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## Functional outcome in the management of fracture both bones of forearm with dynamic compression plate: A study

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### Abstract

In this day of modern technology and industrialization, the occurrence and frequency of fractures is enormously increasing moment by moment. The Orthopaedic surgeon is forced to give them quick and effective measures.

The goals of the fracture treatment to achieve union and restore normal function of the injured part are as old as the orthopaedics itself. Treatment of all fractures by plaster leads to prolonged immobilization of the part. This not only leads to disability of a person temporarily but also causes dependency. If we think the other aspects of the person, he will be temporarily out of the job affecting him financially, and lot of psychological depression. Today, the field's emphasis has changed from rest and prolonged immobilization to active mobilization and return to near normal function as early as possible.

The objectives of the treatment of diaphyseal fractures of both bones of forearm are to have the bones healed in such position that the function and cosmesis of the extremity are unimpaired and return the patient to his vocation and avocation in the shortest possible time.

The forearm is the lever for the hand and important segment of upper limb, as it affects the function & efficiency of the entire part. For full functional recovery of the fracture of forearm not also the flexion & extension at elbow and wrist are important but also the full supination & pronation<sup>[1,2]</sup>.

In achieving these goals it is not sufficient to maintain the length of each bone but, axial, rotational alignment must be achieved and radial bow should be maintained. (Sage 1959).

Due to the extreme difficulties in obtaining the above said criteria by closed methods and with open intramedullary nailing methods we are prompted to try and treat these fractures in the adults by open reduction and internal fixation with dynamic compression plates to better our experience with other types of internal fixation in pursuit of perfection.

**Keywords:** fracture both bones of forearm, dynamic compression plate (DCP)

### Introduction

Internal fixation was attempted by Lapuyada and Sicer in the year 1775 by using wire; this was reported by Guthric. In the early part of nineteenth century Lister used silver sutures to hold bone fragments under cover of antiseptics.

In 1870 Berenger, Friend described the use of screws driven through bone to maintain proper apposition of shafts. They fixed one end of the plate to the bone and the other end of the plate was projecting from the wound for easy removal. Nicolaysen in 1897 nailed fractures of femoral neck. Risses in 1907 used screws to fix oblique fractures of tibia.

Since the beginning of the 20<sup>th</sup> century there has been steadily increasing trend towards operative reduction in the treatment of fractures. The credit of successful internal fixation of fractures in modern fracture surgery goes to Lane (1905) of London and Albin Lambotte (1907) of Belgium. Both used metal plates attached to the bone usually sub periosteally by means of screws driven through the cortex. Sir William Arbuthnot Lane (1865-1943) used these plates and screws with ever increasing frequency and considerable success. Lane stresses a technique of exaggerated asepsis, in which the tissues were handled with great attention by non-touch technique. Hey Groves of Bristol demonstrated both experimentally and clinically that a fracture fixed by a large metal plate, held firmly in place, by long screws passing through both cortices, is less apt to become infected than is one in which a small plate is held

by screws purchasing only a single cortex.

### Aims & Objectives

1. To study the surgical management of fracture both bones of forearm with Dynamic Compression Plating.
2. To produce rigid internal fixation - compression of fracture to facilitate early union.
3. To maintain the length, apposition, Axial and rotational alignment and to facilitate early mobilisation for good range of movement.

### Materials and Methods

This is a prospective study and included cases of fracture both bones of forearm treated by open reduction and internal fixation by DCP from October 2017 till September 2019 at Kamineni Institute of Medical sciences, Narketpally. Total No of cases 22

### Inclusion criteria

1. All Patients attending Kamineni Hospital, Narketpally with Fracture both bones forearm willing for surgery are included in this study.
2. All cases of closed fractures and Type-1 compound fractures included.
3. All cases of delayed union and Nonunion of fracture of both bones of forearm.

### Exclusion criteria

1. Type-2 &3 compound fractures.
2. Patient not willing for surgery.

### Surgical procedure adopted

#### Open reduction and internal fixation with DCP

Fracture Radius: Anterior approach (Henry) : Posterior approach (Thompson)

Fracture ulna : Posterior approach

Implants : 3.5mm Dynamic Compression Plate With cortical screws

### Pre-operative planning

- After admission clinical evaluation is done of the extremity to diagnose fracture both bone forearm.
- X-rays were taken in Anteroposterior and lateral view of forearm to assess the fracture pattern, comminution and the level of fracture.
- Patient is examined for other associated injuries.
- Then immediately limb is immobilised in splint for patients comfort.
- Then all the investigations necessary for the surgery are done.
- Patient is operated earliest depending on the fitness.

### Pre-operative protocol

Extremity is shaved as for any other standard orthopaedic procedure. Preoperative iv antibiotic is given on the day of surgery.

### Operative procedure

- After general anaesthesia /Brachial block anaesthesia, routine preparation and draping of the upper limb as per the standard orthopaedic protocol
- Limb is exsanguinated and tourniquet applied. We routinely used pneumatic tourniquet with 250mm Hg

pressure for upper limb [4, 5].

- Depending on the fracture, radius is approached by either Henry or Thompson's approach.
- For fracture ulna we routinely use posterior approach.
- After reduction, depending on the fracture pattern 6, 7 and 8 narrow 3.5mm Dynamic compression plate is used with atleast 3 cortical screws on either side (6 cortices)
- During plate fixation using drill guides compression is given at fracture site. Then depending on comminution, if necessary bone grafting is done.
- In all delayed and nonunion cases in addition the margins are freshened and bone grafting is harvested in all cases from iliac crest [13, 14].
- All wounds are closed after removing tourniquet and securing haemostasis with suction drain.

### Postoperative care

- When there is no comminution and good compression and rigid fixation have been achieved and the patient is intelligent and cooperative, no external immobilization is given except for armpouch.
- Post operatively intravenous antibiotics i.e iv inj cefataxime 1 grm bid, inj amikacin 500 mg were given for 5 days.
- Post operatively wound drains are removed after 48hrs. A compression dressing is applied for the first few days and gentle active exercise of the elbow, wrist and hand are started immediately.
- When the cooperation of the patient is questionable a split, padded above elbow plaster slab is applied for 4 weeks.
- The skin sutures are removed between ten to fourteen days post operatively.

### Follow up

Patients are followed up every 4 weeks for a minimum period of 6 months. At each follow up

1. Clinical and radiological assessment is made
2. X-rays are taken for radiological union
3. Range of movements are assessed at elbow, wrist, and supination/pronation of forearm. In addition movement at shoulder and hand are noted.

Final evaluation is done at 6months and results are assessed as follows

**Excellent:** Radiological union between 8-12wks

No limitation of supination and pronation

No pain or deformity

**Good:** Radiological union

Limitation of terminal range of (lessthan 20%) supination /pronation/No pain or deformity.

**Fair:** Radiological union/Limitation of of 30% of supination /pronation

No pain or deformity

**Poor:** No radiological union. Pain and tenderness at fracture site.

Gross limitation (more than 50%) of supination/pronation

**Results criteria**

Anderson Criteria

Group	Clinical /Radiological Union	Rotational movements	Deformity	Pain
Excellent	Present	90% Present	Absent	Absent
Good	Present	80% Present	Absent	Absent
Fair	Present	30% Limitation	Absent	Absent
Poor	Absent	50% Limitation	Acceptable	Present

**Observation and Results**

Total No. patients with fracture both bones forearm attended at Kamineni Institute of Medical Sciences Narketpally were 22 between October 2017 to September 2019 All 22 patients were treated by Internal fixation with Dynamic compression Plating.

In 06 patients autogenous cortico-cancellous bone grafting was done in addition to DCP.

**Bone Graft (N) = 22**

Total No of Fracture both bone forearm – 22

**Table 1:** Bone Graft

Bone grafting	No. of Patients	Percentage
Used	6	27.20
Not Used	16	72.70

In present study we used corticocancellous graft in 27.2% of cases (n) = 6

**Bone Graft**

**Total No. of Fracture both bone forearm (N) = 22.**

- In 27.2% of cases we used bone graft

**Clinical / Radiological union**

Total No. of Fracture both bone forearm (N) = 22.

**Table 2:** Clinical / Radiological union

Duration of union in weeks	No. of Patients	Percentage
8-12	16	72.70
13-16	6	27.20

In present study radiological union of fracture both bones forearm between 8 – 12 weeks is 72.7% (n) = 16

Total No. of Fracture both bone forearm (N) = 22.

- Radiological union of # both bone after DCP forearm is

**Table 6:** Radiological union of fracture

Sl. No	Study	Radiological union	Average union in weeks
1	LD Anderson <i>et al.</i> (1975) <sup>[18]</sup>	103(97.4%)	12.3
2	Kirit shah <i>et al.</i> (1988) <sup>[28]</sup>	130(97.3%)	12.4
3	Chapman <i>et al.</i> (1989) <sup>[14]</sup>	125(97%)	12
4	Present study (2009)	22(100%)	11.8

The average fracture union is 11.8 weeks in present study which is comparable with chapman *et al.*

**Table 7:** Complications

Sl.no	Study	Iatrogenic neuro vascular injury	Breakage of plate	Infection	Synostosis	Non union
1	LD Anderson <i>et al.</i> (1975) <sup>[18]</sup>	Radial nerve contusion (transient radial nerve palsy)	No	7(2.9%)	3 (1.2%)	7(2.9%)
2	Kirit shah <i>et al.</i> (1988) <sup>[28]</sup>	Nil	Nil	-	-	-
3	Chapman <i>et al.</i> (1989) <sup>[14]</sup>	Distal radial nerve palsy	Nil	2.3%	1(1.4%)	2(1.5%)
4	Present study (2009)	Nil	Nil	1(4%)	Nil	Nil

72.70% in 8-12 W

**Post op movements of forearm** <sup>[21, 22, 23]</sup>

Total No. Fracture both bone forearm (N) = 22

**Table 3:** Post OP movements of forearm

Movements	Full	Reduced (<20° of restriction)	Gross Reduction (>50° of restriction)
Pronation	17	4	1
Supination	17	4	1

In present study (n) = 17 (77.27%) cases, full range of movements

**Complications**

Total No. Fracture both bone forearm (n) = 22

**Table 4:** Complications

SL. No	Complication	Number of cases
1	Iatrogenic Neuro vascular injury	Nil
2	Infection	Superficial skin infection (n)=1 (4%)
3	Non union	Nil
4	Synostosis	Nil

In present study (n) = 1 case (4%), had stitch abscess

**Discussion**

This is a prospective study of fracture both bone forearm treated in Kamineni Institute of medical sciences with open reduction and internal fixation using Dynamic compression plating.

We had only 16 cases who could be operated immediately after fracture, rest of 6 cases are either delayed union (3 cases) or non-union (3 cases) due to various reasons.

Two cases are associated with other injuries like head injury with polytrauma and ipsilateral lower limb fracture.

**Table 5:** Bone graft

Sl. No	Study	Used
1	LD Anderson <i>et al.</i> (1975) <sup>[18]</sup>	11(19%)
2	Rosacker kopta (1981)	63(25.9%)
3	Chapman <i>et al.</i> (1989) <sup>[14]</sup>	68(52.71%)
4	Kirit shah <i>et al.</i> (1989) <sup>[28]</sup>	10(7.5%)
5	Present study (2009)	6(27.2%)

Bone graft used in Present study n = 6(27.2%)

In present study we had 4% of infection (stitch abscess), apart from this we don't have neurovascular injury and breakage of plate. Even when bone grafting was done in 27.2% of cases

(n) = 6 we don't have synostosis. As bone grafting was done, we don't have nonunion cases.

**Table 8:** Comparison with various series [30, 31]

Results	No & percentage of various series			
	Kirit M. Shah <i>et al.</i> (1988) [28]	LD Anderson <i>et al.</i> (1975) [18]	M W Chapman <i>et al.</i> (1989) [14]	Present study
Excellent	116(86.6%)	54(51%)	36 (86%)	17 (77.2%)
Good	9 (6.7%)	37 (33%)	3 (7%)	3 (13.6%)
Fair	6 (3.8%)	12 (1.7%)	1 (2%)	2(9%)
Poor	3 (2.9%)	3 (2.6%)	2 (5%)	-
Total	134	106	42	22

- In present study excellent results were obtained in 77.2% (17).
- In present study satisfactory results are 91% as compared to chapman *et al* 93%.

### Summary

- Total No.patients with fracture both bones forearm attended at Kamineni Institute of Medical Sciences Narketpally were 22 between october 2007 to September 2009.
- All 22 patients were treated by internal fixation with Dynamic Compression Plating.
- In present study higher incidence of fracture both bone forearm were between 21 - 30 yrs with a mean age of 29.1 yrs.
- Predominantly male patients are affected n = 19 (86.3%).
- Left forearm was affected more n = 16(72.7%).
- Simple fractures were more common n = 16(72.7%).
- Road traffic accident was the most common cause n = 12(54.5%).
- Bone grafting was used in 6 cases (27.2%) which helped in 100% union of fracture.
- Clinico-Radiological union was achieved in 16 cases between 8-12 weeks.
- Postoperatively full range of movements were regained in 17 cases 77.27%.
- In present study, Excellent results are 77.2% n = 17, Good 13.6% (n=3) and fair 9% (n=2).

### Conclusion

1. Dynamic compression plating obviates the need for external immobilisation and ensures early functional rerun.
2. A six or seven holed small 3.5mm Dynamic compression plates and 3.5mm cortical screws of 12mm to 18mm length are suitable for majority of diaphyseal fractures of both bones of forearm in adults.
3. In case of nonunion, excision of sclerosed ends and addition of cancellous bone grafts with dynamic compression plating ensures definite union.
4. Complications of this procedure are few and were avoidable.
5. Open reduction and internal fixation with Dynamic compression plating for displaced diaphyseal fractures of both bones of forearm in adults has shown distinctive advantage of definite union with excellent functional results at the earliest possible time.

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