IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 15, Issue 6 Ver. V (June. 2016), PP 01-07
www.iosrjournals.org

A Prospective Study of Clinical and Radiological Outcome in Fracture Both Bone Forearm in Adults Operated With Dynamic Compression Plate

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Abstract: *Introduction: Both bone forearm fractures in adults are one of the common Upper limb fractures in adults. The purpose of the study was to assess Clinical and radiological outcome in fracture both bone forearm in adults operated with dynamic compression plate.*

Materials and methods: *In this study 60 patients with forearm fractures, were treated by open reduction and internal fixation with 3.5 mm dynamic compression plate (DCP) and screws, in patients with displaced fractures of the shaft of forearm bones.. Forearm movements and Radiological Time for union were recorded.*

Results: *An average of 10 degree extension lag and 15 degree restriction of flexion was seen in our study. An average of 20 degree loss of pronation and supination was seen in our study. And this limitation was more pronounced in Patients with proximal diaphyseal fractures. Average duration of radiological union was 12 weeks. 2 patients had Surgical site Infection, 1 patient had Posterioir Interosseus nerve injury and 1 patient had Nonunion of both bones*

I. Introduction

Both bone Forearm fractures are the "fractures of necessity" i.e. they require operative management and are not amenable for conservative treatment. The principle of fixation of all Diaphyseal fractures is to restore length, alignment and rotation, to achieve stable rigid internal fixation, to maintain fracture biology and to ensure early rehabilitation. Since forearm muscles are under the influences of rotatory forces i.e.. prontion and supination, achieving reduction might be difficult. Malunion and loss of reduction are expected complications. Open reduction and internal fixation with Dynamic compression plate is generally accepted as the best treatment for displaced diaphyseal fractures in the adult. Though Intramedullary nails have the advantage of maintaining fracture biology, they offer little rotational control. Dynamic compression plating is the gold standard method for non osteoporotic and non pathological forearm fractures in adults.

II. Materials And Methods

This prospective study consists of 60 patients of fracture of both bones of forearm, came to our department Bangalore medical college & Research Institute, Bangalore. Who gave informed consent for surgery. The ethical clearance was obtained from institutional ethics committee.

Inclusion criteria were (1)Age more than 15 years and less than 60 years(2)displaced diaphyseal fractures of both bones of forearm in adults.(3).closed or type 1 compound diaphyseal fractures of both bones of forearm.(4)competent neurological and vascular status of the affected extremity.

Exclusion criteria were (1) type II and III open factures (2)fractures of both bones of forearm in children aged less than 14 years (3)Segmental fractures.(4).Cases with pathological fracture(5) Patients with Isolated fracture of radius or ulna(6)Patients with Compromised vascularity .

AO classification was used in our study. All the cases underwent open reduction and internal fixation under brachial block or general anesthesia, under tourniquet. The radius fractures were approached either by Thompson's approach or Henry's approach, the ulnar fractures by standard posterior subcutaneous approach and the fractures were fixed with 3.5mm dynamic compression plate employing the surgical techniques described by the AO/ASIF group.

Figure 1: Preoperative and immediate post operative xrays

The patients were followed up every 4 weeks for first 3 months and every 6 weeks till next 3 months. The results were evaluated on the basis of fracture union, range of movements, muscle (grip) strength and complications. The functional outcome was assessed using the criteria of Anderson et al .The complications were evaluated in terms of infections (superficial/deep), nonunion, implant failure and secondary loss of reduction, refracture.

Table 1: Anderson et al Criteria for Evaluation of Results

Results	Union	Flexion/Extension at elbow joint and wrist	Supination and pronation of forearm
Excellent	Present	$<10^0$ loss	<25% loss
Satisfactory	Present	$<20^0$ loss	<50% loss
Unsatisfactory	Present	$>20^0$ loss	>50% loss
Failure	Non union with or without loss of motion		

III. Results

There were 40 males (67%) and 20 females (33%),with an average age 32 years (range 15-60 years). 45 patients sustained injury due to RTA and 15 patients due to fall on outstretched hand. 58 cases were closed fractures and 2 were open fractures. .39cases (66%) had fractures on the right side and 21 cases (34%) had fractures on the left side. The fractures were classified according to AO/ASIF alpha numeric classification system. 6 cases (10%) had fractures in the upper one third, 44cases (73%) had fractures in the middle one third, 10cases (17%) had fractures in the lower one third.

TABLE 2: Number of cases according to AO classification

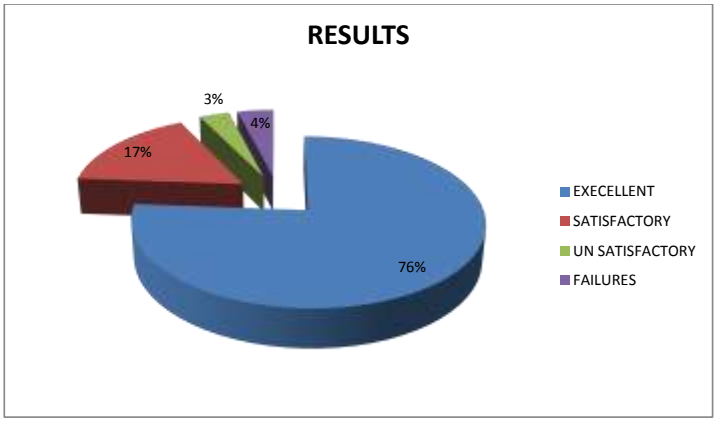
AO CLASSIFICATION	Number of patients
22 A3	35
22 B3	18
22 C3	7

Functional outcomes assessed with Anderson's Criteria according to which 76% were excellent, 16% were satisfactory and 3% failure rate.

Table-3: Results

Results	Number of Patients	Percentage
Excellent	46	76.66
Satisfactory	10	16.66
Unsatisfactory	2	3.33
Failures	2	3.33

GRAPH 1



Duration of Radiological union of the fracture group

Table 4: Duration of union

Bone involved	Duration for union
Both Radius & ulna	12.33 weeks
Only radius	10.3 weeks
Only Ulna	11.6 weeks

IV. Discussion

The forearm, being a component of upper limb serves important movements that are important in activities of daily living. The forearm, allows pronation and supination which in turn helps hand, to perform multi axial movements.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 is necessary to restore function.[11] this study was conducted at our hospital with the aim to know the importance of anatomical reduction and stable fixation of forearm diaphyseal fractures with 3.5 mm DCP. This in turn was reciprocated on the functional results obtained. Our study consists of 60 patients. We evaluated our results and compared them with those obtained by various other studies. Our analysis is as follows.

1. Age distribution: In our study, the age of these patients ranged from 15-60 years and an average age of 32.7 years. Our findings are comparable to the study made by, Michael W.Chapman et al, (1989) series which showed average age as 33years.[21]H.Nevile Burwell and A.D. Charnley in 1964 witnessed 50% of the patients between second and third decade and an average of 44.8 years[52]. Herbert S.Dodge and Gerald W.Cady found 24 years as the average age in their series[12].Berton R.Moed(1986) found the average age was 22years[24].

2. Sex distribution:Our series had male preponderance with (66.666 %) male patients and (33.333%) female patients which were comparable to William.A.T studies. Michael Chapman noted about 78% males and 22% females.[21] William in his series had 67% of males and 33% of females.[53] H.Dodge in his study noted about 89% males and 11% females[12].Talwalkar in his series had 80% males and 20% females.[54]

3. Fracture anatomy

a) Type of fracture: As in our study, Among 60 diaphyseal fractures,in radius 48(80%) were Transverse/short oblique type and 12(20%) were comminuted variety. In ulna 44 (73.33%)were transverse/short oblique and 16(26.66%) were communited.As segmental fractures was excluded in our study.M. W. Chapman et al, series noted about 53% of fractures as comminuted and 47% were transverse/short oblique. On an average we had 66.33% with Transverse/short oblique type and 33.66% were comminuted variety. Ours were not comparable to any of the studies available. The results were not comparable to the previous studies, which can be attributed to low velocity trauma in our country

b) Level of fracture. W. Chapman et al noted about 59% and 61% of fractures in middle third of Radius and ulna, 13% and 21% in proximal third of radius and ulna and 28% and 12% in lower third of radius and ulna respectively[21].A.Sarmiento et al, noted about 84.6% of fracture both bones were in middle third and 15.4% of cases had lower third fracture of both bones[10].H.S. Dodge and G.W. Cady documented 71.5% fracture both bones n middle third, 21.5% in distal third and 7% in proximal third.[12]Our series had 73.33% of fractures in middle third, 10% in proximal third and 16.66% in lower third, comparable to Dodge.H.S and Cady studies.

4. Time of union: Anderson's criteria for evaluation of union were taken into account. In our study we had an average union time of 10.5 weeks. Anderson's et al showed union time of around 7.4 weeks with range of 5 to 10 weeks, 97% of the cases united[1]. Chapman in a study had 98% union with range of 6 to 14 weeks union the average union time was 12 weeks[21].Mc Knee study had average union time of 10.7 weeks with range of 5 to 18 weeks. He had 97.3% union rate. The present series had average union time of 10.5 weeks with a range of 8 to 16 weeks. Radius united in all cases we had Ulna union in 96.6% of cases. The results of our present studies are comparable to the previous studies

5. Complications: In our series we had 2 cases of superficial infection. They resolved with appropriate antibiotics.A case of posterior interosseous nerve palsy noted after surgery where radius was approached in proximal third through dorsal henry approach. Patient was treated conservatively and there was resolution of the nerve injury by 2.5 months.We had noted a case of non union of ulna fracture which was treated by open reduction and internal fixation with bone graft.

Table no 17: Complications Comparison

COMPLICATIONS	Anderson	Chapman[27]	Frankie[2]	Present study
SUPERFICIAL INFECTION	2.9%	2.5%	2%	6.66%
DEEP INFECTION	-	-	-	0
RADIO ULNAR SYNOSTOSIS	1.2%	2.3%	-	0
NON UNION	2.9%	2.3%	-	3.33%
NERVE INJURY-POST INTEROSSEOUS	2%	1.5%	3%	3.33%

6. Functional results:

The range of motion was determined and Anderson et al, scoring system was used as a measure for the functional outcome.[1] Chapman et al reported 36 (86%) cases as excellent, 3 (7%) satisfactory, 1 (2%) unsatisfactory and 2 (5%) failure[21].Anderson et al reported about 54 (50.9%) cases as excellent, 37 (34.9%) satisfactory, 12 (11.3%) unsatisfactory and 2 (2.9%) failure.[1]In our series we had 46 (76.66%) cases with excellent results, 10 (16.66%) satisfactory and 2 (3.33%) case of unsatisfactory result and 2 (3.33%) case of failure due to ulna non union.Our series had 93.33% of excellent /satisfactory results and 3.33% unsatisfactory results and 3.33 (%) failures which is comparable to the previous studies.Unsatisfactory result was seen in a female patient with comminuted fracture. The patient was uncooperative where she didn't follow physiotherapy properly.

Picture 2: Follow up images

V. Conclusion

In the era of Locking Compression plates, Dynamic compression plate still is the gold standard for the diaphyseal fractures of forearm. The plate is designed to give compressionand absolute stability of fractures, which is essentially for fracture union. Hence Dynamic compression plate are still relevant in fixation of diaphyseal fractures.

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