



FUNCTIONAL OUTCOME OF INTRA-ARTICULAR FRACTURE DISTAL END OF RADIUS TREATED WITH DORSAL BRIDGE PLATE – A PROSPECTIVE STUDY

Orthopaedic

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ABSTRACT

Introduction: Distal radius fractures pose a significant threat to the intricate mechanics of the human hand, often regarded as the epitome of dexterity and finesse. Among all fractures, none carry a greater potential to severely impair hand function. This is primarily due to the fact that the distal radius represents a critical juncture where precious soft tissues envelop the metaphysis of the bone. Dorsal bridge plating emerges as a highly valuable treatment option for distal end radius fractures, particularly those marked by complex articular and extraarticular fragmentation, where small, delicate fragments would provide inadequate stability if treated solely with a locking volar plate. The use of a distraction plate not only facilitates prolonged immobilization spanning the wrist joint without compromising functional outcomes but also mitigates the risks associated with pin loosening and pin infection commonly encountered with external fixation methods. **Objectives:** The study is a prospective study of functional outcome of intra articular distal end radius fracture treated with dorsal bridge plate technique. **Methods:** All the cases of intra articular distal end radius fracture treated with dorsal bridge plate technique during the time period of one year will be taken for study. Patients were followed up till 6 months and assessed using Gartland & Werley demerit scoring system. **Results:** Of the 20 patients enrolled in the study after informed consent, all fractures united. The average flexion and extension was found to be 62 degrees and 62.8 degrees, pronation and supination was 79 degrees and 79 degrees, radial and ulna deviation was 20 degrees and 25 degrees respectively. According to Gartland –Werley scoring system twelve patients had an excellent result, two had a good result, two had a fair result and two had poor results. One patient had tendon rupture and no case of post surgical site pain and no cases of infection, tendonitis. **Conclusion:** Functional outcomes following dorsal bridge plate fixation for distal radius fractures were similar to those published in literatures. Our findings suggest that this method is safe with minimal complications, and similar recovery to other methods of distal radius fixation is possible with rehabilitation.

KEYWORDS

Dorsal Bridge Plate, Distal radius fracture, Intra articular fracture, Functional outcome, Prospective study

INTRODUCTION

Distal radius fractures crush the mechanical foundation of mans most elegant tool, the hand[1]. No other fracture has a greater potential to devastate hand function, no metaphysis of bone is embraced by more precious soft tissues. The term fracture of distal end radius refers to fractures beginning at the proximal end of pronator quadratus and ending at radio carpal articulation. Fracture of distal end radius continues to be one of most common skeletal injuries treated by orthopaedics or trauma surgeons. These account for approximately 1/6th of all fractures seen and treated in emergency rooms[2]. In adults under 75 years of age, fracture of the distal end radius is more common than any other fracture. Several of complications arising were the sequelae of treatment rather than original fracture. For decades, the primary treatment method for distal radius fracture was with plaster cast, but plaster cast treatment modality frequently leads to early loss of reduction and poor functional outcome with intra articular fractures being at particular high risk[3]. With operative fixation, patients may require shorter periods of immobilization and may be able to return to normal activities sooner. As external fixation techniques for small bones have evolved multiple studies have demonstrated improved capacity for near anatomic reduction and higher functional scores than were historically possible[4]. Anderson was the first one to use external fixator in the treatment of distal end radius fractures. The successful use of external fixator in the management of distal end radius fracture include careful assessment of fracture pattern, proper patient selection, meticulous surgical techniques, appropriate choice of fixators, proper post operative early aggressive rehabilitation[5,6].

The advent of the volar locking plate has facilitated a dramatic rise in rates of plate fixation for distal radial fractures[7]. The advantage of internal fixation include stable subchondral fixation of intra articular fragments which facilitates early post surgical active wrist motion and lower rates of post traumatic arthritis. Restoration of wrist function is the primary goal in the treatment of unstable distal Radius fractures. It is well accepted that the restoration of disrupted radial anatomy, maintenance of accurate and stable reduction, and early hand mobilization are required for good functional results in unstable distal Radius fractures[8].

In case of Dorsal Bridge Plating for distal end radius fracture, that is associated with complex articular and extraarticular fragmentation, the fragments being very small would be poorly fixed or supported with screws if a locking volar plate was used alone. The distraction

plate allows prolonged immobilization across the wrist joint without compromising functional outcomes and circumvents the risk of pin loosening and pin infection associated with external fixation. Furthermore, the distraction plate may allow for earlier weight bearing across the affected wrist in the multiply injured patient[9]. In theory plating of intra articular fractures gives early mobility and the patient is free from cast. The long term results are not very different when compared with minimal fixation group[10]. The purpose of this study was to find the functional outcome of patients having intra articular fractures of distal radius treated by dorsal bridge plate.

MATERIALS AND METHODS

This prospective study was performed in 20 patients with intra articular distal end radius fracture treated with dorsal bridge plate technique, between December 2021 and December 2022, followed up for 6 months and short-term functional results analyzed by Gartland & Werley demerit scoring system[2]

a. Inclusion criteria

- Age between 20-75 years
- Both males and females
- Fractures up to 3cm from distal articular surface of radius
- Fractures with history of trauma <10 days
- Intra articular fracture distal end radius (AO TYPE B/C)

b. Exclusion criteria

- Pathological fracture
- Fracture with vascular injury
- Open fracture unable to undergo debridement within 24 Hrs
- Wrist arthritis
- Refracture of wrist
- Associated injuries of shaft of radius, ulna, carpal bones
- Surgical delay more than 10 days for closed fractures or 24 hours for open fractures
- Unable to comply with post operative rehabilitation protocols or instructions (i.e. head injury or mentally impaired)
- AO TYPE A fracture distal end radius

Sampling technique-Convenience sampling. Patients attending trauma casualty and orthopaedics OPD at District Hospital Kannur, St Joseph's hospital Karuvanchal and Co Operative Hospital Taliparamba, satisfying the inclusion criteria during the study period were included.

Period of follow up-The patients were followed up for a minimum period of 6 months at 1, 2, 3 and 6 months.

Tool of measurement-The clinical data collected and evaluated with pre surgery activity and present functional levels with Gartland & Werley demerit scoring system[2].

Pre operative assessment

Upon admission to the hospital, a meticulous case history was obtained from both the patients and their attendants to ascertain the injury mechanism and the extent of trauma. Comprehensive physical examinations were conducted to evaluate the patients' general health, any pre-existing systemic conditions, and concomitant injuries, with detailed documentation in the patient's medical records. Systematic observations were made to assess deformities, swelling, and areas of ecchymosis. Clinical examinations were conducted to identify tenderness, bony irregularities, crepitus, and the relative positioning of the radial and ulnar styloid processes. The range of motion in the wrist and forearm was assessed, often revealing pain and limited mobility. Furthermore, distal vascularity was evaluated by examining radial artery pulsations, assessing capillary refill times, observing for pallor, and noting any paraesthesia in the fingertips. Subsequently, the affected forearm was immobilized using a below-elbow plaster of Paris (POP) cast and kept in an elevated position. To manage pain and inflammation, appropriate analgesics were administered. Clinical assessment was followed by radiological investigations- Standard radiographs in PA and lateral views were taken for confirmation of the diagnosis and also to know the type of fracture. The fracture fragments were analysed and involvement of radiocarpal and distal radioulnar joints were assessed and classified according to the AO classification.

Surgical procedure

The patient underwent surgery following standard preoperative assessments and obtaining informed consent. Regional (axillary block) or general anesthesia was administered, and the surgical area was meticulously prepared. A 4-cm longitudinal incision exposed the long finger metacarpal shaft, while a second 4-cm dorsal incision targeted the Lister tubercle. A 12- to 16-hole, 3.5-mm plate was placed proximally between extensor tendons and the joint capsule, secured with bicortical 3.5-mm screws. Under fluoroscopic guidance, radial length was adjusted, and forearm rotation tested, ensuring stability. Interfragmentary screws were used for diaphyseal fragments.

Post-surgery, the patient's upper limb was elevated for 24 hours, and neurovascular status monitored. Post-operative pain and inflammation were managed with analgesics and antibiotics. Active limb movements were encouraged. Dressings were changed on post-op days 2 and 5. Immediate post-op X-rays were taken. Suture removal occurred on the 10th day, with follow-up at 1, 2, and 3 months. Assessments included pain, tenderness, infection signs, function, and deformity. Union was confirmed when there was no tenderness, subjective complaints, and no visible fracture line on X-rays. Non-union required intervention if not resolved after 6 months. Malunion was defined by radial shortening >5mm, volar tilt >15°, dorsal tilt >10°, and radial shift >4mm. The results were assessed at 6 months after the implant removal using the demerit point system of Gartland and Werley based on objective and subjective criteria[2], residual deformity and complications.

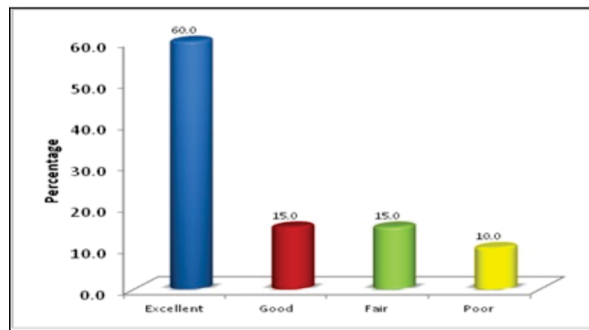
RESULTS

In our study, 20 patients with closed comminuted intra articular distal end radius fracture treated with dorsal bridge plate. In our series maximum age was 70 years, minimum age 19 years. In our study, mean age was 44.0 years. Most of the patients in our study fall in the age group of > 50 years (35%). Out of 20 patients, 14 (70%) were males and 6 (30%) females, showing a male preponderance with the ratio being M: F; 7:3. Right side was involved in 10 (50 %) patients and the left side was involved in 9 (45%) patients and bilateral in 1 (5%) patients. In our study there were 8 (40%) patients with road traffic accidents, 8 (40%) patients had fall from height, and 4 (20%) patients had trivial fall. There were 18 cases of closed fracture and 2 cases of open fracture in our study. Of 20 cases 10 (50%) were AO type C –complete articular and 10 cases (50%) were AO type B –partial articular. 13 (65%) patients were given Brachial Block while 7 (35%) patients operated under General Anaesthesia. The average hospital stay following surgery was 6.6 days. Most of patients 13 (65%) had hospital stay between 5-7 days. Using the Demerit score system of Gartland and Werley[2], among 20 patients, we had 12 (60%) Excellent results, 3

(15%) good results, 3 (15%) fair results and 2 (10%) poor results (Table 1, Graph1).

Table 1 : Distribution of patients according to the Gartland Werley Score[2]

Gartland & Werley[2]	Count	Percent
Excellent	12	60.0
Good	3	15.0
Fair	3	15.0
Poor	2	10.0



Graph 1: Percentage distribution of the sample according to Gartland & Werley[2]

Among 20 patients 19 (95%) patients had no complication while 1 (5%) patient had tendon injury (Extensor Digitorum middle finger).

DISCUSSION

More than 190 years have passed since Colle's described the fracture of the distal end of the radius. It is remarkable that this common fracture remains one of the most challenging of the fractures to treat. Different types of fractures may occur due to the anatomy of the distal radius and the effects of forces in different directions. It is often not possible to have a successful outcome using the same approach and materials for different types of fractures[11]. While mechanical characteristics are important in fixation selection, the strategic placement of the selected materials may in fact be more important than the characteristics of these materials, particularly in intra-articular fractures[12]. The best treatment option for different types of fractures may be determined by comparing different methods. Dorsal Bridge Plate is versatile in managing both intra- and extra-articular fractures with acceptable functional results. Reasons for using dorsal bridge plate include the continuity of reduction under fluoroscopic control, improved reduction by ligamentotaxis, and the ability to protect the reduction until healing occurs. The advantages of closed reduction internal fixation are the relative ease of application, minimal surgical exposure, and reduced surgical trauma[13]. Numerous studies have shown that extra-articular fractures as well as impacted stable fractures with minimal shortening can be managed conservatively. However, more often than not, distal radius fractures involve the radiocarpal joint and/or the distal radioulnar joint. These require an anatomical reduction of the joint surface to reduce the incidence of post-traumatic arthritis and to guarantee a successful treatment outcome. In contrast, the results of conservative treatment of intra-articular fractures, especially in young individuals have been poor. Thus, intra-articular fractures that cannot be reduced by conservative methods and are comminuted, displaced and unstable, require operative treatment. The operative method selected to achieve the treatment objectives requires a careful study of the individual fracture pattern, level of activity, quality of bone and general medical condition. The present study was undertaken to assess the functional outcome of operative management of closed comminuted intra articular fracture distal radial fractures treated by closed reduction and internal fixation with dorsal bridge plate and it was then compared with results from different study groups. (Table 2)

Table 2 : Comparison with different study groups

Series	EXCELLENT	GOOD	FAIR	POOR
John K. Bradway[14]	56	25	19	10
Ruch DS[15]	63	27	10	
Present study	60	15	15	

John K. Bradway[14] (1989) had 81% of excellent & good results. Ruch DS[15] (2005) had 90% of excellent & good results. This is

comparable to our study which shows 75% of excellent & good results

CONCLUSION

In conclusion, our study demonstrates that the utilization of the Dorsal Bridge Plate for distal radial fractures can yield favorable outcomes, ranging from excellent to good, contingent upon a judicious selection of the method. Key determinants for optimal results include consideration of fracture pattern, reducibility, stability, and bone quality. Our research underscores the importance of early fixation, diligent wound care, and the initiation of early post-operative rehabilitation. These factors collectively contribute to reduced hospital stays, facilitating early implant removal as early as three months post-surgery. Moreover, patient education emerges as a vital component of this treatment approach. The Dorsal Bridge Plate not only offers an effective solution for distal radial fractures but also underscores the significance of a comprehensive and patient-centered approach to orthopedic care.

Disclosure

On behalf of all authors, the corresponding author states that there is no conflict of interest.

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