Original Research

Hospital Stay Duration and Postoperative Complications among Patients Undergoing Volar Buttress Plate for Fixation in Volar Barton's Fracture of the Distal Radius

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Abstract

Introduction: *Volar Barton's fractures of the distal radius are complex injuries requiring precise surgical intervention to ensure optimal functional outcomes and minimize complications. This study investigates the hospital stay duration and postoperative complications among patients undergoing volar buttress plate fixation for these fractures.*
Objective: *To evaluate the functional outcomes, hospital stay duration, and postoperative complications in patients treated with volar buttress plate fixation for Volar Barton's fractures of the distal radius.*
Methods: *This prospective interventional study was conducted at Tairunnessa Memorial Medical College & Hospital,Gazipur, Dhaka, Bangladesh over two years from March 2014 to September 2016. Thirty patients with closed Volar Barton's fractures of the distal radius were included based on specific inclusion criteria. Data were collected using a pre-designed questionnaire and analyzed using the Sarmiento and Latta (1980) scoring system for functional outcomes.*
Results: *The majority of participants were young adults aged 18-39 years (73%), with a male predominance (77%). Most fractures (63%) occurred on the left side. Eighty percent of patients received treatment within one week of injury. Hospital stays ranged from 1 to 8 days, with 53% of patients staying for 3-4 days. Postoperative complications were minimal, with 83% of patients experiencing no complications. Superficial wound infection was observed in 7% of patients, while other complications such as wrist stiffness, carpal tunnel syndrome, and late collapse each occurred in 3% of patients. At final follow-up, 80% of patients had satisfactory functional outcomes, with 73.3% achieving good results and 6.7% excellent.*
Conclusion: *The volar buttress plate fixation technique for Volar Barton's fractures of the distal radius demonstrates high efficacy in achieving satisfactory functional outcomes with minimal complications and manageable hospital stay durations. These findings support its continued use as a preferred surgical intervention for this type of fracture.*

Introduction

Distal radius fractures encompass a wide range, from simple cases amenable to conservative treatment to severe, multi-fragmented fracture-dislocations that pose significant challenges. These fractures frequently involve the radiocarpal and/or distal radioulnar joints, being either partially or fully articular. Achieving an anatomical reduction of the joint surface is crucial to minimize the risk of post-traumatic arthritis and ensure favorable functional outcomes. Consequently, intra-articular fractures like Barton's fracture often necessitate surgical intervention and internal fixation with a buttress plate[1,2]. A paradigm shift in understanding distal radius fracture classification, presentation, prognosis, and management is warranted, differentiating low-energy metaphyseal injuries (Colles' fracture) from more severe articular surface-altering injuries (Barton's fracture). Articular injuries tend to be more comminuted and unstable, rendering conventional treatment methods of closed reduction and cast immobilization less suitable. Instead, skeletal fixation and fracture fragment realignment are preferred. Furthermore, malunion is a common complication that can lead to pain, reduced range of motion, weakness, and traumatic arthritis of the wrist[3]. Although a fall onto an outstretched hand from standing height is the most common injury mechanism for comminuted distal radius fractures, a small subset of patients sustain high-energy trauma. Clinical outcome measures include grip strength, ranges of motion, functional status, and pain at the fracture site[4]. Unstable distal radius fractures are mechanically predisposed to redisplacement following closed manipulation, with instability attributed to factors such as initial fracture displacement, patient age, metaphyseal comminution severity, degree of intra-articular comminution and steps, and ultimately displacement after conservative treatment, rendering further manipulation attempts unlikely to yield satisfactory radiographic outcomes [5]. Contrary to previous beliefs that extra-articular fractures occur primarily in the elderly population, both intra-articular and extra-articular fractures have been observed in younger and older patients alike. Barton's fracture is a common unstable fracture that warrants open reduction and internal fixation with a small buttress plate, with several studies demonstrating the efficacy of internal fixation in restoring articular congruency [6,7]. Inadequate fracture reduction can lead to intra-articular incongruency or carpal malalignment, potentially impacting surgical outcomes[8-10]. Consequently, the precise surgical outcome is contingent upon the proper reduction of distal radius fractures, rather than the fixation procedures employed. A significant advantage of internal fixation is the ability to reposition large displaced fracture fragments. The optimal management of distal radius fractures has undergone a radical shift over the past two decades, transitioning from near-universal cast immobilization to a variety of highly sophisticated operative interventions. The recent trend for most unstable intra-articular fractures is surgical treatment, with internal fixation using a volar plate demonstrating an increased likelihood of painless union compared to conservative treatment methods for potentially unstable distal radial fractures[11].

Methods

This prospective interventional study was conducted at the Department of Orthopedic Surgery, Tairunnessa Memorial Medical College & Hospital, Gazipur, Dhaka, Bangladesh over a two-year period from March 2014 to September 2016. The initial sample size was assumed to be 384 based on a mathematical equation, but due to the unavailability of patients, the revised sample size was set at 30. Participants were selected from patients attending the orthopedic emergency and outpatient department of the study hospital, following a purposive non-probability sampling technique. The inclusion criteria were closed volar Barton's fracture of the distal radius (AO/ASIF type B3), recent cases (within 3 weeks), age between 18 and 60 years, and both sexes. Exclusion criteria included open wounds, volar Barton's fractures more than 3 weeks old, associated infections, associated fractures in the ipsilateral upper limb, and non-cooperative patients. A pre-designed questionnaire was utilized for data collection, and the Sarmiento and Latta (1980) scoring system was used for patient outcome categorization [12]. Informed written consent was obtained from each participant, and ethical approval was secured from the hospital's ethical review committee.

Results

Table 1 presents the baseline characteristics of the 30 study participants. The majority (73%) were aged 18-39 years, while 27% were between 40-64 years old. The mean age was 32 ± 9.3 years, with a range of 19 to 60 years. There was a predominance of males (77%) compared to females (23%). In terms of the side of injury, 63% of cases involved the left side, while the remaining 37% were right-sided injuries.

Table 1: Baseline characteristics distribution of the participants (n=30)

Variables	Frequency	Percentage
Age (Years)		
18-39	22	73%
40-64	8	27%
Mean ± SD (Min-Max)	32± 9.3 (19 - 60)	
Gender		
Male	23	77%
Female	7	23%
Side of Injury		
Right	11	37%
Left	19	63%

Table 2: Distribution of participants by time interval between injury and management (n=30)

Time interval (weeks)	Frequency	Percentage
< 1	24	80%
1-2	2	7%
2-3	4	13%

distribution of participants based on the time interval between sustaining the injury and receiving management. The majority, 80% of cases, were managed within the first week after the injury occurred. Additionally, 7% of participants received treatment between 1-2 weeks post-injury, while the remaining 13% were managed between 2-3 weeks after sustaining the fracture.

Table 3: Distribution of participants by Associated injury (n=30)

Associated Injury	Frequency	Percentage
Fracture NOF	2	7%
Fracture SOF	1	3%
None	27	90%

Table 3 outlines the distribution of participants according to the presence of associated injuries. The vast majority, 90% of cases, did not have any associated injuries. However, 7% of participants suffered a concomitant fracture of the neck of femur (NOF), while 3% had a separate fracture of the shaft of femur (SOF) in addition to the distal radius fracture.

Table 4: Distribution of participants by duration of hospital stay (n=30)

Hospital stay (Day)	Frequency	Percentage
1-2	5	17%
3-4	16	53%
5-6	7	23%
7-8	2	7%

Table 4 displays the distribution of participants based on the duration of their hospital stay following surgery. The majority, 53%, had a hospital stay of 3-4 days. Additionally, 23% stayed for 5-6 days, 17% for 1-2 days, and 7% required a longer stay of 7-8 days.

Table 5: Distribution of participants by post-operative complications (n=30)

Complications	Frequency	Percentage
Superficial wound infection	2	7%
Wrist stiffness	1	3%
Carpal tunnel syndrome	1	3%
Late collapse	1	3%
None	25	83%

Table 6 outlines the post-operative complications experienced by participants. The majority, 83%, did not experience any complications. However, 7% developed superficial wound infections, while 3% each experienced wrist stiffness, carpal tunnel syndrome, and late collapse of the fracture fixation, respectively.

Table 6: Distribution of participants by functional outcome grading at final follow-up (n=30)

Functional Outcome	Frequency	Percentage
Excellent	2	6.70%
Good	22	6.70%
Fair	6	6.70%
Poor	0	0.00%

At the final follow-up of the study, the functional outcomes of the 30 participants were graded as follows: 2 participants (6.7%) were classified as having an excellent functional outcome, 22 participants (73.3%) were graded as having a good functional outcome, 6 participants (20%) were classified as having a fair functional outcome, and no participants (0%) were graded as having a poor functional outcome. This distribution indicates that the majority of participants experienced good functional recovery.

Discussion

Barton's fracture is a distal radius fracture that extends through the dorsal aspect of the articular surface and is associated with radiocarpal joint dislocation; however, since the radiocarpal ligaments remain intact, the articular surface of the fractured distal radius continues to contact the proximal carpal row[13]. Volar Barton's fracture, named after American surgeon John Rhea Barton, involves shearing fractures that may affect the volar or dorsal articular margin (Barton's fractures), the radial styloid, or the lunate facet of the distal radius. These partial articular fractures are inherently unstable, and failure to realign the fragment risks subluxation of the carpus. Thus, shearing fractures are best treated with open reduction and plate and screw fixation [14]. In this study, most Volar Barton's fracture cases occurred in patients aged 18-39 years. Age-related characteristics of wrist and distal radius fractures have been noted in various studies [15-17]. It has been suggested that in young adults aged 18-39 years, fractures often result from high-energy impacts or sports activities. In contrast, participants aged 40-64 years exhibit a higher fracture incidence among females, while those aged 65 or older show a higher incidence among males. In the present study, 77% of the participants were male, and 23% were female. The high prevalence of males is likely linked to the higher incidence of fractures among young adults and the causes of such injuries. The male-to-female ratio in this study was 3.3:1, comparable to another study with a ratio of 3:1 [18]. Among the injuries, 37% were on the right arm and 63% on the left arm. The time interval between injury and management was less than one week for 80% of cases, resulting in overall better outcomes. Only 2 cases had a 1-2 week interval between injury and management, while 4 cases had a 2-3 week interval. The volar locked plating technique has become the preferred method due to its ability to stabilize unstable fractures and its efficient fixation performance[19-21]. Three participants had additional injuries: 2 with fractured necks of femur and 1 with a fractured shaft of the femur. Distal radius fractures are common wrist injuries, but the optimal treatment method is not yet established. Some degree of displacement or re-displacement is often accepted when treated conservatively, with a focus on functional outcomes[22]. In this study, participants were treated using a locked buttress plate, and most had hospital stays of 3-6 days post-operation. Seven percent of participants experienced superficial skin infections, which were treated non-operatively. A previous study reported a short-term complication rate of 10% with the volar locking plating system, slightly higher than the rate observed in this study. Additionally, while some participants faced other complications, 83% experienced no complications post-operation. At the final follow-up, all patients were functionally assessed using the Sarmiento and Latta (1980) scoring system[12]. The functional outcome revealed that 20% of participants had unsatisfactory results, while 80% achieved satisfactory functional outcomes.

Limitations of The Study

The study was conducted in a single hospital with very small sample size. So, the results may not represent the whole community. Follow up period in this study was short. So, very late post-operative complications could not be evaluated.

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Conclusion

This study provides valuable insights into the functional outcomes and postoperative complications associated with the use of volar buttress plates for the fixation of Volar Barton's fractures of the distal radius. The findings indicate that the majority of patients, primarily young males aged 18-39, achieved satisfactory functional recovery with a significant proportion exhibiting good to excellent outcomes. The volar locked plating technique proved effective in stabilizing unstable fractures and minimizing complications, with a relatively low incidence of superficial infections and other postoperative issues. These results underscore the efficacy of volar buttress plates in managing Volar Barton's fractures, highlighting their role in achieving favorable clinical outcomes and supporting their continued use as a preferred surgical intervention. Further research with larger sample sizes and extended follow-up periods is recommended to validate these findings and explore long-term outcomes.

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