



COMPARATIVE STUDY EVALUATING OUTCOMES OF CONSERVATIVE VERSUS VOLAR LOCKING PLATE OSTEOSYNTHESIS FOR UNSTABLE DISTAL RADIUS FRACTURES

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ABSTRACT

Background: The objective of the study was to compare the results of conservative management and volar locking plate by assessing the functional and radiological parameters using Stewart et al. system (1) and Sarmiento's modification of Gartland and Werley scores (2) respectively in cases of unstable distal radius fractures.

Materials & Methods: This was a prospective comparative study, which included 50 cases of distal radius fractures with 32 cases in the conservative group and 18 cases in the operative group. Radiographic and functional outcomes were assessed at 2 weeks, 3 months and 6 months using Stewart et al. system and Sarmiento's modification of Gartland and Werley scores respectively.

Results: In operative group, radiological results were well to excellent results in 100% of the patients while in conservative group, 30% had excellent results, 17% had good results and 53% had fair result. At 6 months after surgery, functional results in both groups were improved. In operative group, 100% had excellent results while in conservative group 48% had excellent, 44.44% had good, and 7% had fair results.

Conclusion: This study shows that volar locking plates evidently has better results in terms of achieved faster and accelerated functional recovery.

KEYWORDS : Distal Radius Fracture, Volar Locking Plate, Stewart et al. system, Sarmiento's modification of Gartland and Werley scores.

INTRODUCTION:

Distal radius fractures are one of the most common injuries encountered in orthopedic practice. They make up 8%–15% of all bony injuries in adults (3). The high demanding population for example, labourers, musicians, carpenters, surgeons etc require maximum restoration of functional activities as loss of hand function means loss of a career.

There appears to be a bimodal distribution of distal radius fractures with a younger group who sustains relatively high-energy trauma to the upper extremity and an elderly group who sustains both high-energy injuries and insufficiency fractures. As life expectancy increases, the incidence of distal radius fractures can be expected to increase as well. Distal radial fracture is also frequently associated with low bone mineral density.

The radius initially fails in tension on the volar aspect with the fracture progressing dorsally where bending forces induce compressive stresses, resulting in dorsal comminution. Cancellous impaction of the metaphysis further compromises dorsal stability. Additional shearing forces influence the injury pattern, resulting in articular surface involvement(4).

Unstable fractures of the distal radius remain challenging problems for orthopaedic surgeons. Increasing evidence of unsatisfactory results with significant malunion has lead to a proliferation of methods to maintain radial length and inclination following reduction. The more common methods include plaster immobilization, percutaneous pinning, pins and plaster, external fixation and open reduction with internal fixation, or a combination of these methods.

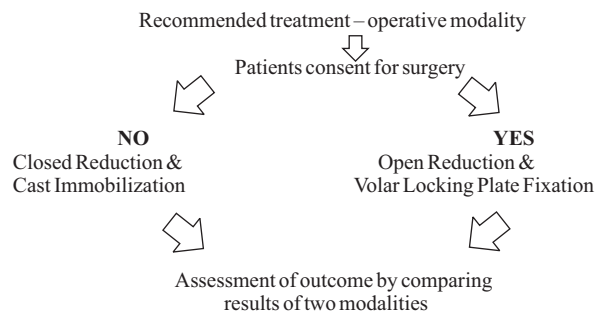
The aim of this study was to evaluate conservative management and open reduction internal fixation with volar locking plate and which technique provides better radiological and functional outcomes for unstable distal end radius fractures.

MATERIALS AND METHODS:

This was a prospective study conducted at the department of orthopaedics, SMS Medical College and Hospital, Jaipur, which involved 50 cases of distal radius fractures presenting to the department of orthopaedics between August 2017 to December 2018. Patients with unstable fractures of the lower end radius who have

attained skeletal maturity were included in this study. Patients with any pre existing deformity, active infection or mental incompetence were excluded from this study.

Flowchart 1: UNSTABLE DISTAL RADIUS FRACTURE



Conservative group and operative group had 32 cases and 18 cases respectively. In the operative group 78% cases had Fernandez type 2 and 3 fractures, which indicates comminuted intra articular fractures (78% males and 22% females). In the conservative group 84% cases had Fernandez type 1 and 2 unstable fractures (53% males and 47% females).

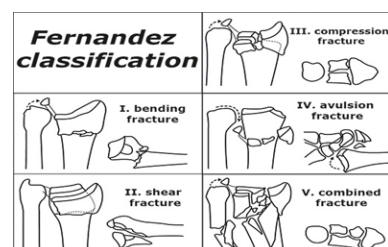


Figure 1: Fernández classification (I: bending of the metaphysis; II: shearing fractures of the joint surface; III: compression of the joint surface; IV: avulsion or radiocarpal fracture dislocations; V: combined fractures with high velocity injuries) (5)

In the conservative group, under the effect of adequate analgesia, traction was applied with the help of an assistant, fracture ends were disimpacted, manipulated and reduction was achieved under fluoroscopy, after which plaster immobilization was given with a slab. Check Xray was obtained at 6 weeks when the slab is removed and then rehabilitation was started.

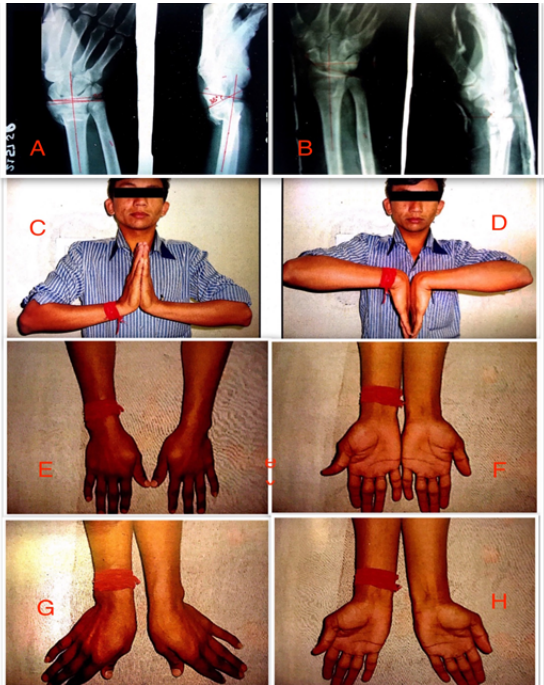


Figure 2: Conservative Management. A-Preoperative Xray, B-Post Operative Xray, C-Wrist Extension, D- Wrist Flexion, E-Pronation, F-Supination, G-Radial Deviation, H-Ulnar Deviation

In the operative group, under the effect of anaesthesia, using standard incision exposure is carried out down to the bone. After full exposure of the fracture site, the hematoma and fibrous materials are removed and fracture disimpacted and reduction facilitated through ligamentotaxis. Once reduction is achieved the plate is positioned and fixed at the adequate level staying proximal to the watershed line. Hardware placement and reduction is confirmed under fluoroscopy guidance after which the wound is washed and closed in layers. They were then placed in a volar slab for 2 weeks until suture removal after which physiotherapy was started.

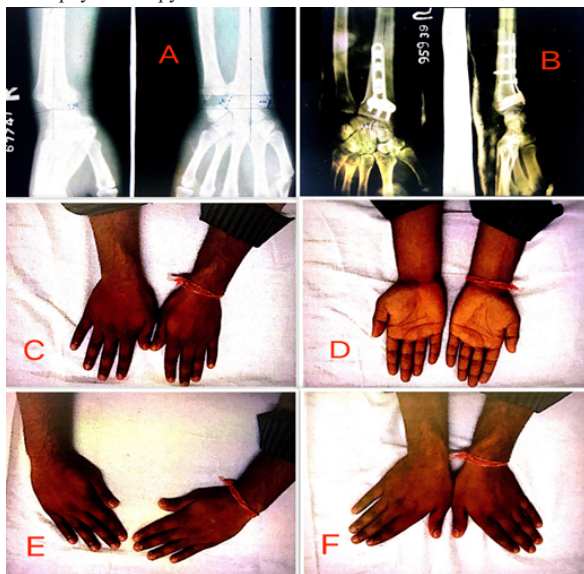


Figure 3: Operative Management. A-Preoperative Xray, B- Post operative Xray, C- Pronation, D- Supination, E- Radial Deviation, F-Ulnar Deviation

Patients were assessed at 2 weeks, 6 weeks, 3 months and 6 months,

and radiological evaluation is done using Stewart et al. system (1). Functional evaluation is done using Gartland and Werley demerit system of evaluation modified by Sarmiento et al. (2)

RESULTS:

We used Fernandez classification, which is a simplified approach for classification that moved away from focusing on the fracture fragments and instead recognized that fracture patterns reflecting specific mechanisms of injury. This system is designed to be practical, determine stability, include associated injuries, and provide general treatment recommendation.

In operative group patients, 17(95.56%) patients had Fernandez type II, III and IV which indicate more comminution and intra-articular extension and fracture had avulsion, compression and shearing type of mechanism while 27(86%) patients of conservative group had Fernandez type I and II which are bending and avulsion mechanism and indicate low energy trauma.

The demographic distribution suggested that out of the 32 patients in conservative group 17(53%) were males and 15(47%) were females, while in a total of 18 patients in the operative group 13(72%) were males and 5(28%) were females. We observed these injuries to be occurring more commonly in males in their early 40s. The mean age of Operative group and Conservative group was 36.27 ± 13.13 years and 44.81 ± 15.93 years respectively. Melone (6) observed the same in his study in 1984.

Road traffic accident was the leading cause of mode of injury in 16(89.89%) patients of operative group and 17(53.12%) patients of conservative group, indicating the increase of unstable distal radius fractures due to increase of high velocity trauma. This is similar to one reported by Knirk et al (7), Harish et al (8), and Schuind et al (9). Slip and fall was the second major cause of injury in 12(37.5%) patients of conservative group. Other causative factors being fall from height, assault, etc. Dominant side was affected in 38(76%) of the total patients indicating that the dominant hand was used first to touch the ground during motorcycle slip or fall.

It was observed that at the 3 month follow up the most common complication was finger stiffness affecting 3(16.66%) and 8(25%) patients of the operative and conservative group respectively. At the 6 month follow up finger stiffness remained in 3(11.11%) patients in conservative group where as in the operative group the stiffness was resolved. Second most common complication observed was pain at the DRUJ affecting 2(11.11%) and 7(21.87%) patients, which reduced to 0 and 2(7.41%) patients at 6 months in operative and conservative groups respectively. At 6 months the complication taking predominance was arthritic changes at radiocarpal joint affecting 1(9%) and 3(11.11%) patients in operative and conservative groups respectively.

Residual deformity in the form of Prominent Ulnar Styloid(PUS), Residual Dorsal Tilt(RDT) and Radial Deviation(RD) were seen in 2(11.1%), 1(5.5%) and 1(5.5%) patients respectively in the operative group while in the conservative group PUS, RDT and RD were seen in 4(12.5%), 7(22.5%) and 8(25%) patients respectively.

At 6 months range of movement in mean \pm SD percentage of normal hand palmar flexion(PF), Dorsiflexion(DF), Radial deviation(RD), Ulnar Deviation(UD), Supination(SUP) and Pronation(PRO) were 83.52 ± 9.37 , 84.70 ± 7.79 , 76.33 ± 9.97 , 82.40 ± 11.39 , 88.28 ± 5.81 , and 88.76 ± 8.21 respectively in the operative group and 65.10 ± 13.01 , 66.75 ± 10.49 , 75.08 ± 11.62 , 67.21 ± 13.61 , 82.52 ± 7.27 and 82.52 ± 7.27 respectively in the conservative group giving a highly significant P value of $< .001$ in PF, DF, UD and significant P value of $< .01$ in PRO and SUP.

Grip strength at 3 and 6 months were 68.05 ± 6.26 and 81.91 ± 7.98 respectively in the operative group and 57.31 ± 7.53 and 74.26 ± 9.69 respectively in the conservative group giving a highly significant P value $< .001$ at 3 months and significant P value $< .01$ at 6 months.

Radiographic results as per Stewart Scoring System in operative group was 100% indicating well to excellent results while in conservative group 30% had excellent results, 17% had good results and 53% had fair results.

At 3 months functional results using Sarmiento's modification of

Gartland and Werley scores in operative group was 95% indicating good to excellent results while 5% had fair results while in conservative group 28% had good results 62% had fair results and 9% had poor results. At 6 months in both groups functional results were improved. In operative group 100% had excellent results while in conservative group 48% had excellent, 44.44% had good, and 7% had poor results respectively.

DISCUSSION:

The management of fractures of the distal end of radius has changed since Cassebaum et al (10) supported Abraham Colles' (11) statement that a patient with a colles fracture will not have pain or serious functional disability despite considerable deformity. This is no longer acceptable.

Extra articular fractures require avoidance of malunion with angulation and shortening. Malalignment results in limitation of movement (5), changes in load distribution (9), midcarpal instability (12) and an increased risk of osteoarthritis of the radiocarpal joint. Radial length is also an important prognostic factor (13,14), loss results in a painful restriction of range of motion due to incongruence of the distal radial-ulnar joint, impingement of the triangular fibrocartilage and subluxation of the ulnar head leading to degenerative arthritis (5, 15). Intra articular fractures with a step of over 2 mm in the radiocarpal joint inevitably results in osteoarthritis and functional impairment (16). It is therefore important to reconstruct the joint surface and make it congruent, and a number of different surgical strategies such as external fixation; percutaneous pinning or open reduction and internal fixation are available. Anatomical plates and locking screws enhance plate stability and support the articular surface of the distal radius. Although some studies have shown good results for various methods, the choice of the best option still remains controversial, as prospective randomized studies have not shown results, which are convincingly better for any one of the procedures.

In our present study an attempt has been made to treat both extra-articular as well as intra-articular type unstable fractures of the distal end radius by conservative (32) and operative (18) modalities. The results have been evaluated at 3 and 6 months.

In conclusion, this study indicates that volar locking plates may be advantageous for a patient who desires an accelerated return of function. Conservative group results suggest that timing and number of follow up visits need to be individualized to both the patient and the fracture. Good anatomical restoration with intense physiotherapy is key to success. We believe that the subjective short-term advantage of the use of a volar plate is robust and applicable to the treatment of unstable distal radius fractures. This study provides new evidence supporting the trend towards fixation of distal radius fractures with volar locking plates.

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