

A study of open reduction and internal fixation of radius and ulna fracture in adults; minimum 6 months follow up

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Abstract: Diaphyseal fractures involving the radius and ulna, so called "both-bone" or "double-bone" forearm fractures are common orthopedic injuries. These injuries can result in significant loss of function if inadequately treated. As the upper extremity serves to position the hand in space, loss of forearm motion and/or muscle imbalance resulting from a poorly treated fracture can be particularly debilitating. Preservation of the anatomic relationships of the proximal and distal radioulnar joints as well as the interosseous space is critical to preserving function. This article overviews the management of diaphyseal fractures of the radius and ulna in adults.

Materials& method: fifty patients with both bone forearm fractures were treated surgically at Department of Orthopaedics.

[Specific Surgical procedure and evaluation scale to be written in short in the methodology]

Results : In our series we had 28 (56%) cases with excellent results, 9 (18%) were satisfactory and 2 (4%) case of unsatisfactory result and 11 (22%) case of failure due to radius and ulnar non union. Our series had 58% of excellent result,18% satisfactory results and 4% unsatisfactory results and 22% failures which is comparable to the previous studies. Unsatisfactory result was seen in a male and female patient with comminuted fracture.

Conclusion: With the use of AO/ASIF 3.5 mm LCDCP for fractures of Both Bone's forearm, rigid and anatomical fixation were achieved and satisfactory outcome 58% is achieved in this study.

- **Radial bowing** is very important for normal supination and pronation. This can be maintained very well with compression plates.
- **Postoperatively** with LC- DCP fixation, additional supportive measures may not be required after soft tissue healing, and shoulder, elbow, and wrist movements can be started early.
- A minimum of **6 cortices** should engage in each fracture fragment. Transverse and short oblique fracture give good result. It is better to use longer plates like a bridge plate in case of comminuted oblique fractures.
- **Infection and nonunion** is the most common complication in 24% after surgery which also require debridement and reprocedure with bone grafting and internal fixation and in some patients with external fixation also.

Key words: both bone forearm fracture ,complication ,functional outcome.

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I. Introduction:

The forearm, being a component of the upper limb serves important movements that are important in activities of daily living. The forearm, in combination with the proximal and distal radioulnar joints, allows pronation and supination which in turn helps the hand, to perform multi-axial movements.

With mechanized farming in India and industrialization, fractures of forearm bones have become more common. Fracture of the forearm bones may result in severe loss of function unless adequately treated. Hence good anatomical reduction and internal fixation of these fractures are necessary to restore function. Closed reduction which was employed in earlier days yielded unsatisfactory results from either nonunion or loss of motion. Also, there are complex forces acting on the forearm bone that makes the reduction and maintenance of displaced fracture fragments difficult.

Union may be achieved with any of the methods available, however, severe loss of function may be the end result unless adequately treated with proper technique and implants. With the development of compression plate osteosynthesis which provides a good treatment option and predictable outcome, there is an important change in the treatment of forearm fractures³⁵. This method helps in the perfect reduction of fracture fragments in anatomical position by rigid fixation and early mobilization, and functions of the hand can be achieved at the earliest.

The functional outcome was certified using "*Anderson et al. scoring system*¹". The variables taken into consideration were:

- a. Union of the fracture
- b. Range of elbow and wrist movements
- c. Extent of functional capacity reached

Aims and Objectives:

AIM

- To assess the functional outcome of open reduction and internal fixation of fracture both bones forearm with plate osteosynthesis.

OBJECTIVES

- To study fracture healing and union rate by using serial radiographs, prevent angulations and rotational deformity and mobilize the forearm as early as possible.

To study age and sex distribution of the patients with fracture of both bone forearm in adults and study complications of surgery if any, depending upon the level of fracture.

II. MATERIALS AND METHODS

A prospective study of FIFTY patients in the age group of 18-60 years with diaphyseal fractures of both bones forearm admitted in Department of ORTHOPEADICS SURGERY, GURU GOVINDSING GOVERNMENT HOSPITAL, JAMNAGAR during the period of JULY 2020 to JANUARY 2022, meeting the inclusion criterion are the subjects for the present study. The complete data was collected by taking the history of illness and by doing detailed clinical examinations and relevant investigations.

Inclusion Criteria:

- Patients with closed diaphyseal fractures of both bones of the forearm.
- Patients above the age of 18 years and below 70.
- Patients fit for surgery.
- Men and women both included in study
- Patients who have completed minimum of 6 months after surgery are included.

Exclusion Criteria:

- Compound fractures of forearm bones.
- Patients not willing for surgery.
- Patients medically unfit for surgery.
- Pathological fracture.
- Age below 18 years and above 70.

Preoperative planning:

- Consent of the patient or relative was taken prior to the surgery.
- The appropriate length of the plate to be used was assessed with the help of radiographs.
- A dose of tetanus toxoid and antibiotic was given preoperatively.
- If evidence of compartment syndrome, surgery must be done as soon as possible.

INSTRUMENTS AND IMPLANTS USED IN PLATING FOR FOREARM BONES

- Drill and Drill Bit of 2.5mm and 3.5mm
- 3.5mm Drill sleeve system
- 3.5mm countersink
- 3.5mm universal drill guide
- Depth gauge
- Tap for 3.5mm cortical screw
- 3.5mm Cortical Screws
- Plate Holding Clamp (Lowman's Clamp)
- Hexagonal Screw driver
- Bending templates
- Bending press/ pliers

- Narrow 3.5mm stainless steel LCDCP & DCP of varying length
- General instruments like Bone Holding Forceps, Periosteum Elevator, Bone Lever, Bone Reduction Clamps

INSTRUMENTS & IMPLANTS



Figure -7: INSTRUMENTS & IMPLANTS

- Osteoporotic fracture.

III. OBSERVATION / RESULTS:

In this study, 50 patients with di

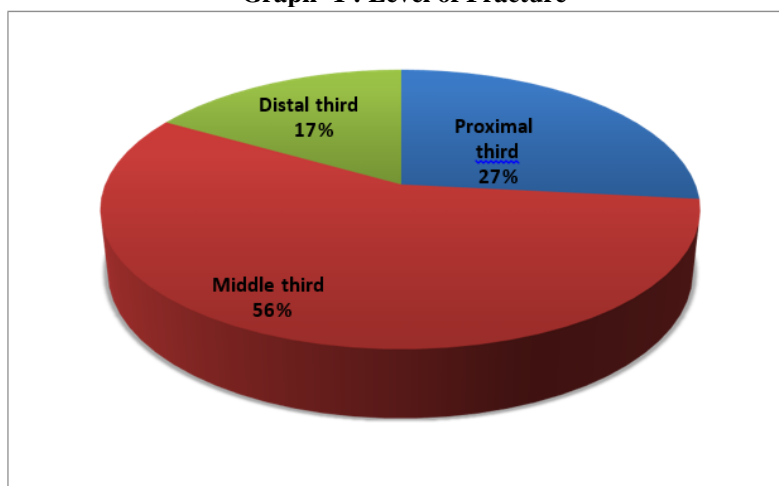
Level of fracture

The majority of the fractures were seen in the mid diaphysis of both bones of the forearm. 24 (48.00%) patients had mid diaphyseal fractures, 15 (30.00%) had proximal third fractures and 11 (22.00%) patients had a lower third fracture of both bones of the forearm.

Table -1: Level of Fracture

Level of fracture	Number of Patients	Percentage
Proximal third	15	26.66%
Middle third	24	56.33%
Distal third	11	16.66%
Total	50	100.00%

Graph- 1 : Level of Fracture



6. Type of the fracture

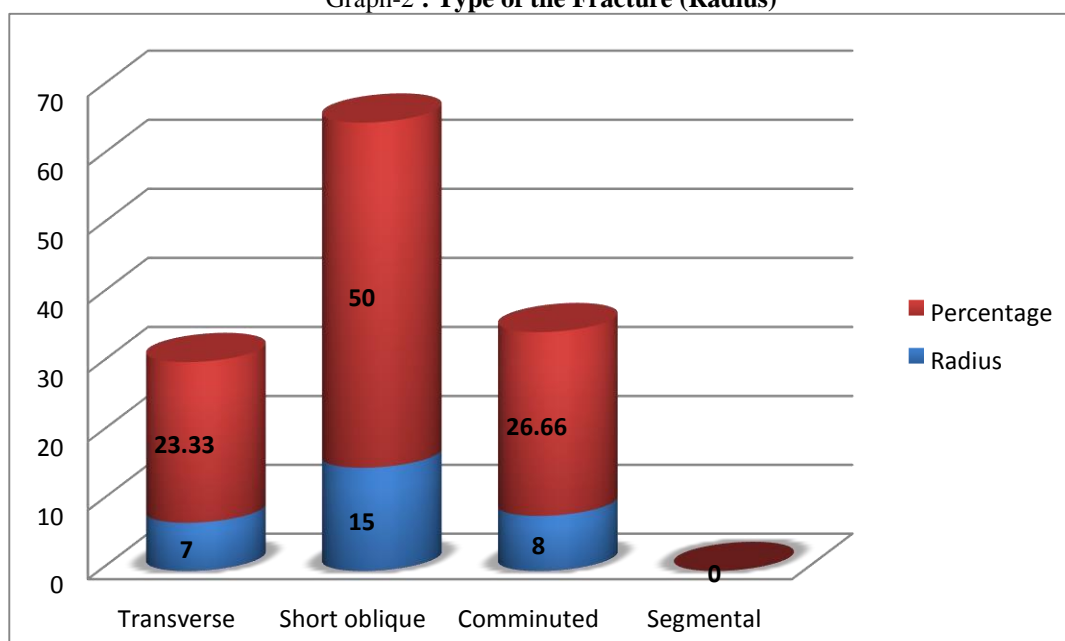
As we had included diaphyseal fractures of both bones, in our study, in total we had total of 50 radius shaft fractures and 50 ulna fractures.

Among 50 radius fractures, 26(52.00%) were transverse and 10 (20%)were short oblique type and 14(28.00%) were comminuted variety.

Table -2: Type of the Fracture (Radius)

Type of fracture	Radius	Percentage
Transverse	26	52.00%
Short oblique	10	20.00%
Comminuted	14	28.00%
Segmental	0	0
Total	50	100.00%

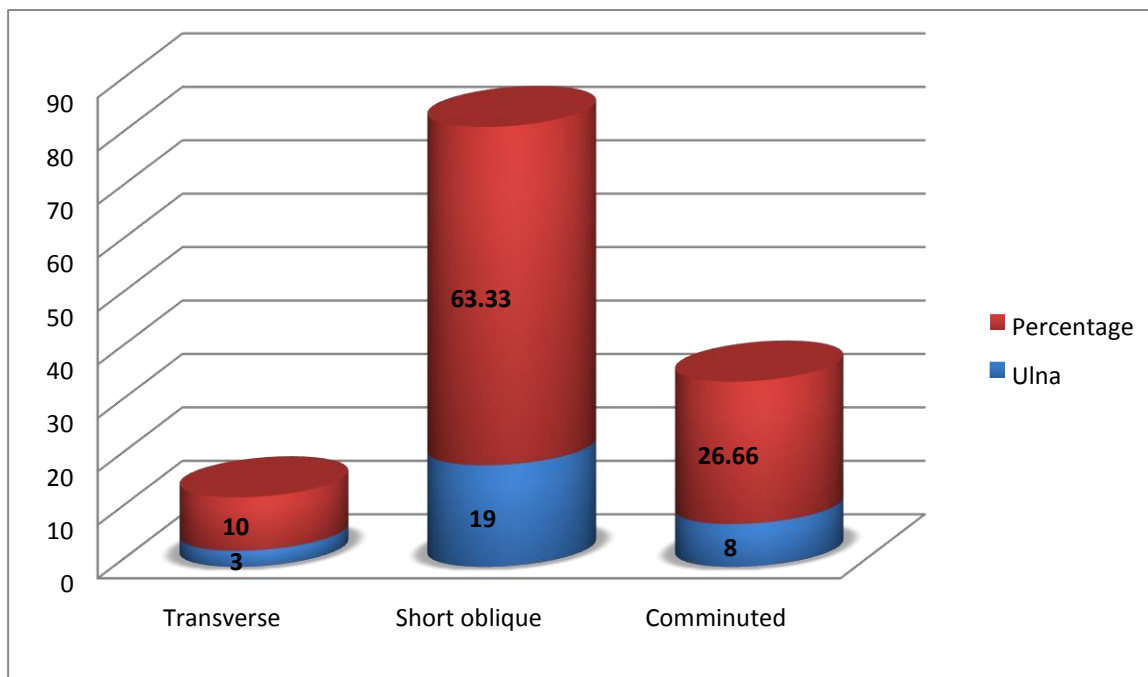
Graph-2 : Type of the Fracture (Radius)



Among 50 ulna fractures, 24(48.00%) were transverse and 10(20.00%) were short oblique type and 16 (32%) were comminuted variety.

Table-3: Type of the Fracture (Ulna)

Type of fracture	Ulna	Percentage
Transverse	24	48%
short oblique	10	20%
Comminuted	16	32%
Total	50	100%



Graph-3 : Type of the Fracture (Ulna)

displaced forearm fractures were treated by open reduction and internal fixation. This study was conducted from SEPTEMBER 2020 to JANUARY 2023, at the Department of orthopaedic Surgery, at GURU GOVINDSING GOVERNMENT HOSPITAL JAMNAGAR, GUJARAT.

Criteria for evaluation of results: "Anderson" et al scoring system (1975)

Table-11: Criteria for Evaluation of Results

Results	Union	Flexion/Extension at elbow joint and wrist	Supination and pronation of forearm
Excellent	Present	<10° loss	<25% loss
Satisfactory	Present	<20° loss	<50% loss
Unsatisfactory	Present	>20° loss	>50% loss
Failure	Non union with or without loss of motion		

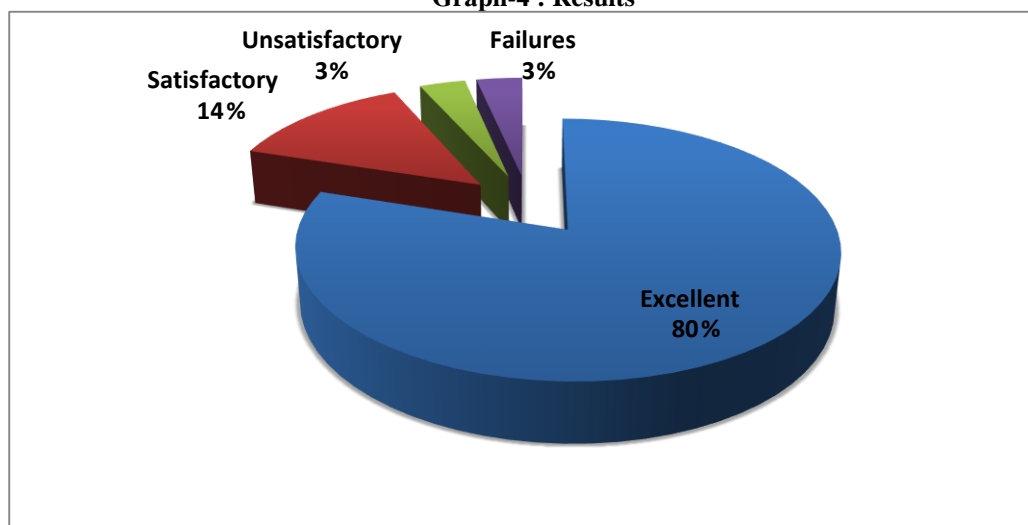
Results

Using the Anderson et al scoring system we had 28 (56%) patients with excellent results, 9 (18%) patients with satisfactory results and 2 (4%) patient with the unsatisfactory result, and 11 (22%) patient had a failure. The failure was due to radius and ulnar non-union which was later treated by open reduction and internal fixation with a bone graft.

Table-4: Results

Results	Number of Patients	Percentage
Excellent	28	56%
Satisfactory	9	18%
Unsatisfactory	2	4%
Failures	11	22%

Graph-4 : Results



IV. DISCUSSION

This study was conducted from JULY 2020 to JANUARY 2023 , at the Department of orthopaedic Surgery, GURU GOVINDSING Government Hospital, JAMNAGAR, GUJARAT.

Unless treated adequately, forearm fractures may lead to severe functional loss. Hence, anatomical reduction and rigid internal fixation of these fractures are necessary to restore function.

This study was conducted at our hospital with the aim of knowing the importance of rigid anatomical reduction and fixation of forearm diaphyseal fractures with 3.5 mm LCDCP. This in turn was reciprocated in the functional results obtained. Our study had a patient number of 50 to obtain a statistically significant result.

We evaluated our results and compared them with those obtained by various other studies. Our analysis is as follows.

1. Age distribution:

The age of these patients ranged from 18-60 years and an average age of 35 years. Our findings are comparable to the study made by Michael W. Chapman et al. (1989) series which showed the average age as 37years.

Table-15: Age Distribution Comparison

Series	Min. age(yrs)	Max. age(yrs)	Average(yrs)
Michael Chapman	13	79	37
H.N. Burwell	16	57	44.8
Present study	18	70	35

2. Sex distribution:

Our series had male preponderance with (70 %) 35male patients and (30%) 15 female patients which were comparable to previous studies.

Michael Chapman noted about 78% males and 22% are females. Talwalkar in his series had 80% males and 20% females³⁴.

Table-16: Sex distribution comparison

Series	Males (%)	Females (%)
M. Chapman	78%	22%
Talwalkar	80%	20%
Present study	70.00%	30.00%

1. Mode of injury:

In our study, there were 17(34.00%) patients with road traffic accidents, 28(56.00%) patients with falls, and 2(4.00%) patients with assault ,1(2.00%) patient with industrial injury,2(4.00%) patients with sports injury. Talwalkar series had 26.6% of his cases to road traffic accident, 16.6% due to industrial accident, **50% due to fall** and 6.6% due to direct blow.

Table-17: Mode of Injury comparison

Series	Accident (%)	Fall(%)	Direct blow/assault(%)	Industrial accident/fall of heavy object
Talwalkar	26.6	50	6.6	16.6
Present Study	34%	28%	4%	1%

4. Extremity affected:

We had about 44% incidence of forearm fractures in right and 56% left extremities, which is also comparable to the previous studies.

M. W. Chapman reported about 55% incidence of fractures in the right extremity.

H. N. Burwell and A. D. Charnley reported about 50% incidence of fracture in the right arm.

Table 18: Extremity Affected

Series	Right (%)	Left (%)
H.N.Burwell	50	50
M.W.Chapman	55	45
Present study	44%	56.00%

5. Fracture anatomy

a. Type of fracture:

As our series we had included diaphyseal fractures of both bones,in our study, in total we had a total of 50 radius shaft fractures and 50 ulna shaft fractures. Among 50 radius, 26(52%) were Transverse,10(20%) were short oblique type and 14(28%)were comminuted variety .

Among 50 ulna fractures, 24(48.00%) were transverse and 10(20.00%) were short oblique type and 16 (32%) were comminuted variety.

M. W. Chapman et al, series noted about 53% of fractures as comminuted and 47% were transverse/short oblique On an average we had 65.33% with Transverse/ short oblique type and 33.66% were comminuted variety. Our observation in this respect was not comparable to any of the studies available.

b) Level of fracture:

M. W. Chapman et al noted about 59% and 61% of fractures in middle third of Radius and ulna, 13% and 21% in the proximal third of radius and ulna, and 28% and 12% in the lower third of the radius and ulna respectively.

Our study had 24(48%) of fractures in middle third, 15(30%) in proximal third and 11(22%) in lower third, comparable to previous studies.

6. Time of union:

Anderson's criteria for evaluation of union were taken into account. In our study, we had an average union time of 7.8 weeks.

Anderson's et al showed union time of around 7.4 weeks with a range of 5 to 10 weeks, 97% of the cases united.

Chapman in a study had 98% union with a range of 6 to 14 weeks of union the average union time was 12 weeks.

The present series had an average union time of 7.8 weeks with a range of 5 to 12 weeks. Radius united in 60% cases. we had Ulna union in 56% of cases.

The results of our present studies are comparable to the all previous studies.

7. Functional results:

The range of motion was determined and Anderson et al, scoring system was used as a measure for the functional outcome.

Chapman et al reported 36 cases (86%) as excellent, 3 satisfactory (7%), 1 unsatisfactory (2%) and 2 failure (5%). Anderson et al reported about 54 (50.9%) cases as excellent, 37 (34.9%) satisfactory, 12 (11.3%) unsatisfactory and 2 (2.9%) failure.

In our series we had 28 (56%) cases with excellent results, 9 (18%) were satisfactory and 2 (4%) case of unsatisfactory result and 11 (22%) case of failure due to radius and ulnar non union.

Our series had 58% of excellent result, 18% satisfactory results and 4% unsatisfactory results and 22% failures which is comparable to the previous studies. Unsatisfactory result was seen in a male and female patient with comminuted fracture.

8. Complications

In our study, we had 4 cases of superficial infection. The wound was debrided, and pus sent for culture. They resolved with appropriate antibiotics. 2 cases of posterior interosseous nerve palsy was noted after surgery where the radius was approached in the proximal third through the dorsal approach. The patient was treated conservatively and there was a resolution of the nerve injury by 2.5 months. We had noted a 12 cases of non-union of fracture which was treated by open reduction and internal fixation with bone graft. We had 2 cases of implant failure which was treated with implant removal and replating and in 2 patients bone shortening also done for rid of infection of that part of bone.

9. Follow Up

Anderson et al had a follow-up from 4 months to 9 years with an average of 3 years. In his series, Moed followed patients from 12 months to 9 years with an average of 3 years. Chapman 5 series had follow-ups which ranged from 6 months to 48 months with an average of 12 months.

We had a follow-up which ranged from 6 months to 24 months with an average mean of 14 months, which is comparable to Chapman series.

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