Original Research Article

Functional outcome of diaphyseal fractures of both bones of forearm in adults after fixation with dynamic compression plate at a tertiary care center

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Abstract

Background: Treatment of diaphyseal forearm fractures in adults is generally based on open osteosynthesis with plates and screws on each of the forearm bones. Nonunion of the fracture seems to be the most frequent complication of these fractures. In present study we aimed to analysed functional outcome of diaphyseal fractures of both bones of forearm in adults after fixation with dynamic compression plate at a tertiary care center. **Material and Methods:** Present study was retrospective, case record based study, conducted in patients with acute diaphyseal fractures of forearm treated with dynamic compression plate or intramedullary nailing who were 18–60 years of age and type 1, type 2 compound fractures. **Results:** 30 cases satisfying study criteria were considered for study. The age of these patients ranged from 18-60 years, had mean age of 35.03 ± 9.82 years. Male to female ratio was 1.5:1. with fracture being most common in 3rddecade and an average age of 31 years. In present study right sided injuries (60%) were common, common mode of injury was RTA (66.67%). Majority of the fractures were seen in the middle 1/3rd (46.67 %), were simple fractures (53.33 %) and closed (86.67 %). Majority of fractures were healed in less than 4 months (73.33 %), followed by 4-6 months (20 %). Mean time required for fracture union was 17.32 ± 3.77 weeks. No intraoperative complications were noted. Postoperative complications such as Superficial Infections (3.3 %) and radioulnar synostosis (3.3 %) were noted in one patient each. Using the Anderson scoring system, at 6 months follow-up, 83.33 % patients had excellent results, 13.33% patients had satisfactory results and 1 (3.3%) patients had unsatisfactory result (radioulnar synostosis). **Conclusion:** Open reduction and internal fixation with dynamic compression plate had excellent functional outcome in the majority of patients, maintain rotational stability and length and early mobilization of elbow and wrist joint and had minimum complications.

Keywords: diaphyseal fractures, Radius, Ulna, Dynamic compression plate, forearm

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INTRODUCTION

The forearm, in combination with the proximal and distal radioulnar joints, allows pronation and supination which in turn helps hand, to perform multi axial movements. Fracture both bones of forearm 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 The incidence of diaphyseal fractures of the radius, ulna or both is reported to be approximately 1 to 10 per 10,000 persons per year, although rates may vary according to age and sex.

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In this era of active life, rapid industrialisation, increasing road traffic accidents, competitive sports; the incidence of fractures of forearm bones are increasing in frequency.[2] Treatment of diaphyseal forearm fractures in adults is generally based on open osteosynthesis with plates and screws on each of the forearm bones. Nonunion of the fracture seems to be the most frequent complication of these fractures.[3,4] The plates most widely used for the internal fixation of the forearm fractures are 3.5 mm locking compression plate (LCP), dynamic compression plate, and limited contact dynamic compression plate. In present study we aimed to analysed functional outcome of diaphyseal fractures of both bones of forearm in adults after fixation with dynamic compression plate at a tertiary care center.

MATERIAL AND METHODS

Present study was retrospective, case record based study, conducted in Department of Orthopaedic, Swami Ramanand Teerth Rural Government Medical College, Ambajogai, India. Cases operated between January 2016 to December 2020, for management of diaphyseal forearm fractures treated by open reduction and internal fixation with dynamic compression plate were considered for this study. Study approval was taken from institutional ethical committee. Acute diaphyseal fractures of forearm treated with dynamic compression plate or intramedullary nailing who were 18–60 years of age and type 1, type 2 compound fractures were included in study and people with pathological fracture, associated neurovascular injury, crush injuries and multiple fractures with head injuries were excluded. Patient details such as demographic details, clinical history, mode of injury, relevant past medical history, clinical examination findings, X-ray reports, laboratory investigations were noted from patient records. Surgery details, hospital course, post-operative details were noted from records. The functional outcome was assessed according to Anderson scoring system which included evaluation of the movements and radiological union done during follow-up were noted. Data was collected and compiled using Microsoft Excel and statistical analysis was done using descriptive statistics.

RESULTS

30 cases satisfying study criteria were considered for study. The age of these patients ranged from 18-60 years, had mean age of 35.03 ± 9.82 years. Male to female ratio was 1.5:1. with fracture being most common in 3rddecade and an average age of 31 years. In present study right sided injuries (60%) were common, common mode of injury was RTA (66.67%). Majority of the fractures were seen in the middle 1/3rd (46.67 %), were simple fractures (53.33 %) and closed (86.67 %).

Table 1: General characteristics of study participants.

Variable	No. of Patient's (n=30)	Percentage
Mean Age(yrs)	35.03 ± 9.82	
Gender (Male: female)	22/08	73.33/26.67
Fracture side (right: left)	18/12	60/40
Mode of injury		
Road traffic accident	20	66.67
Fall from height	4	13.33
Slip and fall down	3	10.00
Assault	3	10.00
Fracture site		
Proximal 1/3rd	7	23.33
Middle 1/3rd	14	46.67
Distal 1/3rd	9	30.00
Type of fracture		
Simple	16	53.33
Comminuted	11	36.67
Segmental	2	6.67
Closed fractures	26	86.67
Open fractures	4	13.33

Majority of fractures were healed in less than 4 months (73.33 %), followed by 4-6 months (20 %). Mean time required for fracture union was 17.32 ± 3.77 weeks.

Table 2: Duration of fracture union

Time of union	No. of cases	Percentage
< 4 months (16 weeks)	22	73.33
4-6 months (16 – 24 weeks)	6	20.00
6 months - 1 year (24-36 weeks)	2	6.67
Mean time	17.32 ± 3.77 weeks	

In present study, no intraoperative complications were noted. Postoperative complications such as Superficial Infections (3.3 %) and radioulnar synostosis (3.3 %) were noted in one patient each.

Table 3: Complications

Complications	No. of cases	Percentage
Superficial infection	1	3.3
Radioulnar stenosis	1	3.3

Using the Anderson scoring system, at 6 months follow-up, 83.33 % patients had excellent results, 13.33% patients had satisfactory results and 1 (3.3%) patients had unsatisfactory result (radioulnar synostosis).

Table 4: Functional outcome

Results	Union	Flexion / Extension at elbow joint	Supination and pronation	No. of cases	Percentage
Excellent	Present	$<10^0$ loss	<25% loss	25	83.33
Satisfactory	Present	$<20^0$ loss	<50% loss	4	13.33
Unsatisfactory	Present	$>20^0$ loss	>50% loss	1	3.33
Failure		Non union with / without loss of motion		0	0

DISCUSSION

Fracture of the forearm both bones may result in severe loss of function unless adequately treated. Anatomical reduction of the fracture fragments, stable internal fixation, preservation of blood supply to the bone fragment, early active pain free mobilization of the adjacent muscles and joints are the principle for fixation of both bone fracture in adults.[5] Open reduction and internal fixation with plate gives good reduction and rigid fixation, and also radial bow can be maintained, primary bone healing is achieved. When fracture gap is compressed by dynamic compression plate, capillaries grow in medullary callus and union rates are high.[6,7] The disadvantages are the risks of any open surgical fixation, that is increase in chance of infection, disturbance of the soft tissues, periosteal stripping, and evacuation of fracture hematoma.[8] With conventional plating, the screw acts as an anchor, with its axial force press the plate against bone, which produces large frictional force at the bone plate interface and this force has been shown to cause vascular disturbance, especially in the periosteum. The term limited contact dynamic compression plate(LC-DCP) stands for a new approach to plate fixation, reduced trauma to the bone , preservation of blood supply, avoidance of stress raisers produced at implant removal and improved healing.[9] In a comparative study by Venkataraman S *et al.*,[10] average union time in DCP group is 23.39 weeks and square nail group is 28.89 weeks. Union in DCP group was 27 (90%) and square nail group 22 (73.33%). Delayed union in DCP group was 03 (10%) and in Square nail group was 6 (20%), non-union in DCP group was 0 (nil) and in square nail group was 2 (06%). Open reduction and internal fixation with DCP plates for both bone diaphyseal forearm fractures gives good results with early union rates. Similar findings were noted in preset study. Girish Sahni *et al.*,[11] studied 50 cases of fracture forearm bones treated by 3.5 mm dynamic compression platting, after follow up period of 6 to 10 months, 80% were graded excellent, 18% good and 2% as failure. Similar findings were noted in present study. External support was not used. ORIF with DCP still has a prospect in repair of forearm factures considering its low complication rate, cost and acceptable results in developing country like India where financial matter and non availability of C-arm image intensifier are to be considered. Kamlesh Jaswani[12] studied 30 cases of fracture BBFA treated by open reduced and internally fixed with 3.5 mm LCDCP. Age distribution ranged from 15- 55 years with fracture being most common in 3rd and 4th decade (Average 31).Side affected 20 (66.66%) right side and 10 patients (33.33%) left side. By Andersons scoring system, 25 (83.33%) patients with excellent results, 4 (13.33%) patients with satisfactory results and 1 (3.3%) with unsatisfactory result (radioulnar synostosis). Superficial infection 2 (6.66%) posterior interosseous nerve injury 3 (10%) and Radioulnarsynostosis 1 (3.3%) were complications. Meeravali SK[13], studied retrospective data of 56 patients with fractures of both the radius and ulna underwent repair by dynamic compression plate with screw fixation. were studied, Patient regained full range of movements within : 6-8 weeks. At 12-14weeks check X ray showed good radiological union. In this series out of 56 cases 42 (75%) cases are graded excellent, 7 (12.5%) cases are graded good, fair 5 (9%) cases and poor 2 (3.5%) cases. better results were noted in present study. It is essential to regain length, apposition, axial alignment and normal rotational alignment while treating diaphyseal fractures of the radius and the ulna to gain good range of pronation and supination can be achieved by open reduction and internal fixation with dynamic compression plate.

Limitations of present study were retrospective nature, small sample size.

CONCLUSION

Open reduction and internal fixation with dynamic compression plate had excellent functional outcome in the majority of patients, maintain rotational stability and length and early mobilization of elbow and wrist joint and had minimum complications.

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