A prospective study to assess the functional outcome of AO Type 23.B3 distal radius fractures treated with volar locking plate osteosynthesis

Dr. Pradeep E, Dr. Sathik Babu MB, Dr. Prajin Raj M and Dr. Dinesh Kumar S

DOI: https://doi.org/10.22271/ortho.2020.v6.i4l.2427

Abstract

Purpose: To study and evaluate the clinical and radiological outcome of open reduction and volar locking plate fixation in AO Type 23B3 fracture of the distal end of radius.

Method: 20 patients operated for AO Type 23B3 fracture of the distal end of radius were prospectively studied and the functional outcome were assessed using the Gartland-Werley functional scoring system.

Result: The overall anatomical result using the criteria of sarmiento’s modification of lidstrom’s classification was fourteen patients (70%) with excellent results, four patients (20%) with good result and two patients with fair results (10%). Based on the functional criteria as described by Gartland and Werley the overall functional results were excellent in twelve patients (60%), good in 6 patient (30%) and fair in two patients (10%). In the present series grip strength was good in eighteen patients (90%) fair in two patients (10%). There were two patients (10%) with complications and eighteen patients (90%) who had no complications.

Conclusion: AO Type 23B3 fracture of the distal end of radius has excellent outcome with volar locking plate fixation, which allows for a anatomical reduction and early mobilization. This improves the wrist function and final outcome significantly.

Keywords: AO type 23.B3 fracture, volar locking plate fixation, distal radius, Garland and Werley scoring system

Introduction

The most common fracture in the upper limb sustained either due to high velocity trauma or a simple trivial fall are the distal radius fractures of the forearm. Most commonly sustained due to fall on an out stretched hand. With the increase in the high velocity trauma, there has been a definite change in the age, incidence and the fracture patterns, in the sense that more and more young individuals with good bone stock sustain this injury with intra articular involvement as well. The conservative form of management has its own complications such as radial shortening, stiffness and wrist joint arthritis are the common sequelae. Because the distal radius is important in the kinematics of the radiocarpal and radioulnar joints, open reduction of the articular surface and restoration of the radial length, volar angulation, and radial inclination are the prerequisites for good clinical outcome. Because the distal radius is the foundation of the wrist joint and an indispensable part of ligamentous support, reconstruction of articular congruity and stable fixation reduces the incidence of post-traumatic osteoarthritis and allows early functional rehabilitation. There are many potential advantages to internal fixation including direct fixation of articular fragments, early range of motion of the joint, and avoidance of constrictive dressing. It is proposed to manage unstable comminuted distal radius fracture by open reduction and internal volar plate fixation for direct restoration of the anatomy, stable internal fixation, a decreased period of immobilization and early return of wrist function.
Materials and Methodology
The patients were followed up at specific intervals and functional outcome were assessed using the Gartland-Werley functional scoring system.
The overall anatomical restoration was evaluated using the criteria of sarmiento’s modification of lidstrom’s classification.

Inclusion criteria
1. AO Type 23.B3 distal radius fractures
2. Age between 18 to 75 years
3. Patient medically fit for surgery

Exclusion criteria
1. Pre-existing wrist arthritis/ disability
2. Previous fracture to the affected wrist
3. Associated skeletal/soft tissue injuries to the same limb
4. Compound fractures of the distal radius
5. Any undelaying medical illness

Table 1: Sarmiento's modification of lindstrom criteria

| Residual deformity | Loss of palmar tilt (degrees) | Radial shortening (millimeters) | Loss of radial deviation (degrees) |
|--------------------|-------------------------------|---------------------------------|----------------------------------|
| Excellent          | No/ Insignificant             | <3                              | 5                                |
| Good               | Slight                        | 1-10                            | 3.6                              |
| Fair               | Moderate                      | 11-14                           | 7.11                             |
| Poor               | Severe                        | At least 15                     | At least 12                      |

Table 2: Demerit point system of Gartland & Werley with sarmiento et al. modification (Functional evaluation)

| Residual deformity | | | |
|--------------------|-------------------------------|---------------------------------|----------------------------------|
| Excellent          | No pain, disability or limitation of movement Good | 0                              |
| Good               | Occasional pain, slight limitation of motion, no disability Fair | 2                              |
| Poor               | Pain, limitation of motion, disability, activities more or less markedly restricted | 6                              |

Objective evaluation
- Loss of dorsiflexion 5
- Loss of ulnar deviation 3
- Loss of supination 2
- Loss of palmarflexion 1
- Loss of radial deviation 1
- Loss of circumduction 1
- Loss of pronation 2
- Pain in DRUJ 1
- Grip strength - 60% or less of opposite side 1

Point range 0-5

End result point ranges
- Excellent 0-2
- Good 3-8
- Fair 9-20
- Poor 21 and above

Result
The patients were selected at random for the study and they were followed up for a minimum of three months. Out of twenty patients who were followed up the mean age was 44.75 years. There were six females – 30% and fourteen males – 70%. The fractures were classified according to mullers classification. The patients selected were the ones with unstable, comminuted fractures of the distal radius.

Pain following the fracture was moderate during the first week after surgery. Residual pain was completely absent in 95% of the patients. Swelling of the fingers and the wrist subsided within a week and residual swelling was almost nil in all patients. In the present series grip strength was good in eighteen patients (90%) fair in two patients (10%). There were two patients (10%) with complications and eighteen patients (90%) who were alright.

The overall anatomical result using the criteria of sarmiento’s modification of lidstrom’s classification was fourteen patients (70%) with excellent results, four patients (20%) with good result and two patients with fair results (10%) based on the functional criteria as described by gartland and werley the overall functional results were excellent in twelve patients (60%), good in 6 patient (30%) and fair in two patients (10%). From this we infer anatomical reduction and maintenance of the same leads to excellent functional and subjective results. Whereas poor reduction leads to poor anatomical, functional and subjective results. It confirms that anatomical restoration is necessary for restoration of good function.

The effects of residual tilt on movement especially dorsiflexion and palmar flexion showed at six weeks nearly 66% of recovery and at three months 90% recovery. The more the dorsal tilt the poorer the recovery of function.
Case 1

Fig 1: Pre Op X-Ray  
Fig 2: Post Op X-Ray  
Fig 3: Follow Up  

Fig 4: Clinical follow up

Case 2

Fig 5: Pre Op X-Ray  
Fig 6: Post Op X-Ray  
Fig 7: Follow Up  

Fig 8: Clinical follow up

Discussion
The initial union in the comminuted distal radius will be a fragile bridge on the volar aspect and a central cavity filled with fibrous tissue. If consolidation is not sound the power of grip and function of wrist will be inhibited until sound consolidation has been achieved. “The best way to functional recovery is by striving primarily for sound osseous union and any factor which will delay osseous consolidation carried the danger of some permanent joint function.

In our study treating unstable comminuted distal radius
Fracture with volar plating has shown excellent to good functional and anatomical outcome. It has proved to be a better alternative to our dynamic young and middle aged Indian patients who have a good bone stock. In elderly patients with osteoporotic bone it has proved likewise. Patients were motivated and explained about the outcome of treatment. Periodic checkup showed excellent to good outcome.

The complication encountered during this study were, mild radio carpal osteo arthrosis and sudeck’s dystrophy which were rehabilitated to provide good functional outcome.

References
1. Cooney WP III, Linscheid RL, Dobyns JH. External pin fixation of unstable Colles’ fractures. J Bone Joint Surg. 1979;61-A:840-845.
2. Bradway JK, Amadio PC, Cooney WP. Open reduction and internal fixation of displaced, comminuted intra-articular fractures of the distal end of the radius. J Bone joint Surg 1989;71:839-847.
3. Leung KS, Shen WY, Tsang HK, et al. An effective treatment of comminuted fractures of the distal radius. J Hand Surg 1990;15-A:11-17.
4. Carter PR, Frederick HA, Laseter GF. Open reduction and internal fixation of unstable distal radius fractures with a low-profile plate: a multicenter study of 73 fractures. J Hand Surg 1998;23A:300-7.
5. Handoll HHG, Madhok R. Surgical interventions for treating distal radial fractures in adults. Cochrane Database Syst Rev 2003;3:CD003209doi: 10.1002/14651858.CD003209.
6. Constantine KJ, Clawson MC, Stern PJ. Volar neutralization plate fixation of dorsally displaced distal radius fractures. Orthopedics 2002;25;125-8.
7. Paksimi N, Panchal A, Posner MA, et al. A meta-analysis of the literature on distal radius fractures: review of 615 articles. Bull Hosp Jt Dis 2004;62:40-46.
8. David S. Ruch, Anastasios Papadonikalakis. Volar versus dorsal plating in the management of intra-articular distal radius fractures. The journal of Hand Surgery / Vol. 31A No. 1 January 2006.
9. Gradl G, Jupiter JB, Gierer P, et al. Fractures of the distal radius treated with a nonbridging external fixation technique using multiplanar K-wires. J Hand Surg 2005;30-A:960-968.
10. Day CS, Kamath AF, Makhni E, Jean-Gilles J, Zurakowski D. Sandwich Plating for intra-articular distal radius fractures with volar and dorsal metaphyseal comminution. Hand (N Y) 2008;3(1):47-54. Epub 2007 Jul 13.
11. Gesensway D, Putnam MD, Mente PL, et al. Design and biomechanics of a plate for the distal radius. J Hand Surg 1995;20-A:1021-1027.
12. Drobetz H, Kutschka-Lissberg E. Osteosynthesis of distal radial fractures with a volar locking screw plate system. IntOrthop 2009;27;1-6.
13. Nunley JA, Rowan PR. Delayed rupture of the flexor pollicis longus tendon after inappropriate placement of the pi plate on the volar surface of the distal radius. J Hand Surg 1999;24-A:1279-1280.
14. Egol K, Walsh M, Tejwani N, Mclaurin T, Wynn C. Paksiman: Bridging external fixation and supplementary Kirschnerwire fixation versus volar locked plating for unstable fractures of the distal radius: a randomised, prospective trial. Bone Joint Surg (Br) 2008;90(9):1214-1221.
15. Schmelzer-Schmied N, Wieloch P, Martini AK, et al. Comparison of external fixation, locking and non-locking palmar plating for unstable distal radius fractures in the elderly. Int Orthop 2008;33:773-778.
16. Fernandez DL. Fractures of the distal radius: operative treatment. Instr Course Lecture 1993;42:73-88.
17. Jakubietz RG, Gruenert JG, Kloss DF, et al. A randomised clinical study comparing palmar and dorsal fixed-angle plates for the internal fixation of AO C-type fractures of the distal radius in the elderly. J Hand Surg. 2008; 33-B: 600--604.
18. Gesensway D, Putnam MD, Mente PL, Lewis JL. Design and Biomechanics of a plate for the Distal Radius, Jornal of Hand Surgery 1995;20A:1021-7.