum 50°), 20 (100 percent) had supination within the normal functional range (minimum 50°), 16 (80%) had radial deviation within the normal functional range (minimum 15°) and 19 (95 percent) patients had ulnar deviation within the normal functional range (minimum 15°). 19 (95 percent) patients had grip strength more than 60% compared to the opposite side. 1 (5 percent) had significant loss of grip strength (< 60% compared to the opposite side). 2 (10 percent) patients had pain in distal radioulnar joint. None of the patients had stiffness of wrist. 2 (10 percent) patient had stiffness of joints. None of patient had developed arthritis of the wrist joint and median nerve complications. There were no intraoperative complications. Demerit score system of Gartland and Werley has shown evaluation of result was excellent in the 50 percent cases, 40 percent cases was good, 10 percent cases was fair and none was poor.

Graph 1: Results (according to Gartland and Werley demerit scoring system)



Table 1: Impact of time from injury to surgery on result

Duration	Excellent	Good	Fair	Total
Within 1-5	8	8	1	17
Within 6-10	2	0	1	3
Total	10	8	2	20

It evident from table 18 that calculated chi-square statistic is 3.5294 and the p-value of the same is 0.17124. Therefore, the result is not significant at p<0.05. It shows that time from injury to surgery has no impact on the quick recovery from the fracture.

DISCUSSION

Unlike the dorsal approach, by using the volar approach, large volar fragments from the lunate fossa are reduced by direct manipulation and stabilized with the plate's buttressing surface. Use of a volar approach and plating avoids irritation of the extensor tendons and late tendon rupture provided that threaded screws do not perforate the dorsal cortex. We encountered a complication rate of 10%, stiffness of wrist joint and arthritis of wrist joint secondary to improper reduction and articular step. Ayhan Kilic et al. (2009) reported a complication rate of 11.1%, Anakwe et al. (2010) reported a complication rate of 4.8%. In our series, we had 50% excellent, 40% good, 10%, fair and 0% poor result. Patients, who obtained excellent results, had no residual deformities or pain. Range of motion was within the normal functional range. They had no arthritic changes or other complications. They were operated within 4 days after injury. Radial length, volar tilt and articular step-off were within acceptable limits. Patients with good results had minimal residual deformities, pain and slight limitation. Rest of their findings was within acceptable parameters.

Patients with fair results, along with residual deformity, pain and limitation also had pain in the distal radio-ulnar joint and minimal complications. Few of their movements were less than that required for normal function.

Our series is comparable to that of Ayhan Kilic et al., (2009) who had 44.4% excellent, 44.4% good, 11.2% fair.

Kevin C Chung et al. (2006) outcome measures included radiographic parameters grip strength, lateral pinch strength, the Jubsen Taylor test, wrist range of motion and Michigan hand questionnaire compared to

normal side. In his series decrease in mean grip strength, ear pinch strength and mean flexion of the wrist was 86% of normal side.

Limitations of our study

Small sample size limited our statistical analysis. There was no control group; hence, no conclusions can be made as to comparison with other types of treatment methods. The series was non-homogeneous and included different cohorts ranging from simple articular to complex intra-articular fracture patterns, which were not analyzed separately.

CONCLUSION

Use of volar plates in distal radius fractures provide good to excellent results and are effective in the correction and maintenance of distal radius anatomy. By using these plates, joint motions and daily functioning is recovered in a shorter time

SUMMARY

The study comprised of twenty cases of distal radial fractures in adults.

All patients treated with open reduction and internal fixation with a volar plate. Almost all (90%) patients had their range of motion within the normal functional range. Two of the patients had wrist stiffness. There were 2(10%) cases of wrist stiffness and arthritis because of intra articular fractures not being adequately did for articular step off and doing well with physiotherapy. Though we had 12 (60%) cases of intra articular fracture, the complication of post traumatic arthritis was in only 2(10%) cases. Long term follow up is needed to assess the arthritic changes.

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