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Evaluation Of Results In Fracture Both Bones Forearm Treated With Dynamic Compression Plating. A 2 Year Follow-up Study.

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I. Introduction

The incidence of forearm fractures are increasing faster than the predicted rate due to increase in population, increasing number of vehicles rapid industrialisation, increased incidence of violence and various sports activities have contributed to the increased incidence of fracture shaft of both bones forearm.

The reasons for higher rate of non-union and malunion as well as poor functional outcome, are due to complex anatomical structure with a coordination between muscles, tendon, bones and joints which is responsible for the multifold functions of the arm and hand including pronation and supination where the radius rotates around the ulna.

Conservative treatment has resulted in malunion, non-union, synostosis and ultimately poor functional outcome. Open reduction helps in perfect reduction of fracture fragments in anatomical position by rigid fixation and early mobilisation, the normal functions of the hand can be re achieved at the earliest.

We evaluated Twelve cases of fracture both bones forearm after inclusion and exclusion criteria, and treated by open reduction and internal fixation wit DCP. The objective of our study is to the age and sex incidence of fracture both bones forearm, possible complications of the surgery and to evaluate the functional outcome after fixation.

II. Materials and Methods

This study includes treatment of twelve cases of fracture of both bones of forearm by open reduction and internal fixation with 3.5 mm DCP between august 2013 to august 2015, with 2 year follow up of all the 12 patients. This is a prospective time bound study. Sample size is 12 patients.

Inclusion criteria

1. Simple fractures.
2. Open fracturesGustilo and Anderson type I and type II.
3. Age criteria from15 to 70 years, both males and females

Exclusion Criteria

1. Age criteria 0 to 14 years &> 70 years
2. Radiologically proven segmental fractures and isolated fore arm bone fractures.
3. Pathological fracture..
4. Gustilo and Anderson type III
5. Patient medically unfit for surgery.

Evaluation

The results are evaluated with DASH SCORE criteria and for evaluation of forearm bones fracture. The results are compared with previous studies.

All the patients were evaluated clinically and radiologically after admission. surgical profile and pre anaesthetic evaluation were done. 8 cases were done under general anaesthesia and 4 cases were done under brachial block. Under tourniquet Radius was approached by Volar Henry approach and ulna as it can be palpated subcutaneously, incision given directly palpating it. A narrow 3.5 mm LC-DCP was used and a minimum of 6 cortices were engaged with screw fixation in each fragment. In comminuted fractures long plate was used to achieve adequate stability and prevent mechanical overload and failure. Minimal periosteal elevation was done to preserve the blood supply.

Postoperative care

The limb was kept elevated for 24 to 48 hours and the patient was instructed active elbow and fingers movements as tolerated. Suction drain was removed after 24 to 48 hours. Suture removed on 10th postoperative day. In grossly comminuted patients posterior slab was given for 3 weeks unless its a stable rigid fixation.

Physiotherapy
A posterior plaster splint was applied for comfort for 2 to 3 days. Patient was encouraged to perform both active and assisted range of motion exercises of shoulder, elbow and hand. Elbow range of motion, supination and pronation exercises were begun as soon as remission of pain and swelling of forearm permits. Because of rigidity of fixation, rapid return of motion was expected. These isotonic exercises are very much essential for the excellent outcome. Physiotherapy helps in fracture union by increasing blood supply and preventing muscles from getting tethered to bone and soft tissues from contractures.

Follow-up
All the patients were followed every six monthsupto 2 years, and evaluation was done based on "Anderson et al scoring system"(1).Elbow movements and wrist movements were noted and the union was assessed radiologically.The fracture was designated as united, when there was presence of periosteal callus bridging the fracture site and trabeculations extending across the fracture line.The patient rated outcome was assessed using the disabilities of the arm, shoulder and hand (Quick DASH) questionnaire, a 11 item similar questionnaire in regional language intended to assess the functional symptoms of patients with disorders of the upper limb.(2)
The DASH score was seen to be higher in patients who did not regain their full range of motions at the wrist and forearm. The DASH scoring was performed from 6 months onward.

III. Results

The present study consists of 12 cases of fracture both bones of the forearm. All the cases were openly reduced and internally fixed with 3.5mm DCP. The study period was from August 2013 to September 2015.

AGE	NO OF PATIENTS	PERCENTAGE
15-20	2	17
21-30	3	25
31-40	4	33
41-50	1	8
51-60	2	17
61-70	0	0
TOTAL	12	100

1. The age of these patients ranged from 15- 70 years with fracture being most common in 3rd decade and an average age of 31 years.

Table 1 Age distribution.

2. Out of 12 patients, 8 patients (66%) were males and 4 patients (34%) were females, showing male preponderance because of working in fields and motor vehicle accidents.

SEX	NO. OF PATIENTS	PERCENTAGE
MALE	8	66
FEMALE	4	34
TOTAL	12	100

Table 2. Sex distribution

3. Out of 12 patients, 4(34%) with right forearm fracture and 8 (66%) patients with left forearm fracture.

SIDE EFFECTED	NO. OF PATIENTS	PERCENTAGE
RIGHT	4	34
LEFT	8	66
TOTAL	12	100

Table 3. side effected.

4. Majority of the fractures were seen in the mid diaphysis of both bones. 5(42%) patients had middle third fractures, 4(33%) had lower third fractures and 3 (25%) patients had proximal third fractures both bones forearm.

LEVEL OF INJURY	NO. OF PATIENTS	PERCENTAGE
MIDDLE THIRD	5	42
PROXIMAL THIRD	3	25
LOWER THIRD	4	33
TOTAL	12	100

5. Majority of the fractures were transverse / short oblique. About 9% of radius and 9%of ulna fractures were comminuted.

TYPE OF FRACTURE	RADIUS	ULNA
TRANSVERSE/ SHORT OBLIQUE	11	11
COMMINUTED	1	1
TOTAL	12	12

6. Duration of fracture union.

TIME OF UNION	NO. OF CASES	PERCENTAGE
< 4 MONTHS	9	75
4-6 MONTHS	3	25
6 MONTHS - 1 YEAR	0	0
TOTAL	12	100

7. Only one case developed post operative complication : superficial surgical site infection, managed with antibiotics.

8. Functional results at 2 years follow up

RESULTS	NO. OF CASES	PERCENTAGE
EXCELLENT	11	91.6
SATISFACTORY	1	8.4
UNSATISFACTORY	0	-
TOTAL	12	100

IV. Discussion

Fracture both bones of forearm are commonly encountered in day-to-day orthopaedic practice in our hospital and it presents a formidable challenge to the orthopaedicians, as the various muscle forces acting upon the fracture tend to displace it. Hence to provide the functional rehabilitation of the upper limb, anatomic reduction and rigid fixation is mandatory.

As reported by Knight and Purvis closed reduction and its maintenance is difficult (3) and intramedullary nails have got high failure rate. Though there are few advantages like closed nailing, minimal tissue dissection and hospital stay. So, the best option is plating. Different types of plates are available. The dynamic compression plates (DCP) give good results. We evaluated our results and compared with those obtained by various other studies utilising different modalities of treatment.

Analysis

1. Age distribution : In 2003, Frankie Leung and Shew Ping chow accounted an average of 36 years (11-90 years)(4).In the present study, fracture was common in third and fourth decadewith average age of 31 years.
2. Sex distribution: In 2006 Frankie-Leung series showed 82.6% males and 17.4% females(4). In our study, male preponderance with 66% males and 34% female patients, which was comparable to 1964 burwell et al, and William AT studies.
3. Fracture anatomy :

Type of fracture : Chapman et al series noted about 53% of fractures as comminuted and 47% were transverse/short oblique(5). In present study accounted 91% of fractures as transverse/short oblique and 9% were comminuted . The results were not comparable to the previous studies, which can be attributed to low velocity trauma in our country

Level of fracture

In all reported series, the incidence of fracture is highest in the middle third and least in the proximal third. Sarmiento A et al noted about 84.6% of fracture on both bones were in middle third and 15.4% of cases had lower third fracture of both bones(6).

Herbert Dodge and Cady GW documented 71.5% fracture on both bones in middle third, 21.5% in distal third and 7% in proximal third.

Chapman MW et al noted about 59% and 40% 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(5).

4. Time for union

In most of the reported series, it is usually around 12 weeks except in the series of Anderson et al,where he reports a union time of 7.4 weeks (average). Time for union varies according to age, general condition, rigidity of fixation and presence of infection. Also interobserver variation is there, regarding time of union.

Absence of tenderness at the fracture site and disappearance of fracture line with callus formation is taken as union. Anderson's criteria for evaluation of union were taken into account. In our series, we had an average union time of 12.2 weeks, with the range of 9 to 28 weeks. We had 100% union of both radius and ulna.

5. Functional results

Fracture union and range of movements are the two factors, which affect the functional outcome. So early mobilization prevent soft tissue contracture, muscular tethering and improves the vascularity. Dash scoring system was used as a measure for the functional outcome.Anderson et al reported about 54 (50.9%) cases as excellent, 37 (34.3%) satisfactory, 12 (11.3%) unsatisfactory and 2 (2.9%) as failure(1).

Chapman et al reported about 36 (86%) cases as excellent, 3 (7%) satisfactory, 1 (2%) as unsatisfactory and 2 (5%) as failure(5).Frankie Leung reported 98% cases as excellent and 2% as satisfactory results(4).

In present study, we had 11 (91.6%) with excellent results, 1 (8.4%) as satisfactory.

V. Conclusion

We conclude open reduction and internal fixation using DCP for both bones fracture forearm is an effective treatment modality when compared other methods like pop casing and nailing with minimal surgical complications . Functional results at 2 year follow up were at acceptable range .Use of separate incisions for radius and ulna and preservation of the natural curves of radius will lesser the rate of complication. It minimizes vascular damage to the plated bone segment. It should lead to more versatile and efficient application of internal fixation.

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