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"A study of functional outcome of fracture both bones forearm in adults treated with locking compression plate."

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Abstract:
Background*: Fractures of Both Bones Forearm are one of the most common fractures of upper extremity in adults. Malunion and nonunion is not uncommon in both bone forearm fracture because of the difficulties in reducing the fracture and also maintaining reduction of two parallel bones in the presence of supinating and pronating muscles, which have angular as well as rotatory elements. Hence perfect fracture reduction and rigid fixation is mandatory which is achieved by plating*
Materials and Methods*: : In this retrospective study, we examined 40 patients, 31 male and 9 female of age group 18 to 70 years presented to department of orthopaedics JIIU's IIMSR, Jalna from 2018 to 2020 and who satisfied inclusion and exclusion criteria. all patients were treated with open reduction and internal fixation with 3.5 mm and locking compression plate and the results was evaluated according to Anderson criteria.*
Results*: 40 cases of fractures of both bones forearms were treated by Locking compression plate. Male were predominate (80%) and left forearm affection more (57.5%) than right. Most of the fractures are due to RTA (65%) rather than fall and assault. The average age was 37.35 yrs Most of the fractures of both bones of forearm were middle third and the fracture pattern simple was commonest. 37 patients had sound union in less than 16 weeks, remaining 3 patients had union between 16-24 weeks. The results were based on Anderson et al scoring system and in our study there were 37(87.5%) patients with excellent results and 04(10%) with good and 01(2.5%) patients with unsatisfactory results and no patient with poor results.*
Conclusion: *Our data show that open reduction and internal fixation with LCP provides good functional outcomes and low rate of complications.*
Key Word*: Both bones forearm fracture, LCP, Anderson et al criteria.*

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I. Introduction

Fractures of Both Bones Forearm are one of the most common fractures of upper extremity in adults [1, 2]. Increasing incidence of RTA, industrial accidents, assault, competitive sports and natural disasters have led to increase in frequency of both bone forearm fracture. A forearm fracture involving both bones requires open anatomical reduction with stable fixation [3]

Malunion and nonunion is not uncommon in both bone forearm fracture because of the difficulties in reducing the fracture and also maintaining reduction of two parallel bones in the presence of supinating and pronating muscles, which have angular as well as rotatory elements.Hence perfect fracture reduction and rigid fixation is mandatory which is achieved by plating [4-11]

Internal plate fixation stabilizes the fracture of both bones forearm & restores nearly normal anatomy & motion. The plates most commonly used for the internal fixation of the forearm fractures are 3.5mm locking compression plate (LCP).The LCP is an effective bridging device used for treating comminuted fractures12 And LCP is a stronger construct and by preventing primary and secondary loss of reduction it does not alter the natural course of healing of fracture[13]

The scoring system used to access functional outcome of fracture both bones forearm is "Anderson scoring system".

And variables to consider are–

a. Union of the fracture,

b. Range of elbow and wrist movements[2].

The purpose of this retrospective study was to know the functional outcome and duration of union of diaphyseal fracture both bones forearm in adults treated with locking compression plate in our institution.

II. Material And Methods

This retrospective study reports a consecutive series of 40 patients, who underwent open reduction and internal fixation with 3.5mm locking compression plates(LCPs) for diaphyseal fractures of the both bones forearm at the orthopaedics department of JIIU's Indian Institute of Medical Science and Research, Jalna between January 2018 to December 2020.

Study Design: Retrospective study

Study Location: This was a tertiary care teaching hospital based study done in Department of Orthopaedics, at JIIU's Indian Institute of Medical Science and Research, Jalna.

Study Duration: January 2018 to December 2020.

Sample size: 40 patients.

Inclusion criteria:

1. Patients > 18 years of age.
2. Patients with diaphyseal fracture of both bones of forearm
3. Closed fractures
4. Fresh fractures

Exclusion criteria:

1. Compound fractures of forearm bones
2. Infected fractures
3. Associated compartment syndrome
4. Neurovascular compromise

Demographic data of the patient, mechanism of injury, type of fracture (closed or open fracture), site and location of injury, complications were recorded.**(Table 1)**

Table 1: Table 1:Demographic Data

No. of patients	40
Age	18-70 years
Sex	Male-31 Female-9
Mechanism of Injury	RTA-26 Fall injury-13 Physical Assualt-1
Type of Fracture	Closed fracture-40 Open fracture-00
Level of fracture	Proximal third- 3 Middle third- 27 Distal third- 10

PROCEDURE METHODOLOGY:

Preoperative planning

- Pre-Operative Investigations (ECG, Chest X-ray, CBC,Hb, Blood group, PT-INR, LFT, KFT, HIV, HBsAg) and X-ray forearm AP,Lat.
- A written and informed consent was taken
- With the help of radiographs an approximate length of the plate to use was assessed
- A dose of IV antibiotics was given 30minute before the surgery.

Operative Procedure

- Type of Anaesthesia –General Anaesthesia or Brachial Block
- **Approaches**[16]

1) Dorsal Thompson Approach
   -For Proximal Radius & mid shaft fractures
2) Volar Henry's Approach
   -For distal two third radius fracture
3) For Ulna – directly over the subcutaneous border

- A plate of at least 6 holes used

Postoperatively

- Active elbow wrist and finger movements was encouraged

- IV Antibiotics (second generation cephalosporin) for 3 days given
- Wound inspected after 5 days
- Suture removal done after 14 days
- Patient was followed up regularly at 2 weeks, 6 weeks, 12 weeks and 24 weeks and evaluation done using **Anderson et al scoring system (Table 2)**

Table 2: Anderson et al Criteria to grade functional outcome

Results	**Union**	**Flexion and Extension at elbow joint**	**Supination and pronation at forearm**
Excellent	Present	< 10 degree loss	< 25% loss
Satisfactory	Present	< 20degree loss	<50% loss
Unsatisfactory	Present	> 20 degree loss	>50% loss
Failure	Nonunion with / without loss of motion		

X-ray photos

Figure 1: Pre-operative

Fiegure 2: Post-operative

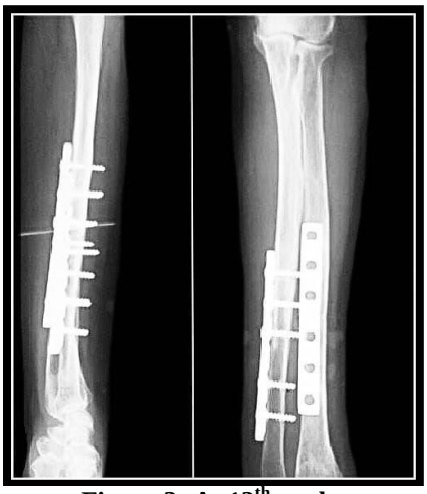


Figure 3: At 12th weeks

Figure 4: At 24th weeks

Statistical analysis
Data was analyzed using SPSS version 20 (SPSS Inc., Chicago, IL)

III. Result

A total of 40 patients, 32 males and 8 females were treated with locking compression plate after initial preoperative check up and investigation.

Distribution according to Age (Table 3)
In our study patients between ages of 18 to 70 were included with a mean age was 37.35%

Table 3 Distribution according to Age

	Minimum	Maximum	Mean	S.D.
Age	18	70	37.35	14.34

Distribution according to Sex (Table 4)
In our study 80% cases were males and 20% cases were females.

Sex	**Frequency**	**Percentage**
Male	32	80 %
Female	8	20 %
Total	40	100 %

Distribution according to Mode Of Injury (Figure 4) (Table 5)

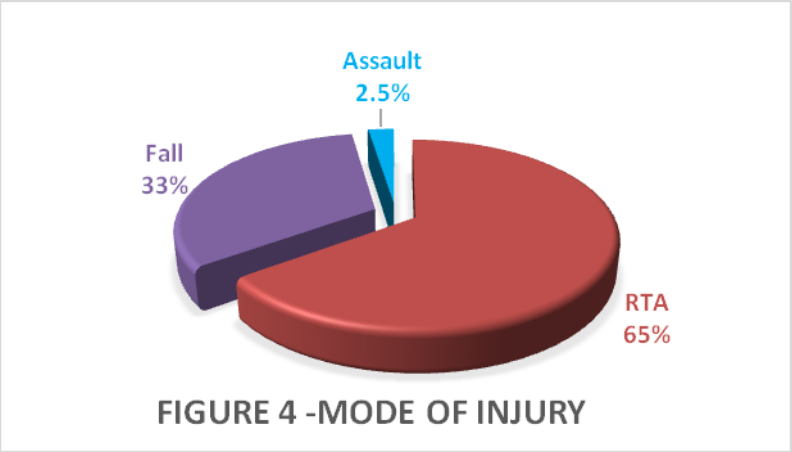


FIGURE 4 -MODE OF INJURY

In our study we found that 26 patients had history of RTA, 13 patients had history of fall and 1 patient had history of assault.

Table 5

	Frequency	Percentage
RTA	26	65 %
Fall	13	32.5 %
Assault	1	2.5 %
Total	40	100 %

Distribution according to Laterality (Table 6)

In our study right side was implicated in 17 cases (42.5%) and the left in 23 cases (57.5 %)

Side	Frequency	Percentage
Right	17	42.5 %
Left	23	57.5 %
Total	40	100 %

Distribution according to Level Of Fracture (Table 7)

In our study we found out that there was an incidence of 7.5 % fractures in proximal 1/3rd , 67.5% fractures occurred at middle 1/3rd and 25% fractures at distal 1/3rd.

	Frequency	Percentage
Proximal 1/3rd	3	7.5 %
Middle 1/3rd	27	67.5 %
Distal 1/3rd	10	25 %
Total	40	100 %

Distribution according to Type Of Fracture (Table 8)

	Frequency	Percentage
Simple	29	72.5 %
Wedge	8	20 %
Complex	3	7.5 %
Total	40	100%

Surgical complication among patients(Table 9)

In our study we found out that 97.5% didn't have any postoperative infection, while 2.5% developed superficial surgical site infection.

Table 9

	Frequency	Percentage
No any superficial infection	39	97.5 %
Superficial infection	1	2.5 %
Total	40	100%

Time taken for union of the bone(Table 10)

It was found out in our study that 92.5% of cases achived union before 16 weeks, 7.5% united between 16 to 24 weeks.

Table 10

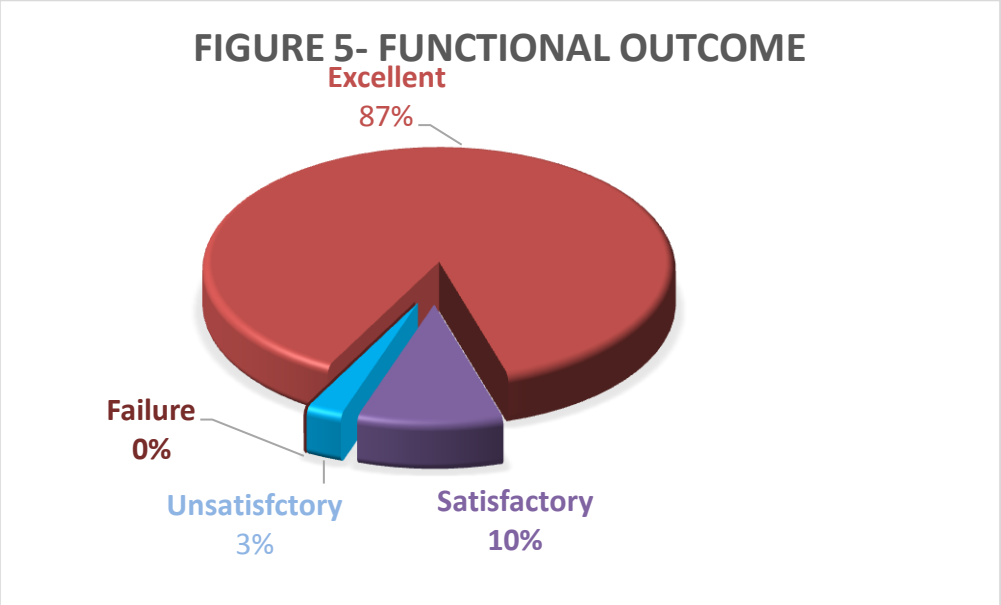
	Frequency	Percentage
<16 weeks	37	37 %
16 to 24 weeks	7.5	3 %
>24 weeks	00	0%
Total	40	100%

Functional outcome(Table 11) (Figure 5)

In our study the functional outcome was assessed on final follow-up that is on 24th weeks according to Anderson scoring system which included evaluation of flexion and extension range of motion of elbow, supination and pronation range of motion of wrist and the radiological union. On evaluation we found out that there was 87.5% patient with excellent results 10% patients with satisfactory results, 2.5% patient with unsatisfactory results and 0 with poor result

Table 11

	Frequency	**Percentage**
Excellent	35	87.5%
Satisfactory	04	10%
Unsatisfactory	01	2.5%
Failure	00	00
Total	40	100%



IV. Discussion

Fractures of both bone forearm are one of the most common fractures of upper extremity in adults. The forearm plays an important role in positioning of the hand in space by flexion and extension of the elbow and wrist as well as pronation and supination through the proximal and distal radioulnar joint. Fracture of both bone forearm therefore result in significant dysfunction if treated inadequately. The return of function depends on union of fracture and motion of forearm. This can be achieved by open anatomical reduction with rigid fixation with locking compression plate (LCP) and screws.

The results obtained from our study was compared with the similar study conducted countrywide.

40 cases of diaphyseal fracture of both bones forearm in adults treated at JIIU's IIMSR Jalna with locking compression plate (LCP).

Age distribution

In the present study the average age of patient was 37.35years with range being 18 to 70 years which is comparable to the study made in 2007 to 2009 by Saikia, et al[12] who found it to be 29 years.Leung F,et al[17] accounted an average age as 35 years.

Sex distribution
In the present study we found the incidence of forearm fracture to be 80% in males and 20% in females the incidence of forearm fracture was more among males compared to females. Which is comparable to the study by Leung F,et al[17] in 2003 (Males 82.6% & Females 17.4%).Chapman et al[9] in 1989 found males 78% & females 22%.

Extremity affected
In our study we found an incidence of 42.5% of right forearm fractures and 57.5 % left forearm fractures which is comparable to study by chapaman et al[9] (right 55% and left 45%) in 1989. Singh S, et al[18] in their study found incidence to be 42% right & 58% left.

Mode of injury
In our present study majority of patients mode of injuries RTA 65%, 32.5% had fall and 2.5% had assault which is comparable to study by Saikia et al[12] in 2006 to 2009 with RTA 53.3%,fall 30%,assault 6.7%. Singh S,et al[18] found incidence of 64%RTA and 12% fall.

Type of fracture
In our present study we found an incidence of 72.5% simple 20% of wedge and 3% complex fracture.

Level of fracture
In our present study we found an incidence of 67.5% middle one third 7.5% proximal one third and 7.5% distal one third fracture which is similar to study by Manjappa CN[19] 60% middle 1/3rd, 25% proimal1/3rd, and 15% distal 1/3rd)

Time of union
In our present study mean union time was found to be 14weeks.Which was comparable to the study conducted by Sakia,et al[12] where mean union time for forearm fixed with LCP was found to be 14.16 weeks (range 8-21weeks) Sharma S,et al[13] in their study of diaphyseal forearm bone fractures treated by locking compression plate(LCP) reported mean union time of 12.6 weeks (range 8-24 weeks).Leung F, et al[17] in their diaphyseal forearm bone fractures treated by locking compression plate(LCP) reported mean union time of 20 weeks(range 8-36weeks)

Complications
In our study 39 patient did not have any post operative infection and 2.5% patient developed superficial infection which was successfully treated with oral antibiotics

Functional outcome
Detailed analysis of functional result of patient it was done on the basis of Anderson et al criteria. In our study we had 35 (87.5%) patient with excellent result and 4 (10%) patient with satisfactory result 1 (25%) patient with unsatisfactory results and no failure results. Chapman et al[9] reported 36 (86%) cases as excellent ,3(7%) satisfactory, 1(2%) unsatisfactory and 2(5%) failure. Leung et al[17] reported 98% of cases as excellent and 2% of satisfactory results. Saikia et al[12] reported89% of cases excellent, 8% of cases as satisfactory, 3% patient of cases as unsatisfactory without any failure case. Anderson et al[14] reported excellent 50.9%, satisfactory 34.9%, unsatisfactory 11.3% and failure 2.9% in their study.

V. Conclusion

Our data show that open reduction and internal fixation with LCP provides good functional outcomes and low rate of complications.

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