

**Clinical Article  
Orthopaedics**

# ROLE OF LOCKING COMPRESSION PLATES IN THE TREATMENT OF FRACTURES DISTAL END OF RADIUS

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**Abstract:**

**Background:** Distal Radius fractures are the most common fractures of the human skeleton. The distal radius fracture is almost always within an inch of the wrist joint and fracture lines may extend into the wrist joint. Dorsal angulation in distal radial fractures is common and there is tendency towards secondary displacement after conservative management. Hence, open reduction of the articular surface, stable reduction, restoration of the radial length, volar angulation and radial inclination are the prerequisite for good clinical outcome. The volar locking compression plate can provide a safe and effective implant for treatment of dorsally displaced fractures of distal radius. The present study is proposed to evaluate the role of locking compression plate in treatment of fractures of distal end of radius.

**Material and Methods:** Twenty five patients, coming to Sri Guru Ram Das Institute of Medical Sciences and Research (SGRDIMS&R), Sri Amritsar, having fractures of distal end of radius grouped as per A. O Classification were treated by locking compression plates.

**Results:** Most of the functional and clinical outcomes showed continued improvement between the three and six months periods. The grip strength showed score of 53% at 3 months and 69% at 6 months as compared to contralateral side. Lateral pinch strength improved to 81% of the value for the normal side by three months and 89% till 6 months. The Jebsen-Taylor

test was exceptional and showed that the scores on the injured side were close to 87% of those on the uninjured side even at three months and continued to improve.

**Conclusion:** locking compression plate system for the management of distal radius fractures showed significantly good results as shown by various functional outcome scores

**Key words:** locking compression plate, distal radius

## Introduction

Distal Radius fractures are the most common fractures of the human skeleton.<sup>1</sup> The percentage of these fractures that are considered unstable and require surgical fixation has been reported to be as high as 40 to 49%.<sup>2,3</sup> The distal radius fracture is almost always within an inch of the wrist joint and fracture lines may extend into the wrist joint.

Traditionally, the fracture has all along been treated conservatively by closed reduction and POP cast immobilization. The assumption has always been that a good result will be achieved whatever the appearance of reduction.<sup>4</sup> This may be acceptable in the elderly, osteoporotic patients with low demands on the wrist but there is a clear distinction between this group and those with higher demands, bearing in mind that these may not necessarily be younger.<sup>5,6</sup>

Dorsal angulation in distal radial fractures is common and there is tendency towards secondary displacement after conservative management. Distal radius is important in the kinematics of radiocarpal and radioulnar joints. Hence, open reduction of the articular surface, stable reduction, restoration of the radial length, volar angulation and radial inclination are the prerequisite for good clinical outcome. All this reduces the incidence of post-traumatic osteo-arthritis and allow early function "biological osteosynthesis" a terminology introduced to indicate a new type of osteosynthesis leading to a sufficiently stable fixation of bone fragments allowing early mobilization, but without major disturbance of the vascularisation.<sup>7</sup>

To help accomplish this new concept of biological plate fixation, new implant such as locking

compression plate (LCP) was introduced.<sup>8</sup> Locking minimizes the compressive forces exerted by the plate on the bone. This method of screw plate fixation means that the plate does not need to touch the bone at all. Precise anatomical contouring of a plate is no longer necessary because the plate does not need to be pressed on the bone to achieve stability. This prevents the loss of primary reduction of fracture fragments caused by inadequate contouring of a plate at rehabilitation.<sup>9</sup>

The volar locking compression plate can provide a safe and effective implant for treatment of dorsally displaced fractures of distal radius.<sup>10</sup>

The present study is proposed to evaluate the role of locking compression plate in treatment of fractures of distal end of radius.

## Material And Methods

Twenty five patients, coming to Sri Guru Ram Das Institute of Medical Sciences and Research (SGRDIMS&R), Sri Amritsar, having fractures of distal end of radius grouped as per A. O Classification were treated by locking compression plates. The study had prospective component only. While certain fracture pattern in this series were amenable to simple techniques such as percutaneous pinning, we used volar locking plate system in all cases to better understand the properties and outcomes of this new technology.

## Inclusion criteria

All patients having fracture of distal end of radius were grouped as per A. O. classification.<sup>11</sup> Patients over 18yrs were included in this study.

Type A: Extra-articular fractures involving neither the radiocarpal nor the radioulnar

joint.

Type B: Simple articular fracture affecting a portion of the articular surface, but with the continuity of the metaphysis and epiphysis intact.

Type C: Complex articular fracture affecting the joint surface and the metaphyseal area.

## Exclusion criteria

- Patients with concomitant upper extremity injuries (carpal bone, proximal forearm, elbow, or humeral fracture).
- Patients with systemic, multiple-organ, or head injuries.
- Patients who were managed conservatively for more than three weeks i.e. old fractures.
- Patients with bilateral fractures.
- Patients having fractures associated with neurovascular injuries, inflammatory arthritis, open fractures and malunited fractures.

## Operative protocol

Informed consent was taken as per proforma. Type of anaesthesia to be used was decided by anesthesiologist. The patient placed in the supine position with affected limb positioned to expose the surgical site. Following standard operative procedures for painting and draping of the part, volar fixation of distal radius was performed through Henry's Approach with locking compression plate.<sup>20</sup> Proper placement of locking impression plate was guided by C-arm image intensifier. Removable volar plaster splint was given for six weeks. All patients was allowed to perform activities of daily living while wearing the splint. They were given once a week structured hand therapy programme that included

active and passive finger movements, hand and wrist edema control, and active wrist motion exercises. Strengthening exercises were initiated six weeks after the surgical procedure. Postoperatively, patients were assessed clinically and radiologically (at one week to ten days) and then at six, nine and twelve weeks as well as six months after surgery. The commonly used hand function test included test of hand strength (grip test), lateral pinch, test range of motion and Jebson Taylor Test. Range of motion of wrist was evaluated by recording flexion, extension and radioulnar deviation with standard goniometer. Grip strength test was measured with dynamometer and value was compared with contralateral extremity. Anteroposterior and lateral radiograph were taken at each visit. Fracture was considered united when osseous bridging across the fracture site was seen in radiographic views. Radial height, radial inclination, and volar tilt was measured in the immediate post-operative period (ten days after surgery) and at the time of the last follow up (six months after treatment). Activities of daily living and general postoperative quality of life were assessed with the Michigan hand outcomes questionnaire scores.<sup>12,13,14,15</sup>

The collected data and results obtained was subjected to standard statistical analysis.

**Observations And Results**

25 procedure were performed, 18 in males and 7 in females with use of the volar locking plating system for fracture distal radius at SGRDIMS&R Amritsar from 2009 to 2011. Most of the patient were in the age group of 31-50years (48%) followed by group of 18-30 years (36%). Most common affected was

right radius (52%). Fracture was of closed variety in all cases and in most case was the result of road traffic accident (RTA) followed by fall on outstretched hand. The patients were approached for participation in the study, usually at the time of the three and six months after operation. Functional outcomes (grip strength, lateral pinch strength and the Jebson Taylor test), clinical outcomes (wrist flexion, wrist extension, ulnar deviation, radial deviation, supination, and pronation), and radiographic measurements of distal radial alignment (radial height, radial inclination, volar tilt and ulnar variance) are shown in tables 1,2,3. Most of the functional and clinical outcomes showed continued improvement between the three and six months periods. The grip strength showed score of 53% at 3months and 69% at 6 months as compared to contralateral side. Lateral pinch strength improved to 81% of the value for the normal side by three months and 89% till 6 months. The Jebson-Taylor test was exceptional and showed that the scores on the injured side were close to 87% of those on the uninjured side even at three months and continued to improve. The six months period is noted in terms of grip strength, lateral pinch strength, Jebson-taylor test, flexion, extension, ulnar deviation,

radial deviation, pronation, supination (p < 0.05) adjusting for the outcomes values for the three month period. When we assessed the Michigan hand outcomes questionnaire score over the two measurement times, significant improvements were detected between three and six months in all domains. In summary at six months, the injured side still had worse outcomes than the uninjured, contralateral side in all domains. At three months, however, patients had a mean activities of daily living score of 83%, indicating excellent ability to perform most daily tasks. Patients appeared to improve in terms of their functional recovery at six months.

**Complications**

Three patients had short term complications (defined as complications occurring during the first thirty days postoperatively): two patients had painful wrist which resolved after physiotherapy and one had a suture abscess, that resolved with suture removal. Sudeck's osteodystrophy and deformity present noted in one case which was operated late (after 2 weeks). Two plate related complications were present, in one a screw back tracked (pulled out) and in the other one screw violated the articular surface of distal radius.

**Table 1**  
**Postoperative Hand Function On Injured Side**

Test	12 weeks (n=25)		6 months (n=25)	
	Raw mean	Percentage of values for contralateral side	Raw mean	Percentage of values for contralateral side
Grip strength (kg)	19.52 ± 4.7	53.2	25.36 ± 5.7	69.3
Lateral pinch (kg)	8.16±1.2	81.2	9.0±1.2	89.7
Jebson-Taylor test (s)	34.88 ± 2.5	86.8	32.8±2.3	91.46

**Table 2**  
**Postoperative Wrist Range Of Motion On Injured Side**

Test	12 weeks (n=25)		6 months (n=25)	
	Raw mean	Percentage of values for contralateral side	Raw mean	Percentage of values for contralateral side
Flexion	53.4± 6.5	73.1	56.8±7.3	77.6
Extension	55.8± 5.5	79.3	59.6±6.2	84.6
Ulnar deviation	29.4± 4.6	83.1	31.6±3.7	89.7
Radial deviation	17.2± 4.8	83.4	18.2±4.05	89
Pronation	71.6± 3.7	92.6	73.2±4.0	94.7
Supination	70.4± 4.3	87.6	75± 4.1	93.4

**Table 3**  
**Radiographic Outcomes**

Radial height (mm)	
Immediate Postoperative	10.96 ± 0.84
Six months	10.84 ± 0.85
Change	0.12 ± 0.33
Radial inclination (deg)	
Immediate Postoperative	21.52 ± 1.4
Six months	20.52 ± 1.6
Change	0.1 ± 1.35
Volar tilt (deg)	
Immediate postoperative	2.84 ± 1.1
Six months	3 ± 0.95
Change	0.16 ± 0.37
Ulnar variance	
Immediate postoperative	-0.84 ± 0.88
Six months	-0.8 ± 0.89
Change	0.04 ± 0.01

## Conclusion

There has been a distinct shift in the surgical techniques for distal radial fracture fixation over a period of time. There are many possible influences, and the change is probably multifactorial. This dramatic shift may have been due to introduction and reported good results for volar locking plates for the treatment of distal radial fractures. Surgeons believe that open reduction with locked volar locking plates provides more stable fixation and allows earlier range of motion than percutaneous fixation does.<sup>16</sup> The literature, on outcome after distal radial fractures, is controversial with only few comparative studies. Wright

et al. performed a case control study of 32 patients in which use of volar fixed angle plate was compared with external fixation; significantly better radiographic outcome were found in association with use of plates but no difference between the groups in terms of patient based outcome. Leung et al. reported that those who had been managed with plate fixation had a better cosmetic result and function at two years<sup>17</sup>.

We would like to emphasize the importance of careful case selection, surgery in fresh cases & early physiotherapy to give better functional outcome. In summary, continued use of the volar locking plating system is

supported by the excellent outcomes data presented in the current study.



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