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Open Reduction and Internal Fixation of Intra-articular Distal Radius Fracture by Buttress Plate: An Outcome Assessment

Muhammad Faraz Jokhio[1], Najeeb Ur Rehman[2], Raheel Akbar Baloch[3], Mohsin Aijaz Soomro[4], Ajmal Khan Silro[5], Niaz Hussain Keerio[*6], Syed Shahid Noor[7]

[1]Orthopedic, Liaquat University of Medical and Health Sciences, Jamshoro, Pakistan
[2]Peoples University of Health and Sciences for Women, Nawabshah, Pakistan
[3]Liaquat University Hospital, Hyderabad, Pakistan
[4]Suleman Roshan Medical College, Tando Adam, Pakistan
[5]Dibba Hospital, Fujairah, United Arab Emirates
[6]Muhammad Medical College and Hospital, Mirpurkhas, Pakistan
[7]Liaquat National Hospital and Medical College, Karachi, Pakistan

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ABSTRACT

This study aims to evaluate the surgery outcomes of distal radius fractures using open reduction and internal fixation (ORIF) with buttress plate in our hospital. 200 patients were included with age above 18 years, having distal radius fractures and who were treated by ORIF buttress plate. The patients who had intraarticular distal radius fractures were included in this study. Data was collected from hospital records. Mean age of our patients was 38.5 ± 8.3 years. Patients were assessed functionally using Gartland and Werley point system and anatomically (radiologically) using Sarmiento's modification of Lindstrom criteria. Among study participants, 140 patients had excellent restoration (70%), 20 patients had good restoration (10%) and the rest had fair restoration. There were some complications among patients like superficial infection and injury to superficial branch of radial nerve. In the follow up, we notice stiffness in one case with reduced range of movement of wrist and fingers. In our study, we had good to excellent results in 80% cases, anatomically and functionally. We conclude from our study ORIF using buttress plate is the best method for managing displaced intra-articular distal radius fractures.

*Corresponding Author

Name: Niaz Hussain Keerio
Phone: 00923333008501
Email: niaz_h@hotmail.com

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INTRODUCTION

Distal radius fractures are present in around sixth of all treated fractures (Cooney *et al.*, 1979). There are several mechanisms for this type of fractures and more than one joint might be included. This is why different names are given for distal radius fractures such as Colles', Barton and Smith fractures depending on the direction of the fragment's displacement (Arora *et al.*, 2011; Trumble *et al.*, 1994).

In fixation any fracture, it is very important to keep the alignment correct to avoid any further complications. Anatomical reduction with good functional outcome is the desired for the management. In order to reach a satisfactory result for displaced intra-articular distal radius fracture, we should

restore normal anatomy (Medoff, 2006; Orbay and Fernandez, 2002). On the other hand, managing comminuted fractures is challenging especially when using closed methods such as cast, K-wire fixation or even with external fixation which leads to unfavorable outcomes in most cases (Müller *et al.*, 1990; Soong *et al.*, 2008).

Therefore, for this type of fractures, clinicians prefer to perform open reduction and internal fixation (ORIF) to gain good anatomical reduction for displaced fractures (Soong *et al.*, 2008). This study aims to assess the effectiveness of ORIF for intra-articular fractures in the distal radius using buttress plate.

METHODS

Study Design

This is a prospective study conducted on 200 patients with displaced intra-articular distal radius fractures.

Study Setting

Study was conducted in Liaquat University of Medical and Health Science Jamshoro Pakistan from march 2019 to march 2020.

Participants

Participants in this study were patients admitted to the orthopedic department suffering from displaced intra-articular distal radius fractures. All study participants (patients) were adults above 18 years of age. Patients who were younger were excluded from the study.

Statistical Analysis

Data were entered and analyzed using SPSS program version 23 computer software. Independent T test and one-way Anova are used to show statistical significance among participants characteristics. Chi-square test is used to show relationship between categorical variables.

Permission and Ethical Considerations

An approved permission was gained from ethical research committee of our hospital. After explanation the patients who agree to participate in study were included. In addition, written informed consent was gained from patients before doing the procedure.

RESULTS

Patients were assessed for both functionality and anatomical reduction and for possible complications. Patients' assessment results are present in Table 1. With regard to the radiological assessment (anatomical), it was performed depending on the residual angulation at the dorsal aspect, radius length and loss of radial inclination. The mean radial angle was 17.83, the volar tilt mean was 6.43 and the radial length mean was 9.24 mm. The range of motion and mean palmar flexion, dorsiflexion was also assessed. The mean value of palmar flexion dorsiflexion was 79.22°, radial deviation mean was 63°, the ulnar deviation mean was 17.84° and the supination and pronation mean were 74.3° and 68° respectively.

The previous assessment was graded using the Sarmiento's medication. At the anatomical level (radiological), there were 120 patients (60%) had an excellent restoration and 50 (25%) patients had good restoration and the rest had fair restoration. Thus, 85% of patients had excellent to good anatomical fracture reduction with good reduction outcomes.

On the other hand, the functional assessment results were done using Gartland and Werley. The results of functional assessment were as follows: 140 patients had excellent restoration (70%), 20 patients presented with good restoration (10%) and the rest with fair function restoration.

There were no intraoperative complications for all cases. However, at the follow up there was one patient with superficial infection and one case with injury to the superficial branch of radial nerve. In later follow up, there were one case with joint stiffness. Most important, there were no mal-union or union results among participants in our study.

DISCUSSION

The distal radius intraarticular fracture main aim is anatomical reduction of the articular surface through with stable pain free fixation. It has been shown that, in the long term, residual intra-articular incoordination can lead to post-traumatic arthritis, although this is not always related to the prognosis of the support plate. "The treatment strategies to achieve the anatomical reduction of these intra-articular fractures are different. Studies have shown that the extended FCR method with DVR coating provides a successful way to treat most intra-articular distal bone fractures " (Joseph and Harvey, 2011; Atzei, 2009).

"At present, the treatment trend of incompressible compression fractures on the articular surface (C3 fractures or pilon fractures of the distal radius bone) has shifted from bridging external fixators, pins and bone grafts to open reduction, stable internal

Table 1: Patients' assessment results with mean value

Assessment content	Mean
Radial angle	17.83°
Volar tilt	6.43
Radial length	9.24 mm
Palmar flexion dorsiflexion	79.22°
Radial deviation	63°
Ulnar deviation	17.84°
Supination	74.3°
Pronation	68°

fixation, and functional deal with. Many studies have shown that the long-term functional results are the same, but the earlier functional results are more inclined to open reduction and internal fixation (ORIF) rather than external fixation" (Jakob *et al.*, 2000; Lutz *et al.*, 2011).

Through volar approach, the large volar fragmentation can be reduced directly under vision. "As for the small palmar edge fragments on the edge of the crescent socket, it must be supported on a flat plate or fixed with a separate screw, K-wire or tension band (if present)" (Khamaisy *et al.*, 2011; Chung and Petruska, 2007).

The characteristic of this study is to locate the spatial direction of screws in anatomical direction especially subchondral surface. It is important that the distal row of screws should be inserted as close to the subchondral plate as possible. It should be noted that if the ulna fragments are large should be fixed for stability (Egol *et al.*, 2008; Gehrmann *et al.*, 2008).

As long as the screw is not used to penetrate the dorsal cortex, the volar approach and plate can avoid irritation of the extensor tendon and late tendon rupture. The position of the board is important. Recently, due to the protrusion of the distal edge of the volar plate, which leads to direct contact with the flexor tendon, the incidence of flexor tendon irritation and/or rupture (Benson *et al.*, 2006) has increased in the application of the distal plate. The volar protrusion of the plate is usually related to insufficient fracture reduction, dorsal tilt of dorsal fragments (Chiang *et al.*, 2002; Berglund and Messer, 2009), and the application of the plate distal to the watershed line. In our series, we did not observe irritation or rupture of the flexor or extensor tendons. Except for one case in this series, after this case was reduced and fixed with a narrow plate, satisfactory articular surface repair was obtained in all other cases (Koo and Ho, 2006). The recovery of metacarpal inclination, ulnar inclination and radial bone length is also very satisfactory. Since the ideal position of the plate position is 0-2 mm near the watershed line, the ideal position is directly under the cartilage of each joint bone fragment, so there is no settlement, and the phenomenon of secondary fragment displacement and shortening seems to be related to the fixation nail (Tyllianakis *et al.*, 2011; Soong *et al.*, 2011). The exact placement is relevant. In our study, the patient's final functional outcome has advantages compared "with other series of studies for complicated open reduction, internal fixation and post-functional treatment of distal bone fractures".

CONCLUSION

It is crucial to maintain the right alignment while fixing any fracture to prevent additional problems. The management is intended to see anatomical reductions with acceptable functional results. As noticed from previous results, there are 80% of patients with excellent to good restoration at both levels; anatomically and functionally. Thus, we conclude that ORIF using buttress plate is the best method for managing displaced intra-articular distal radius fractures.

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Conflict of Interest

The authors declare that they have no conflict of interest for this study.

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