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Evaluation of functional outcome of open reduction and internal fixation with volar plating in reverse Barton's fracture of distal radius

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Abstract

Purpose: A study evaluating the clinical and functional outcome of open reduction and internal fixation with volar plating followed by early mobilization in reverse Barton's fracture of distal radius.

Method: 43 adults patients operated for distal radius reverse Barton's fracture (Muller AO classification type 23 B3) were studied and functional outcomes were assessed using the DASH scoring system.

Result: Functional outcome was excellent in 29 (67%), good in 11 (26%) and fair in 3 (7%) according to patient rated DASH score. Patients who obtained excellent and good results, had no residual deformities or pain. Complication occurred in 4 (9%) cases of which 2 (4%) had joint stiffness, 1 (2%) had superficial infection and 1 (2%) developed median nerve neuropathy for which plate was removed.

Conclusion: Reverse Barton's fracture of the distal radius has excellent functional outcome with open reduction and internal fixation with volar plate. Anatomical reduction and early mobilization improves the outcome significantly.

Keywords: Reverse Barton's fracture, open reduction and internal fixation (ORIF), volar plating, distal radius, DASH score

Introduction

The fractures of distal end radius constitute approx 10-12% of skeletal trauma. Most of these occur due to the fall on out-stretched hand or road traffic accidents. Malunion is the most common complication which leads to deformity, decreased range of motion at wrist and hand, decreased grip strength due to arthritis^[1].

Congruent articular reduction with restoration of radial inclination, volar angle and radial length in intra-articular distal end radius fractures decrease complications such as osteoarthritis and joint stiffness. Good surgical handling of bone and soft tissues with early post operative mobilization further aids the functional outcome^[2, 3].

Subluxation or dislocation of the radiocarpal joint is usually present in intra-articular fractures involving the dorsal or volar rim of the radius. Barton described the fractures of the dorsal rim of radius, so when the volar rim is fractured it is referred to as volar Barton's fracture. Term volar Barton's being considered as an eponym, current literature favours calling it as reverse Barton's fracture^[4]. This fracture is also classified as Type 23 B3 in Muller AO classification^[12]. Conservative treatment is usually unsuccessful in volar rim fractures frequently leading to instability, early osteoarthritis and subluxation mostly due to collapse of the volar fragment and loss of reduction^[5]. Many surgical techniques have been published in literature^[6, 7]. However the current treatment of choice is ORIF with volar plating. The stability achieved with volar plate aids in maintenance of reduction and allows early mobilization^[8, 9].

The aim of the current study is to evaluate the clinical and functional outcome of reverse Barton's fracture treated with ORIF by volar plating followed by early mobilization. Scoring for evaluation used was Disabilities of the Arm, Shoulder and Hand (DASH)^[10].

Methodology

43 Adult patients with reverse Barton's (Muller AO type 23 B3) distal radius fractures treated at a tertiary care hospital in Surat from 2014 to 2017 are included in this study.

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Inclusion Criteria

- 1) Age 18 years or older.
- 2) Reverse Barton’s fracture (Muller AO type 23 B3) of distal radius.
- 3) Patients who are medically fit for surgery.
- 4) Patients who had undergone aggressive supervised physiotherapy.
- 5) Patients willing for treatment and giving informed and written consent.

Exclusion Criteria

- 1) Patients below the age of 18 years.
- 2) Extra-articular and dorsal Barton’s fracture of distal radius.
- 3) Patients who were medically unfit or not willing for surgery.
- 4) Compound or pathological distal radius fracture.
- 5) Patient’s whose follow up was inadequate for surgery.

Operative protocol

Standard modified Henry’s approach to distal radius was taken in all cases under general anaesthesia or brachial block. Volar plate of varying length and screws was applied as per fracture requirement and surgeon preference. The protocol in post-operative phase was same for all patients. The wrist was immobilised for 5-7 days in a plaster followed by removable orthosis for allowing active and passive mobilization of fingers and wrist but under supervision 2-3 times a week. Follow up was regularly done at 3 weeks, 6 weeks, 3 months, 6 months, 1 year and 2 years. Functional outcome evaluation was done using DASH score.

Results

There were 43 patients included in this study and operated with volar plate. The following is the age distribution:

Age in Years	No. of Cases	Percentages (%)
21 – 30	07	16
31- 40	12	28
41 – 50	14	33
51 – 60	08	19
61 – 70	02	04

Males accounted 23 (53%) and females accounted 20 (47%) of our included cases so there was not a significant difference in sex distribution. Out of 43 cases in the present study mechanism of injury was road traffic accident in 24 (56%) cases and fall on out stretched hands in 19 (44%) cases. There was right side predilection of injury owing to 26 (60%) cases were involving right wrist and 17(40%) with left wrist. Majority of the patients 34 (79%) of the cases were operated within 5 days of injury. Duration of fracture union as measured by radiological and clinical signs of union was at 3 months for 38 (88%) of the patients.

Complications observed in 4 (9%) of which 2 (5%) had joint stiffness, 1 (2%) had superficial infection which recovered post local debridement and antibiotics, and 1(2%) had delayed median nerve neuropathy for which decompression of the nerve was done.

Out of 43 patients there was excellent functional outcome in 29 (67%), good in 11 (26%) and fair in 3 (7%) using the DASH scoring system which is tabulated below:

Results	Functional (DASH)	Percentages (%)
Excellent	29	67
Good	11	26
Fair	3	07
Poor	0	00

Discussion

Reverse Barton’s fracture (Muller AO Classification type 23 B3) discussed in the present study of distal radius is not much common constituting only 1.3% of distal radius fracture.⁴ Good vascular supply, articular congruity, adequate stability and early rehabilitation favor fracture healing. The distal radius has a lot of cancellous bone that aids the fracture union. Thus a non-union is rare but a malunion is common at this area. Malunion along with articular cartilage injury due to articular disruption can cause grave disabilities^[5, 8, 11].

The current study was done for the clinical evaluation of functional outcome of reverse Barton’s fracture of distal radius treated with volar plating using the DASH scoring system. We now compare and discuss our previously mentioned results with similar studies.

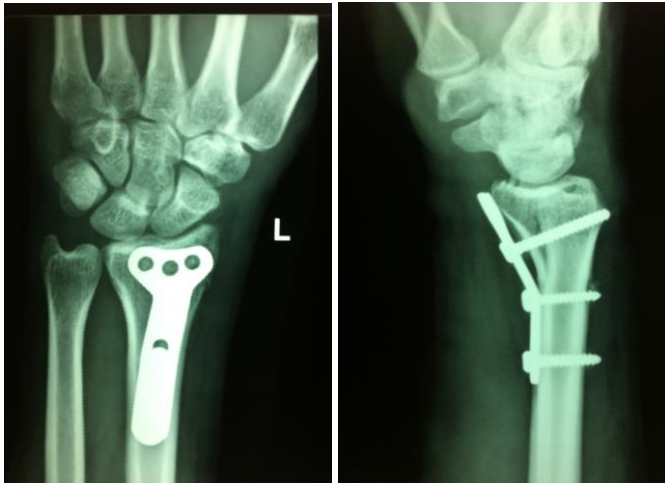
In our study the average was 43.9 years which is comparable to Mehara *et al* 1993^[13], Zoubos *et al* 1997^[14], Kilic A *et al* 2009^[15] and Aggarwal AK *et al*^[5] 2004. Rozental TD *et al* 2006^[16] reported these fractures in elder age group more frequently but current study had more patients of road traffic injury (high velocity trauma). In current study the fractures were more common in male 53% which is comparable to Zoubos *et al* 1997^[14], Kilic A *et al* 2009^[15] and Aggarwal AK *et al* 2004 a^[15].

Predilection of injury on right side 60% and road traffic accidents as mechanism of injury accounted 56% in the current study which is comparable to Aggarwal AK *et al*⁵ 2004 and Zoubos *et al* 1997^[14]. Duration of fracture union was 3 months in 88% cases in this study which is comparable to Kilic A *et al* 2009^[15] and Aggarwal AK *et al* 2004^[5].

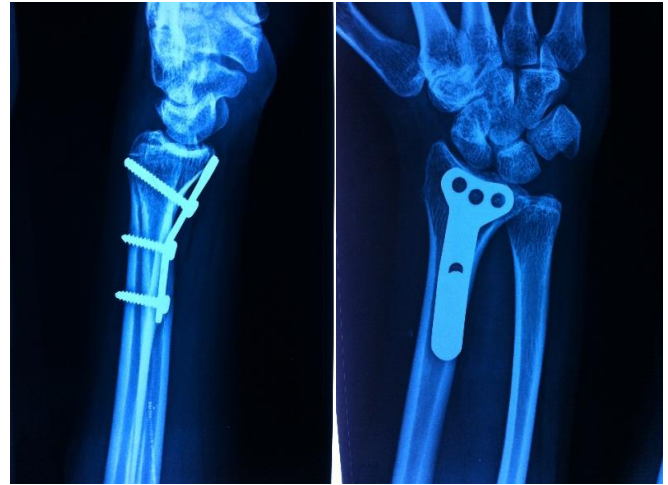
Complication happened in 4 (9%) patients in this study. There was joint stiffness in 2 (5%) which is comparable to Mehara *et al* 1993^[13], Kilic A *et al* 2009^[15] and Rozental TD *et al* 2006^[16]. 1 (2%) case in our study developed early infection which was superficial and cured with local debridement and culture specific antibiotics. There was median nerve neuropathy, which is a delayed complication in 1 (2%) patient for which decompression of median nerve was done. Zoubos *et al* 1997^[14] in study of 35 reverse Barton’s fracture cases concluded that there was no need of routine decompression of median nerve. Though our patient developed median nerve neuropathy we too are not in favor of elective nerve decompression in all cases. We did not have any non-union, malunion, osteoarthritis, arthritis, tenosynovitis, complex regional pain syndrome, loss of alignment, fracture collapse or hardware removal in any of our cases.



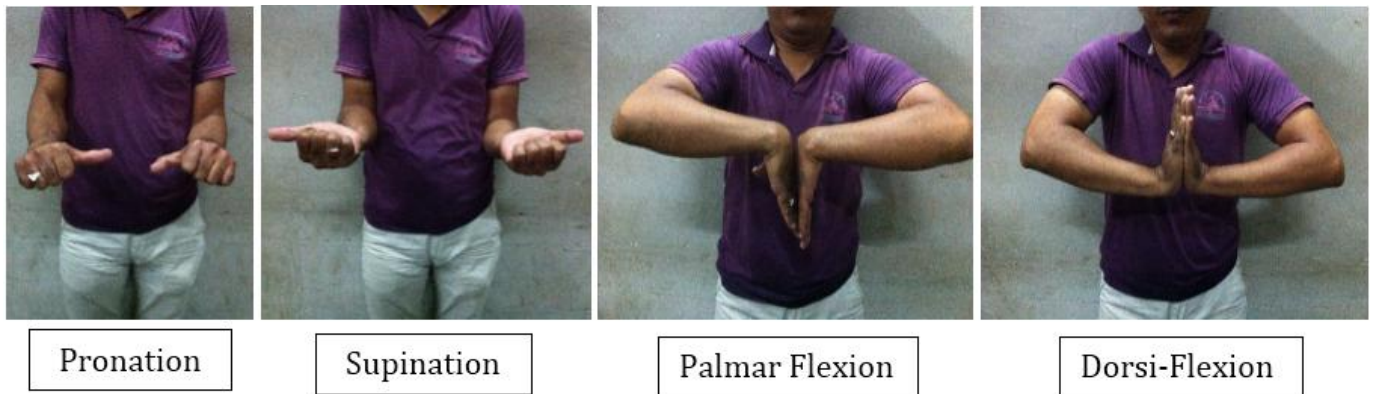
Pre-Operative Radiograph



Immediate Post-Operative Radiograph



Follow up



In our study we got 40 (93%) results as excellent and good by ORIF with volar plating as measured by DASH scoring system. In all cases articular reduction with restoration of radial inclination, volar angle, radial length and articular step-off were within the acceptable limits. Range of movement was

within the normal function range. Early mobilization under supervision was started in all cases from 5-7 days post operative. Below is the comparison of our case series with other similar case series in tabulated form:

Study	Total number of cases	Good to excellent results (%)	Fair (%)	Poor (%)
Mehara <i>et al.</i> 1993 ^[13]	78	90%	10%	-
Zoubos <i>et al.</i> 1997 ^[14]	35	94%	6%	-
Aggarwal AK <i>et al.</i> 2004 ^[5]	16	87.5%	12.5%	-
Rozental TD <i>et al.</i> 2006 ^[16]	41	70.6%	7.3%	21.9%
Kilic A <i>et al.</i> 2009 ^[15]	27	88.8%	11.2%	-
Our study	43	93%	7%	-

Conclusion

Reverse Barton’s (Muller AO classification type 23 B3) fracture of distal radius is caused by shearing forces, so is very unstable. Its increasing incidence in younger population is due to rise in road traffic accidents (high velocity trauma). Loss of articular reduction, volar collapse and articular step-off are the major concerns not favoring conservative management. Operative management in form of ORIF by volar plating is the treatment of choice for such fractures. Standard modified Henry’s approach to distal radius provides adequate exposure. Proper reduction of fracture fragment and achieving anatomical articular reduction should be the focus for enhancing functional outcome and minimizing complications. Availability of different types volar plates (size/ shape/ locking/ variable angle) have made osteoporotic and comminuted fractures easy to fix. Early post operative supervised mobilization greatly enhances the functional outcome.

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