

Original Research Article

Evaluation of functional and clinical outcome of open reduction and internal fixation of Barton's fracture of the wrist in a central hospital of Kashmir

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ABSTRACT

Background: Fractures of the distal end of radius continue to pose a management challenge. Defective alignment of extra articular as well as intra articular fractures result in a variety of complications like post traumatic arthritis, decreased in grip strength and endurance as well as limited range of motion and instability of carpus. The main aim of this study is to assess the functional results of open reduction and internal fixation in the treatment of volar Barton's fracture.

Methods: From December 2006 to December 2019, forty cases of volar Barton's fracture were operated in Skims Medical College Hospital, Srinagar, Kashmir, however only 32 cases were included in the study group and 8 cases were lost to follow up. In the majority of our cases the injury was sustained as a result of road traffic accident followed by fall. Majority (24) of the cases were operated within one week of trauma, followed by six in two weeks and two in 3 weeks of time since injury.

Results: Functional evaluation was done after a mean follow-up of 28.7 months. Fracture union was achieved within 8 to 12 weeks and excellent results were obtained in 18 cases and 10 cases were categorized as good followed by fair result in 4 cases. Median nerve compression was not observed in any case.

Conclusions: Good to excellent result can be achieved after open reduction and internal fixation which restores joint congruity.

Keywords: Volar Barton, Distal radius, Fracture, Displacement

INTRODUCTION

Fractures of the distal end of radius continue to pose a management challenge. Defective alignment of extra articular as well as intra articular fractures result in a variety of complications like post traumatic arthritis, decreased in grip strength and endurance as well as limited range of motion and instability of carpus.

Open reduction and internal fixation is indicated to treat these fractures and those with articular incongruity that

cannot be anatomically reduced and maintained through external manipulation and ligamentotaxis, provided sufficient bone stock is present to permit range of motion.¹⁻³

Internal fixation of metaphyseal bending fractures has become increasingly popular primarily due to: directly control and maintain physiologic palmar tilt; prevent collapse with external fixation; and avoid bridging the radio carpal joint. Volar plating is preferred, as the screws directly buttress against collapse and loss of palmar tilt.⁴⁻⁶

Volar Barton's fractures of the distal end of the radius are one in which there is anterior subluxation of carpus with the fracture fragment. The volar Barton's fractures are mechanically unstable injuries.

Different methods have been advocated for the treatment of volar Barton's fractures. It includes closed reduction and immobilization in plaster cast, closed reduction and percutaneous fixation with Kirschner (K)-wire, Steinmann pins and open reduction and internal fixation with pins or buttress plating.⁷⁻¹⁰

Barton's fracture is named after the American surgeon John Rhea Barton.¹¹ This is a fracture of the distal end of radius that involves the distal rim and extends into the intra-articular region. Non-operative treatment is usually unsuccessful and is also fraught with complications such as early osteoarthritis, deformity, subluxation and instability. However, there are studies who have reported effectiveness of surgical treatment.^{8,12,13}

The main aim of this study is to assess the functional results of open reduction and internal fixation in the treatment of volar Barton's fracture.

METHODS

From December 2006 to December 2019 a total of forty cases were operated by open reduction and internal fixation at Skims Medical College Hospital. 8 cases were lost to follow-up and 32 cases were included in the study. The mean age of 22 men and 10 women was 29.5 years (range 20-60 years). The mechanism of injury was high energy trauma (i.e. motor vehicle accident) in 26 cases and fall in 6 cases. The Barton's fractures were classified based on radiographic and operative findings. All 32 cases were type B3.1. In terms of fracture subtype, 4 cases were B3.1 fractures (characterized by small volar fragment and an intact sigmoid notch). 8 cases were B3.2 fractures (a large volar fragment that included the sigmoid notch) and 20 cases were B3.3 fractures (communion of the volar fragment). In 12 of B3.3 fractures, the volar fragment was split into 2 parts, in other 8 cases, there were multiple fragments. The majority of the cases (24) were operated within one week of the injury. Further Bier's block was administered in 12 cases, and general anaesthesia in 20 patients.

Surgical technique

The fracture site was exposed through the distal part of the volar approach of Henry.¹⁵ Open reduction of all major fragments was performed, focusing on restoring articular integrity. A K-wire was used to provisionally fix the position of the fragments. Definitive fixation was done with a 3.5 mm Ellis T plate/locking plate. A pop slab was applied and continued up to 3 weeks.

Post-operative radiographs were assessed by measuring the volar angulation and ulnar angulation of the distal-end

radius and radiocarpal index. Volar and ulnar angles were angles of the articular surface of the distal end of the radius in the lateral and anteroposterior views between sagittal and coronal planes, respectively. The radioulnar index was determined by measuring (in millimeters) the distance between distal most aspect of sigmoid notch of the radius and distal most part of ulnar head.

Patients were followed up initially at 3 week-intervals up to 6 weeks, then every 6 weeks for 3 months, every 3 months for one year and then every 6 months (Figure 1). Results were evaluated using the functional criteria proposed by Pattee and Thompson in 1988.¹⁶ Radiocarpal post-traumatic osteoarthritis was assessed radiographically.¹⁶



Figure 1: Pre-operative and post-operative X-rays.

RESULTS

The mean age in our series was 34.8 years. Right side was involved in 22 cases and left in 10 patients. In 24 cases road traffic accident was mode of injury and 8 cases had sustained injury as a result of fall down. All cases were type-B3 fractures. 20 cases were B3.3 subtype, 8 of the B3.2 subtype, 4 of the B3.1 subtype. Majority (24) of the cases were operated within one week of trauma, followed by six in two weeks and two in 3 weeks of time since injury.

Fractures healed in 8-10 weeks (mean 9.68 weeks) postoperatively. The follow-up ranged from 13 to 48 months (mean 28.7). Excellent results were achieved in 18 cases, good in 10 cases and fair in 4 cases. Postoperative radiographic assessment was done and found satisfactory.

Mild radiocarpal osteoarthritis developed secondary to trauma in 4 cases. In two cases out of four categorized as fair, Sudeck's dystrophy was noticed, the cause being non-compliant to physiotherapy protocol. These patients were

treated by active and passive movements of fingers, analgesic and anti-inflammatory drugs and limb elevation. These patients recovered by six weeks with some residual

stiffness of the wrist and fingers. No infection was seen in the present series and no case of median nerve compression was found.

Table 1: Comparison of present with previous studies.

Parameter	De Oliveira 1973	Pattee andThompson 1988	Mehara et al 1993	Jupiter et al 1996	Zoubos et al 1997	Present study
Mean age (years)						34.8
Injury side						
Right						22
Left						10
Mode of injury						
RTA						24
Fall						8
Type of #						
B3.1						4
B3.2						8
B3.3						20
Surgery lag time (days)	8.6		11.7			7
Mean surgical time					2 hours 40 min	1 hours 20 min
Mean hospital stay (days)			26.5		19	5
No cases	26	20	78	49	35	32
Treatment method (no)	Orif with buttress plate (26)	Closed reduction 11, orif 9, buttress plate 3, K-wire 5, screw 1	Orif or closed rduction (78)	Orif (49)	Orif with Ellis T-plate 35	Orif with Ellis T plate 16, locking plate 16
Good/excellent results %	77	85	90	83.7	94	87.5
Complications (no)	NA	Mild post traumatic arthritis 13	Mild osteoarthritis (OA) 10, moderate OA 2	Early 6, DVT 1, sympatheti maintained pain 3, loss of reduction 1 scapholunate dislocation 1, late 14, pain 5, median nerve compression 3, tenosynovitis 2, subluxation of distal radioular joint 2, severe OA 1, ruptured extensor pllocis longus 1	NA	Radiocar pal OA 4, Sudeck’s atrophy 2

DISCUSSION

Volar Barton’s fractures are not common injuries; they constitute only 1.3% of distal end radius fractures.¹⁶⁻¹⁹ Different treatment modalities have been described. They include closed reduction and plaster application, percutaneous pinning, external fixation, open reduction and internal fixation with K-wires, and ORIF with locking plate or buttress plating. Closed reduction is usually easy to achieve but difficult to maintain. In an experimental study of the pathomechanics of volar Barton’s fractures,

King observed that the stability of a reduction depends on an intact radiocarpal ligament and concluded that these fractures should be immobilized, keeping the wrist in palmar flexion.¹⁷ Although King reported no poor results, all patients had mild pain, weakness, and some loss of motion at follow-up.

In the present series, results were good to excellent in 28 cases. Our results are consistent with those studies that supported the effectiveness of open reduction and internal fixation.^{8-13,16-20} An extensive review of the literature

revealed only a few studies making use of ORIF in displaced, volar Barton's fracture.^{8-13,16-20} As with all intra-articular fractures, anatomical reduction and internal fixation are the ultimate goals of treatment for these injuries. This point has been very well emphasized by few authors in their studies on Barton's fractures.^{13,18} de Oliveira in a series of 26 cases had 77% good to excellent results while as Pattee and Thompson, 1988 had in his 20 cases 85% good to excellent results using closed reduction, ORIF, Buttress plating, K-wires and screws.^{7,20} Mehara et al in his 78 cases had ORIF or closed reduction and reported 90% good to excellent results while as Jupiter et al in his 49 cases had 83.7% good to excellent results and reported deep vein thrombosis, loss of reduction, median nerve compression and severe post traumatic arthritis and rupture extensor pollicis longus.^{8,13} Zoubos et al in his 35 cases had 94% good to excellent results after ORIF with Ellis T-plate.¹²

Mild radiocarpal osteoarthritis was seen in four cases in present series but did not affect their functional outcome.

Two cases of Sudeck's dystrophy were found but did not affect the functional result and these were graded as fair. Median nerve involvement was not found in any case. This finding is consistent with that in the study of Zoubos et al in 1997.¹² In all displaced Barton's fractures, we recommend that open reduction and internal fixation can result in a satisfactory functional outcome.

Limitations of this study are that cohort of patients was small but this study exhibited that execution of good surgical techniques, including proper plate position, proper insertion of screws and proper selection of patients, a satisfactory functional and radiological outcome can be expected for a great majority of patients.

CONCLUSION

Good to excellent result can be achieved after open reduction and internal fixation which restores joint congruity.

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Conflict of interest: None declared

Ethical approval: The study was approved by the institutional ethics committee

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