

BOTH BONES FOREARM FRACTURES TREATED WITH LC-DCP: A SURGICAL OUTCOMEH. D. Ranganath¹, Prakash Savakkanavar², Ravish V. N³, Sumanth B⁴**HOW TO CITE THIS ARTICLE:**

H. D. Ranganath, Prakash Savakkanavar, Ravish V. N, Sumanth B. "Both Bones Forearm Fractures Treated with LC-DCP: A Surgical Outcome". Journal of Evolution of Medical and Dental Sciences 2014; Vol. 3, Issue 37, August 21; Page: 9648-9656, DOI: 10.14260/jemds/2014/3248

ABSTRACT: Fractures of the forearm present a unique management problem for years. A forearm fracture involving both bones requires open anatomical reduction with stable fixation.^[1] The forearm represents the critical anatomic unit of upper limb, permitting the effect of organ of the upper limb, the hand, to perform multi axial daily activities of living. Historically, the closed management of forearm fractures has been met with frustration in adults and resulted in poor functional outcome, hence perfect fracture reduction and rigid fixation is mandatory and achieved by plating.^[2] The number of forearm fractures is increasing faster than the predicted rate due to increasing number of road traffic accidents, increased incidence of violence, rapid industrialization, and various sports activities. Conservative treatment has resulted in malunion, non-union, synostosis and ultimately poor functional outcome.^[3] The present study is undertaken to know the functional outcome, advantages and complications of the LC-DCP. Thirty cases of fracture both bones of forearm were selected along the inclusion criteria's and treated with LC-DCP in Department of Orthopedics, Kempegowda Institute of Medical Sciences, Bangalore.

BACKGROUND: Fractures of forearm are difficult to treat because of rupture of interosseous membrane, interposition of soft tissue and malunion and nonunion.

KEYWORDS: Both bones forearm, radius, ulna, limited contact dynamic compression plate.

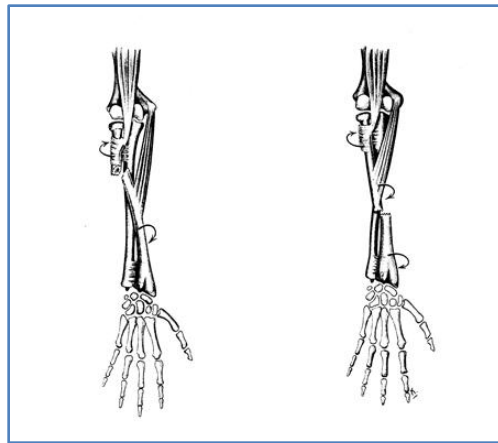


Fig. 1: Distracting forces in the forearm

METHODOLOGY: The present study includes treatment of 30 cases of fracture both bones of forearm by open reduction and internal fixation with 3.5mm LC-DCP at Kempegowda institute of medical sciences, Bangalore.

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Inclusion Criteria:

- Patients with both fresh and old diaphysial fractures of both bones of forearm.
- Patients above the age 16years.

Exclusion Criteria:

- Compound fractures, segmental fractures of forearm.
- Pathological fractures, infected fractures, non-union, malunion, delayed union.
- Monteggia and Galeazzi fractures.

RESULTS: The present study consists of 30 cases of fracture both bones of the forearm. All the cases were openly reduced and internally fixed with 3.5mm LC-DCP. The age of these patients ranged from 16-60 years with fracture being most common in 2nd and 3rd decade and an average age of 32.26 years. Out of 30 patients, 25 patients (83%) were males and 5 patients (17%) were females, showing male predominance. 17(56.7%) patients had injuries from Road traffic accidents, 10(33.3%0 from fall and 3(10%) from assault.

Mode of Injury	Number (n=30)	%
RTA	17	56.7
Fall	10	33.3
Assault	3	10

MODE OF INJURY

Side of Injury	Number (n=30)	%	95% CI
Left	18	60.0	42.32-75.41
Right	12	40.00	24.59-57.68

SIDE OF INJURY

Fracture site	Number (n=30)	%	95% CI
Proximal third	7	23.33	11.79-40.33
Middle third	16	53.33	36.14-69.77
Lower third	7	23.33	11.79-40.93

FRACTURE SITE

Majority of the fractures were seen in the middle third of both bones. 7 (23.33%) had proximal third fractures, 16 (53.33%) patients had middle third fractures and 7 (23.33%) patients had lower third fractures both bones forearm.

	Radius	Ulna	%
Comminuted	10	12	36.7
Transverse/ Short oblique	20	18	63.3

TYPE OF FRACTURE

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Surgical approach	Number (n=30)	%
Thompson	7	23.33
Henry's	23	76.67

SURGICAL APPROACH

Associated Injury	Number (n=30)	%
Abdominal injury	1	3.3
Fracture left tibia	1	3.3
Fracture Right Fibula	1	3.3
Head injury	1	3.3
Rib fracture	1	3.3
Right colles fracture	1	3.3

ASSOCIATED INJURY

Time of union	No. of cases	Percentage
<16 weeks	20	66.67
16 - 24	8	26.66
24-36	2	6.66
Total	30	100

TIME OF UNION

28 (93.33%) patients had sound union in less than 6 months, 2 (6.66%) patients had delayed union.

COMPLICATIONS:

Intraoperative complications: There were no cases of intraoperative complications.

Postoperative complications:

1. **Superficial Infections:** Three patients developed superficial infection. After culture and sensitivity report patient was treated with appropriate antibiotics and infection was subsided.
2. **Posterior Interosseous nerve Injury:** One Patient had developed posterior interosseous nerve injury on immediate postoperative period. Patients was treated with cockup splint and nerve stimulation, which recovered in about 12 weeks.
3. **Radioulnar Synostosis:** One patients developed proximal radioulnar synostosis and resulted in poor functional outcome.

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Complications	Number (n=30)	%
Posterior Interosseous Nerve injury	1	3.3
Radioulnar synostosis	1	3.3
Superficial infection	3	10.0
Nil	26	86.7
COMPLICATIONS		

Criteria for evaluation of results: “Anderson” et al scoring system (1975).^[4]

“Anderson’s Criteria”:

- **Excellent:** Union + loss < 10° Flexion/ Extension + loss of < 25% pronation/supination.
- **Satisfactory:** Union + loss of < 20° Flexion/ Extension + loss of < 50%.
- **Unsatisfactory:** Union + loss of > 30° Flexion/ Extension + loss of 50% supination/ Pronation.
- **Failure:** Nonunion with/ without loss of motion.

“AO group Criteria”^[1]:

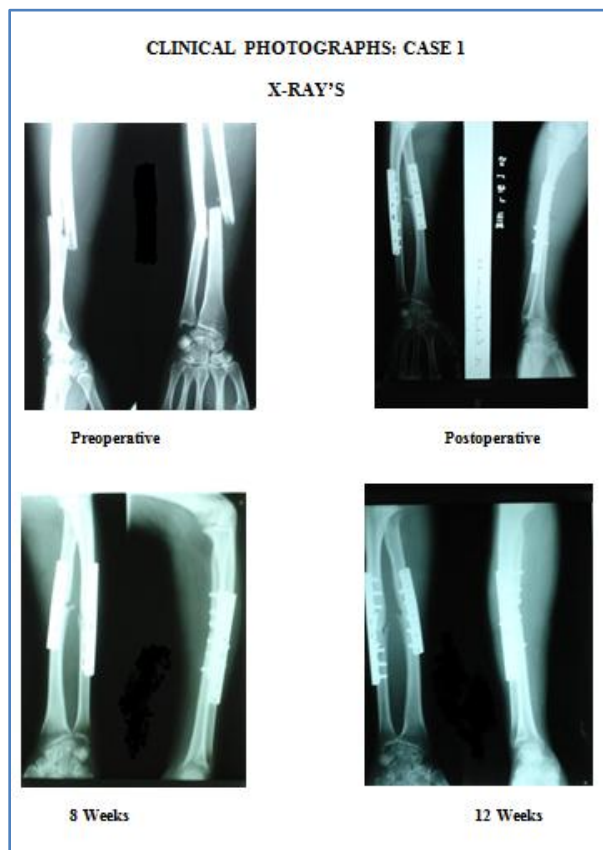
Judgment	Restriction of moment	Function	Discomfort:
Excellent	Flex 0/ Ext to 15 Pron/ Supin to 15 Dors/ Palmflex to 15 Rad/Ulnar abd to 5	OK	No
Good	Flex to 15/ Ext to 30 Pron/ Supin to 25 Dors/ Plamflex to 25 Rad/ Ulnar abd to 10	Minor loss	Yes
Satisfactory	Flex to 20/ Ext to 45 Pron/ supin to 45 Dors/ palmflex to 35 Rad/ Ulnar abd to 10	Medium loss of arm strength Neurologic dysfunction	Considerable
Poor	More than above	Considerable loss of arm strength Neurologic Dysfunction	Severe

Based on “Anderson’s” Criteria^[4] and “AO Criteria”^[1], we have formulated “Our- Criteria” and assessed the functional outcome result according to it.

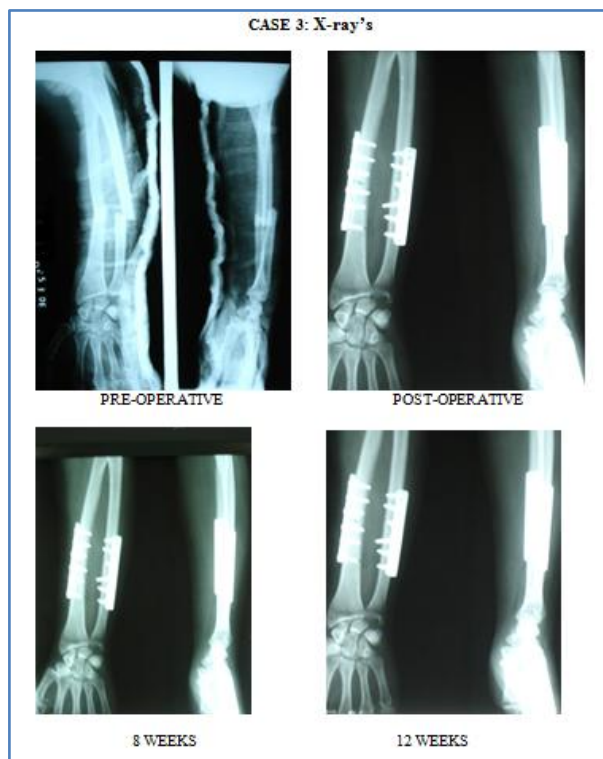
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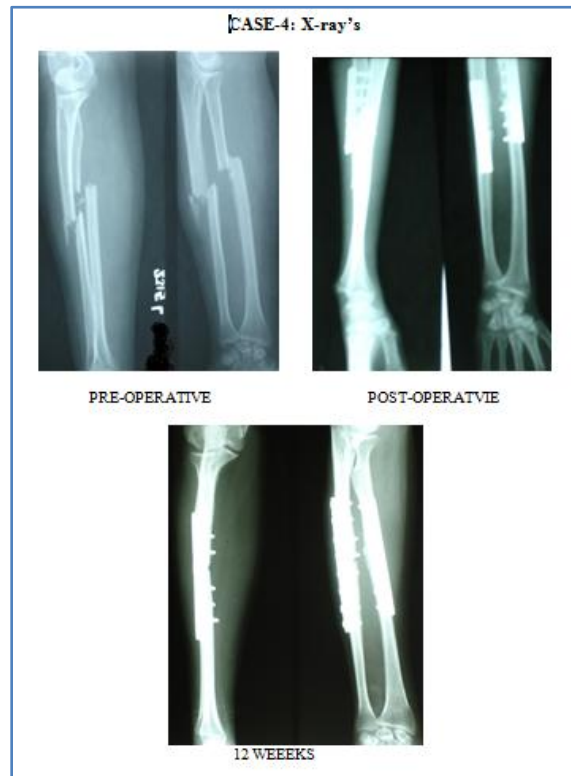
“Our Criteria”:

Result	Union	Restriction of movement	Function
Excellent	Union	Flex/ Ext Nil to 15 Pron/ Supin Nil to 15 Dors/ Plamflex Nil to 15 Dors/ Plamflex Nil to 15	No loss of function No pain
Good	Union	Flex/ Ext 15 to 30 Pron/ Supin 15 to 25 Dors/ Plamflex 15 to 25 Mild pain	Able to perform all the function,
Fair	Union	Flex/ Ext 25 to 35 Pron/ Supin 25 to 35 Dors/ Plamflex 25 to 35	Moderate restoration of function, Moderate pain
Poor	Nonunion	With or without restriction of movement	Complete loss of function, Severe pain



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DISCUSSION: Function of the forearm and hand is dependent on the combination of stability and mobility. Thus injuries of the forearm return of function depends on union of the fracture and motion of the forearm.^[1] To provide functional rehabilitation of forearm, anatomic reduction and rigid fixation is mandatory. This can be achieved by open reduction and internal fixation with limited contact dynamic compression plate and screws.^[5]

The present study was undertaken to determine the efficacy of LC-DCP in the treatment of fractures of both bones of the forearm. A total of 30 patients of fracture both bones of forearm were treated with open reduction and internal fixation using 3.5 mm LC-DCP. We evaluated the results. In our study fracture both bones of forearm was common between age group of 20-40 years with an average of 32.26 years (16-60 year). Our series had male predominant with 83% male patients and 17% female patients

In our study 56.7% of patients had road traffic accidents, 33.3% had a fall and 10% had direct blow (assault). We have accounted for 40% incidence of fracture both bones in right extremity, Our study accounted for 63.3% of fractures as transverse/short oblique and 36.7% were comminuted. In our series had 53% of fractures in middle third, 23.3% in proximal third and 23.3% in distal third. In our series we had an average union time of 13.56 weeks with range of 8 to 26 weeks. We had 100% union of both radius and ulna. In our series we had 21(70%) cases with excellent results, 5(16.7%) good, 3(10%) fair and 1(3.3%) case of poor result.

COMPLICATION: In our series, we had two cases of superficial infection. They were treated with appropriate antibiotics. There was one case of posterior interosseous nerve palsy. This case was treated conservatively with cockup splint and physiotherapy.

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We had a case of proximal radio-ulnar synostosis. We do not believe that this complication is related to the method of fixation: but rather to level of fracture and the degree of comminution.

Complications	Anderson	Chapman	Frankie	Present study
Infection	2.9%	2.5%	2%	10%
Nonunion	2.9%	2.3%	-	-
Posterior interosseous nerve injury	2%	1.5%	3%	3.3%
Radioulnar synostosis	1.2%	2.3%	-	3.3%

CONCLUSION: The aim of the present study was to assess the efficiency of operative treatment of forearm shaft fractures with LC-DC plating. Fracture of the both bones forearm is common in male in-between 20-40 years. Majority of the fractures were due to Road traffic accident and transverse/short oblique fractures in the middle third of the both bones of forearm were more common due to low velocity injuries. Open reduction and internal fixation with narrow LC-DC plating is an excellent mode of fixations as it gives good result and minimizes the complication of non-union, refracture and synostosis.

Early attempts at the functional result improve by open reduction and internal fixation and stable fixation with LC-DC plating. All the cases were operated at the earliest for all displaced fracture both bones of forearm. We preferred to proceed with the surgery as soon as possible. In surgical technique we preferred use of tourniquet in closed fracture to ensure blood less field, thus reducing the time of operation.

Surgical approach to ulna was relatively simple, for radius fracture of middle and lower third Henry's approach and for upper third Thompson approach was used. It is important for 6 cortices to be fixed on either side of fracture; however length of the plate was depended on the degree of comminution. The site of ulnar plate application was on subcutaneous border. The site of majority of radial plate application was on volar aspect.

Most of fractures united with an average range of 13.6 weeks due to biological and bio-mechanical principles of LC-DC plating (preserving the periosteal blood supply and less contact area between bone plate interface resulting in early union.) LC-DC plating of both bones of forearm produces excellent results when applied properly. To obtain excellent results proper preoperative planning, minimal soft tissue dissection, strict asepsis, fixation technique by AO principles, post-operative rehabilitation and patient education are mandatory.

SUMMARY: 30 cases of both bone forearm fracture were treated by open reduction and internal fixation with 3.5 mm LC-DCP, with a follow up range of 6-24 months. Road Traffic Accidents were common mode of injury, males were predominantly affected. Middle third of both bones were most affected region and transverse/ short oblique fractures were common due to low velocity injuries.

Comminution were common in ulna than the radius because of the stationary bone and subcutaneous border. Fractures united with an average of 13.6 weeks earliest being 8 weeks and longest union was 26 weeks. The results were based on our criterion, the combination of Anderson et al and AO criteria. In our study there were 70% (21 cases) excellent results, 16.7% (5 cases) good results, 10% (3 cases) fair and 3.3%(1 case) poor result.

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There was 100% union in all cases. 1 Case with poor function outcome had fracture united but with restriction of movement. This is not due to the method of fixation but due to poor postoperative rehabilitation.

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Date of Submission: 04/08/2014.
Date of Peer Review: 05/08/2014.
Date of Acceptance: 11/08/2014.
Date of Publishing: 20/08/2014.