

## Treatment outcome of Volar Barton fracture fixed with locking compression plates

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### Abstract

**Objective:** To assess the radiological and functional results of open reduction and internal fixation of volar barton fracture fixed with locking compression plate (LCP).

**Patients and Methods:** This study was conducted in Department of orthopaedic surgery Karachi Medical and Dental College and Abbasi Shaheed Hospital, from January 2008 to December 2009. A total of eleven patients of volar Barton's fracture were treated by open reduction and internal fixation using locking compression plate. There were 8 males and 3 females. The mean age was 31 years (range from 20-56 years). All cases were Type B-3 of distal radius fracture. The major cause of injury was Road traffic accident in 64% of patients. All of them were operated within one week of injury. Functional assessment was performed using Q Dash and Gartland and Werley.

**Results:** All fractures united in a mean time of 7.5 weeks. The mean Q Dash score was 8.0 range from 0-50. Eight patients were excellent, two were good and one was fair, according to Gartland and Werley scoring. No significant surgical complication occurred.

**Conclusion:** locking compression plate fixation is an effective treatment in the anatomical and functional restoration of volar Barton fractures.

**Keywords:** Volar Barton fracture, Locking plate, Distal Radius Fracture

### Introduction:

Distal radius fractures are common and share a major orthopaedic workload<sup>1</sup>. If it involves the dorsal rim and extends into the intra-articular region is known as Barton fracture. It is named after the American surgeon John Rhea Barton<sup>2</sup>. Barton fractures are uncommon and usually associated with high velocity trauma<sup>3</sup>. Multiple treatment options available for obtaining acceptable alignment include closed reduction and pinning, external fixation and open reduction with plate and screw fixation<sup>4</sup>. Conservative treatment is usually unsuccessful and may result in complications, such as early osteoarthritis, deformity, subluxation, and instability<sup>3</sup>.

Many complications have been reported with plate and screw fixation around the wrist such as rupture of extensor tendon<sup>5</sup>. Modification of dorsal plate has little effect on outcome<sup>6</sup>. The recent development of locking plate technology,

used for distal radius fracture through a volar approach is associated with fewer soft tissue complications<sup>7</sup>.

The purpose of the study is to assess the functional result of volar barton fracture treated with locking plate through volar approach.

### Purpose:

To assess the radiographical and functional results of open reduction and internal fixation of volar barton fracture fixed with locking compression plate (LCP).

### Material and Methods:

This study was conducted at the department of orthopaedic surgery; Abbasi Shaheed hospital and Karachi Medical and Dental college during the period of January 2008 to December 2009. It was a descriptive analytical study. Patients

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with distal radius volar barton fracture comprehensive classification type B-3 were included in the study. Patients in which epiphysis were open were not included in the study. Compound fractures were not included in the study.

The volar Barton's fractures (Figure 1) were classified according to a comprehensive classification system<sup>8</sup> based on radiographic and operative findings. All eleven cases were type-B3 fractures. In terms of fracture subtype, 4 cases were B3.1 fractures (characterised by a small volar fragment and an intact sigmoid notch), 6 were B3.2 fractures (a large volar fragment that included the sigmoid notch), and 1 were B3.3 fractures (comminution of the volar fragment). All the patients were initially managed with closed reduction and given a plaster splint in emergency and then definitely treated by open reduction and internal fixation with the 2.4 mm LCP (locking compression plates) titanium distal Radius Plates (Fig 2). All patients were operated within one week of injury.

#### **Surgical technique:**

General anesthesia was used for all patients. A pneumatic tourniquet was used in all cases in order to provide bloodless field during surgery. The fracture site was exposed through the distal part of the volar approach of Henry<sup>9</sup>. Open reduction of all major fragments was performed, focusing on restoring articular congruity. Image intensifier was used in all cases. In two patients with alignment problems of distal radioulnar joint, a temporary Kirschner wire fixation was conducted.

A below-elbow plaster-of-Paris slab was applied for 3 weeks and then active movement of wrist was started. 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.

The lack of pain in the palpated fracture area was considered as clinical union. Real anterior-posterior and real lateral wrist graphics were examined comparatively to healthy side for radiographical controls. Tilting angle of radius,



Figure 1: *Lat view*



Figure 2: *Post-Operative AP/Lateral view*

radial inclination angle, radial height and ulnar variance were measured and compared with normal side.

Functional subjective outcome was measured with the Quick DASH<sup>10</sup> (Disabilities of the Arm, Shoulder and Hand Questionnaire) and Gartland – Werley<sup>11</sup>.

#### **Results:**

Eleven cases of volar Barton's fracture were operated by ORIF. There were 8 (73%) males and 3(27%) females. The mean age was 31 years (range, 20.0–56.0 years). The mean follow up was 14 months (range 11-18 months ). The right hand was involved in 7 (64%) patients. The mechanism of injury was high-energy trauma (i.e. a motor vehicle accident) in 7(64%) patients, fall in 3(27%) and 1(09%) patient had polytrauma.

All fractures were healed in a mean period of 7.5 weeks (range 6-9 weeks). There were no significant postoperative complications. Postoperative radiographic assessment revealed Ulnar variance equalized in 9 patients (82%). In 8 (73%) patients, radial inclination angles have been equalized with the healthy side. In remaining 3 (27%) patients the mean angle for the healthy side was 24.8° (range 22°-29°) while the mean angle for the operated side was 22.3° (range 19°-29°).

Radial tilting angle was equalized with the healthy side in eight patients (73%). In three patients (27%), the mean radial tilting angle was 7.3° towards volar direction (range 0°-14°) on the healthy side and 4° towards volar direction (range dorsal 3°-volar 11°) on the operated side. Radial height equalized with the normal side in 9 (82%) patients.

Motion distances of the patients at the final followup were as follows: Mean flexion angle was 55° (range 0°-70°), mean extension angle was 45° (range 35°-65°), mean radial deviation was 20° (range 10°- 25°), mean pronation was 70° (range 0°-80°) and the mean supination angle was 78° (range 0°-85°). The mean Quick DASH score was 8.0 (range 0-50). On Gartland- werley evaluation scale, eight patients were excellent, two patients were good, one patient were fair. Radiologically a significant correction was obtained in all fractures. By the end of a mean follow up of one year.

One patient had wound dehiscence in early postoperative period. The wound closed with secondary healing. There were no deep infection and no patients developed compression neuropathies. Late complications included loss of reduction with ensuing malunion in three patients. Metacarpophalangeal joint stiffness occurred in one patient, but recovered with generous physiotherapy.

#### **Discussion:**

Volar barton's fractures are uncommon injuries. It constitutes only 1.3% of distal radius fracture<sup>12,13</sup>. A variety of treatment options available<sup>3</sup>. They include closed reduction and appli-

cation of cast, manipulation under anaesthesia and percutaneous pinning, the application of external fixator or open reduction and internal fixation using a variety of dorsal or volar plates. Unfortunately all are associated with complications. Closed reduction is usually difficult to maintain the reduction<sup>14</sup>. Pinning frequently fails to maintain reduced position and associated with pin site infection<sup>14</sup>. Loss of radial length and pin site infection remains problem with external fixator<sup>16</sup>. Significant soft tissue problem occurs with dorsally placed plates including soft tissue adherence, tendon irritation and rupture. In comparison volar plates are associated with fewer complication<sup>6</sup>.

In our study a successful anatomical alignment and stability was achieved by volar locking plate. Therefore our subjects started active range of motion exercises in early post-operative period. No patient had developed sudeck's atrophy as one in Aggarwal study<sup>3</sup>. No median nerve dysfunction reported in our study. This is consistent with studies of Zoubos et al<sup>17</sup> and Aggarwal<sup>3</sup>. Therefore we suggested that median nerve decompression is not necessary in open reduction and internal fixation of volar Barton's fracture.

Review of literature revealed only few studies have used open reduction and internal fixation for displaced volar Barton fracture<sup>12,18,19</sup>. Anatomical reduction and stable fixation are the goal of treatment for volar Barton, as in other intra-articular fracture<sup>3</sup>.

Locked plates are progressively replacing conventional support plates. While facilitating the positioning, those anatomical plates have more biomechanical strength against forces occurred on the fracture surfaces, due to screw-plate interlocking feature<sup>20</sup>.

Therefore locking compression plates are widely used successfully especially in intra-articular fracture of the distal radius<sup>21,22</sup>. Volar locking plates maintain fracture position and provide sufficient fracture stability due to its fixation strength<sup>23</sup>. Therefore enables early postoperative mobilization. By comparison all of the conven-

tional treatments usually involves lengthy periods of complete or partial immobilization due to inadequate fracture stability<sup>24</sup>. This in turn results in poor long term function<sup>15</sup>.

### Conclusion:

Volar locking plate provides fracture stability and early mobilization in all displaced Barton's fractures. By using locking plates, joint motion and daily activities is recovered in short span of time.

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