

A STUDY OF SURGICAL MANAGEMENT OF VOLAR BARTON'S FRACTURES USING ELLIS PLATE

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ABSTRACT

BACKGROUND

The distal end of radius fractures continue to pose a therapeutic challenge. Post-traumatic osteoarthritis decreased grip strength, and endurance, as well as limited motion and carpal instability, are the complications because of intraarticular and extra-articular malalignment¹ Barton's fracture was named after the American surgeon John Rhea Barton. Barton's fracture is a fracture of the distal end of the radius that involves the articular surface of distal radius and is usually accompanied by subluxation or luxation of the radiocarpal joint. These fractures may result from high- or low-energy injuries, and they account for approximately 1.2 % to 4.2 % of distal radial fractures. Barton's fractures are classified into volar or dorsal Barton's fractures based on the site and shifting the direction of fragments. According to AO classification, volar Barton's fractures are classified as type B3 fractures of the distal radius. Conservative treatment is usually unsuccessful and fraught with complications, such as early osteoarthritis, deformity, subluxation, and instability. ORIF with a volar Ellis plate system is currently practised for the treatment of volar Barton's fracture as it results in good reduction and provides immediate stability. Moreover, the patients can be mobilised early and quickly potentially reducing wrist stiffness.

MATERIALS AND METHODS

This clinical study includes 20 patients with volar Barton's fracture, which were admitted through OPD and casualty of Government General Hospital, Kurnool. The study was done for a period of 2 years i.e. from November 2016 to November 2018.

RESULTS

All cases were followed up periodically during the period 2016 to 2018 at 1, 3, 6, 12 months postoperative period, and results evaluated at the end, and scored by Gartland and Werley scoring system. 11 (55%) had an excellent result, 7 (35%) had good result, 1 (5%) had fair and 1 (5%) had a poor result.

CONCLUSION

Ellis plates gave successful results for the volar Barton's distal radius fractures. This method, which is effective in anatomic realignment, allows early joint motion, owing to its fixation strength. Close placement to joint interface and screwing capability in different orders are its biomechanical superiorities. The volar approach provides both access with minimal surgical trauma on distal radius and fixation with a better adoption to surrounding tissues. In the subjects of our study, a successful anatomic alignment was acquired with the volar approach, regardless of the direction of fracture angulation. The patients who were young adults in the majority went back to their daily activities with 90% recovery. These Ellis plates not only provide restoration of radial length but also help in stabilizing palmar angulation. They maintain intraarticular congruity thus reducing radiocarpal arthritis and decrease in grip strength. At last, not the least they also provide quicker recovery and better functional range of movement and provide better fixation in an osteoporotic bone.

KEYWORDS

Volar Barton's Fracture, Open Reduction and Internal Fixation, Ellis Plate.

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BACKGROUND

The distal end of radius fractures continue to pose a therapeutic challenge. Post traumatic osteoarthritis decreased grip strength, and endurance, as well as limited motion and carpal instability, are the complications because of Intraarticular and extra-articular malalignment.¹ Barton's fracture was named after the American surgeon John Rhea Barton. Barton's fracture is a fracture of the distal end of the radius that involves the articular surface of distal radius and is usually accompanied by subluxation or luxation of the radiocarpal joint. These fractures may result from high- or

low-energy injuries, and they account for approximately 1.2 % to 4.2 % of distal radial fractures. Barton's fractures are classified into volar or dorsal Barton's fractures based on the site and shifting the direction of fragments.² According to AO classification, volar Barton's fractures are classified as type B3 fractures of the distal radius. Conservative treatment is usually unsuccessful and fraught with complications, such as early osteoarthritis, deformity, subluxation, and instability. ORIF with a volar Ellis plate system is currently practised for the treatment of volar Barton's fracture as it results in good reduction and provides immediate stability. Moreover, the patients can be mobilised early and quickly potentially reducing wrist stiffness.²

Aims and Objectives

- To study the clinical and radiological outcome of Barton's fracture using Ellis plate.
- To study the postoperative complications following surgery.

MATERIALS AND METHODS

This clinical study includes a minimum of 20 patients with volar Barton's fracture, which were admitted through OPD and casualty of Government General Hospital, Kurnool. The study was done for a period of 2 years i.e. from November 2016 to November 2018.

Inclusion Criteria

- Age between 20 to 60 years
- H/o trauma (RTA, Fall from height)

Exclusion Criteria

- Dorsal Barton's fracture.
- Extra-articular distal radius fracture.
- Severely comminuted distal end radius fracture.
- Gustilo Anderson compound grade II and III fractures.

Sample Size

20 Cases.

Sample Procedures

A Prospective study, patients are followed up periodically post operatively.

Patients are assessed by

Gartland and Werley scoring system.

Methodology

Immediately after receiving the patient, thorough history about the trauma severity and mechanism of injury have been elicited. A thorough examination of the associated injuries and other systems diseases were done, and their findings were recorded in the proformas. Patients with these types of fractures will present with flexed elbow and supporting his curve using the other hand signs of the fracture like tenderness, deformity, crepitus, abnormal mobility, relative portion of the radial and ulnar styloid process were elicited. The range of movements of all joints including elbow, wrist and finger movements should be examined. The blood supply should also be evaluated by

capillary filling, radial artery pulsations and altered sensations over tips of fingers. If the fracture is confirmed, the involved upper limb should be immobilized using a below elbow slab. Analgesics can be given to reduce pain. The affected limb should be kept elevated to reduce swelling. But it is difficult to evaluate DRUJ stability until the fracture is stabilized.

Standard X-ray films in AP and lateral view should be taken to confirm the diagnosis and to know about the nature of the fracture.

In the case of complex comminuted fracture, oblique views of the wrist should be useful. The fracture can be classified according to Mehara's et al classification and AO classification. Surgeries were performed under general anesthesia for all cases except 4 cases in which brachial plexus block is given. The patient is placed supine on OT table with the affected upper limb lying on a side table. The shoulder is usually placed in abducted position. Fracture of the upper limb is important because it should allow proper imaging aims c-arm. A tourniquet is usually applied to reduce blood loss, a pneumatic tourniquet is preferred over esmarch bandage. Fracture was approached through Henry's approach and fixed with open reduction and internal fixation with Ellis plate.

Post-Operative Regimen

Elevation of forearm maintained post operatively. CPM exercises initiated from first postoperative day. Gradually increase in the range of motion as and when tolerated by patient. Suture removal done between 9th and 12th post-operative days. Post-operative follow-up done on 1st, 2nd and 6th month.

RESULTS

The present study consists of 20 cases of volar Barton's fractures treated at Kurnool Medical College, Kurnool treated between Nov. 2016 to Nov. 2018. All were closed fractures. All cases were followed up periodically during the period 2016 to 2018. Postoperative and result evaluated at the end and scored by Gartland and Werley scoring system. The following are the observations made to the available data analyzed as follows-

Age in Years	No. of Cases	Percentage
20-30	5	25
31-40	9	45
41-50	5	25
51-60	1	5
Table 1. Age Incidence		

The age of the patients ranged from 20-60 years with an average of 36.1 years.

Sex	No. of Cases	Percentage
Male	16	80
Female	4	20
Table 2. Sex Incidence		

Out of 20 patients, 16 (80%) were males and 4 (20%) were females, showing a male preponderance with the ratio being M:F – 4:1.

Side	No. of Cases	Percentage
Right	7	35
Left	13	65

Table 3. Side of Involvement

Right wrist involved in 7 (35%) cases and left wrist in 13 (65%)

Mechanism of Injury	No. of Cases	Percentage
Road Traffic Accident (RTA)	12	60
Fall on An Outstretched Hand (FOOH)	8	40

Table 4. Mode of Injury

In the present study, there were 12 (60%) patients with road traffic accidents and 8 (40%) patients fell on their outstretched hand.

AO Type	No. of Cases	Percentage
A1	0	0
A2	0	0
A3	0	0
B1	0	0
B2	0	0
B3	20	100
C1	0	0
C2	0	0
C3	0	0

Table 5. AO Classification

In the present study of the 20 patients, all were intra-articular volar Barton's fractures which belong to type B3.

Type	No. of Cases	Percentage
Type 1	0	0
Type 2	5	25
Type 3	15	75

Table 6. MEHAR et al Classification

In the present study of 20 patients, 5 cases belonged to type 2, 15 cases were belonging to type 3.

Type	No. of Cases	Percentage
Closed	20	100
Open	0	0

Table 7. Closed or Open Fracture According to Gustilo and Anderson Classification

In the present study of 20 cases, all were closed injuries.

Associated Injuries	No. of Cases	Percentage
Contralateral Compound Fracture of The Distal Third Leg with A Contralateral Communicated Fracture of The Distal Radius	1	5
Ipsilateral Intercondylar Fracture of The Distal Humerus	1	5
Contusional Head Injury	2	10

Table 8. Associated Injuries

In the present study out of 20 cases, 4 (20%) cases had associated injuries

Duration	No. of Cases	Percentage
1-5 Days	17	85
6-10 Days	3	15

Table 9. Duration of Operation from Date of Injury

Most patients 17 (85%) patients were operated on an elective basis. Of these 11 (65%) were operated on day 2 and rest 6 (30%) delayed till day 4 for oedema to comedown and upon control of hypertension and hyperglycemic status with physician consent. Remaining 3 (15%) were delayed on account of other associated injuries of limbs and head injury upon receiving consent from a neurosurgeon.

Time of Union	No. of Cases	Percentage
2-3 Months	17	85
3-4	3	15

Table 10. Duration of Fracture Union

In present study 17 (85%) patients had union within 2-3 months and 3 (15%) patients had a union by 3-4 months.

Movement (Within Normal Function Range)	No. of Cases	Percentage
Dorsiflexion (min. 45°)	20	100
Palmar Flexion (30°)	20	100
Pronation (50°)	20	100
Supination (50°)	20	100
Radial Deviation (15°)	18	90
Ulnar Deviation (15°)	19	95
Pain in Distal Radioulnar Joint	3	15
Grip Strength (60% Or Less Than on Opposite Side)	1	5

Table 11. Range of Motion

Complications	No. of Cases	Percentage
Malunion	2	10
Arthritis	3	15
Tendon Irritation	1	5
Complex Regional Pain Syndrome	1	5

Table 12. Complications

The assessment of results was made using the demerit score system of Gartland and Werly based on objective and subjective criteria, residual deformity and complication.

Result	No. of Cases	Percentage
Excellent	11	55
Good	7	35
Fair	1	5
Poor	1	5

Table 13. Evaluation of Results

Using the demerit score system of Gartland and Werly, we had 11 (55%) had an excellent result, 7 (35%) had a good result, 1 (5%) had fair and 1 (5%) had a poor result.

Volar Barton's fracture is an unstable fraction involving the distal end of the radius, usually associated with dislocation of the wrist joint.

The study is done to evaluate the functional outcome of treatment of volar Barton's fracture with an Ellis plate. Our study compared with various other studies using different methods of treatment.

Age Distribution

In our study, volar Barton's fracture was more common in the age group of 31 to 41 years old and was related to RTA.

Series	Minimum Age in Years	Maximum age in Years	The Average Age in Years
Kevin C. Chung et al., (2006) ³	18	77	45
Mehara et al (1993) ⁴	24	65	42
Zhibing Tang et l., (2012) ⁵	23	72	49.8
Present study	20	60	36.1

Table 14. Age Distribution

Sex Distribution

Our study had a male preponderance with 16 male patients and 4 female patients and is comparable to the following previous studies mentioned in the table below.

Series	Males	Females
Kevin C. Chung et al., (2006) ³	37	50
Mehara et al, (1993) ⁴	57	21
Zhibing Tang et l., (2012) ⁵	10	7
Present study	16	4

Table 15. Sex Distribution

Series	Right	Left
Kevin C. Chung et al., (2006) ³	50	37
Mehara et al, (1993) ⁴	-	-
Zhibing Tang et al., (2012) ⁵	12	5
Present study	7	13

Table 16. Involved Side

Mode of Injury- In our study, 60% of the patients had a road traffic accident and 40% had a fall on the outstretched hand.

Series	RTA	FOOH
Kevin C. Chung et al., (2006) ³	42	45
Mehara et al, (1993) ⁴	52	26
Zhibing Tang et al., (2012) ⁵	11	6
Present study	12	8

Table 17. Involved Side

Complications

The complications of this plating method include-

- Arthritis of wrist joint in 3 patients (15%) due to alteration of the biomechanics of wrist.
- Malunion of fracture in 2 patients (10%) due to improper reduction.
- 1 patient suffered from complex regional pain syndrome.
- Extensor pollicis longus tendon irritation in 1 patient (5%) due to long screw placement through the outer cortex irritate the tendon.

DISCUSSION

Following is the results of our study-

- 55% - Excellent result
- 35% - Good result
- 5% - Fair results
- 5% - Poor results

That of the patients were operated within 4 days of trauma patients with excellent results had followed characteristics

- No arthritis change or other complication
- Articular step, volar tilt, and length of the radius are within acceptable limits.
- They are co-operative to physiotherapy
 - Patients with good results had a slight limitation of movements, pain and minimal residual deformities.
 - Patients with fair results had a minimal complication like pain and limitation of movements of DRUJ, mild residual deformity and also these range of motion were slightly less than those required for normal functioning of the wrist.

Darrocks procedure was done for 1 patient who complained of severe wrist pain with limitation of movement 3 months after the procedure.

CONCLUSION

The study aimed at evaluating the outcome of volar Barton's fracture operated by Ellis plate and the following results were obtained.

According to demerit score system of Gartland and Werley-

- 11 (55%) had excellent results.
- 7 (35%) had good results.
- 1 (5%) had a fair result.
- 1 (5%) had a poor result.

Ellis plates gave successful results for the volar Barton's distal radius fractures. This method, which is effective in anatomic realignment, allows early joint motion, owing to its fixation strength. Close placement to joint interface and screwing capability in different orders are its biomechanical superiorities. The volar approach provides both access with minimal surgical trauma on distal radius and fixation with a better adoption to surrounding tissues. In the subjects of our study, a successful anatomic alignment was acquired with the volar approach, regardless of the direction of fracture angulation. The patients who were young adults in the majority went back to their daily activities with 90% recovery.

These Ellis plates not only provide restoration of radial length but also help in stabilizing palmar angulation. They maintain intraarticular congruity thus reducing radiocarpal arthritis and decrease in grip strength. At last, not the least they also provide quicker recovery and better functional range of movement and provide better fixation in an osteoporotic bone.

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