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Original Research Article

A Retrospective Functional Outcome Assessment of Diaphyseal Fractures of Both Bones of Forearm in Adults after Fixation with Dynamic Compression Plate

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Abstract

Aim: The aim of the present study was to analyse the functional outcome of diaphyseal fractures of both bones of forearm in adults after fixation with dynamic compression plate at a tertiary care center.

Methods: The present study was retrospective, case record-based study, conducted in Department of Orthopaedics for the period of 2 years. 50 cases satisfying study criteria were considered for study. Cases operated for management of diaphyseal forearm fractures treated by open reduction and internal fixation with dynamic compression plate was considered for this study.

Results: The age of these patients ranged from 18-60 years, had mean age of 36.04 ± 8.84 years. 72% were male and 28% were females. In present study right sided injuries (64%) were common, common mode of injury was RTA (66%). Majority of the fractures were seen in the middle 1/3rd (46%), were simple fractures (52%) and closed (86%). Majority of fractures were healed in less than 4 months (72%), followed by 4-6 months (20%). Mean time required for fracture union was 16.34 ± 3.78 weeks. Postoperative complications such as Superficial Infections (4%) and radioulnar synostosis (4%) were noted in two patients each. Using the Anderson scoring system, at 6 months follow-up, 84% patients had excellent results, 12% patients had satisfactory results and 2 (4%) 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

Introduction

Fractures of both radius and ulna are one of the most common fractures in adults in upper extremity. [1] In this era or active life, rapid industrialisation, increasing road traffic accidents, competitive sports, the incidence of fractures of forearm bones are increasing in frequency. [2] 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. The chances for the occurrence of malunion and non-union are greater because of the difficulties in reducing and maintaining the reduction of two parallel bones in the presence of the pronating and supinating muscles, which have regulatory as well as rotatory influences. [3] To obtain and hold an accurate reduction internal fixation is usually necessary.

Open reduction and internal fixation with dynamic compression plate is a common procedure done for fractures of both bones forearm. [4] Newer modalities of plate osteosynthesis such as locking plate and limited contact plate have been introduced, DCP is still a choice of many surgeons. [3] Bone fractures are commonly encountered in today's industrial era. Various treatment modalities have been introduced from time to time and each of them have some edge over the previous one. Fracture of the forearm bones may result in severe loss of function unless adequately treated. The number of forearm fractures is increasing faster than the predicted rate due to rapid industrialization, increased incidence of violence, fall, road traffic accidents, various sports activities and direct blow.

In general, complications are more common and prognosis is worse for displaced both bone fracture and for open fractures in adults. On an average, undisplaced fracture takes six to eight weeks to heal, and displaced fracture takes 3 to 5 months. Function may be most obviously affected with loss of pronation/ supination [5] and as many as half of patients with both bone forearm fractures will have obvious loss of forearm pronation, which may or may not be functionally significant. Intramedullary nailing is also an option for both bone forearm fracture fixation with advantages like less operative time, less blood loss, less soft tissue damage, no periosteal stripping minimizes disruption of fracture biology. Intramedullary nail can be used in open diaphyseal fracture of radius or ulna. Fracture both bone forearm treated with various surgical modalities like open reduction and internal fixation with dynamic compression plating, limited contact dynamic compression plating, semi-tubular plating or closed reduction and internal fixation with intramedullary nail. There is no consensus as to whether intramedullary nail or plate is the optimal treatment method. In forearm both radius and ulna form important bone, along with both bone, introsseous membrane is also stabilizing structure. Any fracture at any level with disruption of introsseous membrane will results in loss of function. Therefore restoring near normal anatomy becomes important to regain full function. Rotational alignment should be achieved. [6]

The aim of the present study was to analyse the functional outcome of diaphyseal fractures of both bones of forearm in adults after fixation with dynamic compression plate at a tertiary care center.

Materials and Methods

The present study was retrospective, case record based study, conducted in Department of Orthopaedics, Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga, Bihar, India for the period of 2 years. 50 cases satisfying study criteria were considered for study. Cases operated for management of diaphyseal forearm fractures treated by open reduction and internal fixation with dynamic compression plate was considered for this study. 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 was noted. Data was collected and compiled using Microsoft Excel and statistical analysis was done using descriptive statistics.

Results

Table 1: General characteristics

Variables	N	%
Mean Age(yrs)	36.04 ± 8.84	
Gender (Male: female)	36/14	72/28
Fracture side (right: left)	32/18	64/36
Mode of injury		
Road traffic accident	33	66
Fall from height	7	14
Slip and fall down	5	10
Assault	5	10
Fracture site		
Proximal 1/3rd	11	22
Middle 1/3rd	23	46
Distal 1/3rd	16	32
Type of fracture		
Simple	26	52
Comminuted	18	36
Segmental	6	12
Closed fractures	43	86
Open fractures	7	14

The age of these patients ranged from 18-60 years, had mean age of 36.04 ± 8.84 years. 72% were male and 28% were females. In present study right sided injuries (64%) were common, common mode of injury was RTA (66%). Majority of the fractures were seen in the middle 1/3rd (46%), were simple fractures (52%) and closed (86%).

Table 2: Duration of fracture union

Time of union	N	%
< 4 months (16 weeks)	36	72
4-6 months (16 – 24 weeks)	10	20
6 months - 1 year (24-36 weeks)	4	8
Mean time	16.34 ± 3.78 weeks	

Majority of fractures were healed in less than 4 months (72%), followed by 4-6 months (20%). Mean time required for fracture union was 16.34 ± 3.78 weeks.

Table 3: Complications

Complications	N	%
Superficial infection	2	4
Radioulnar stenosis	2	4

Postoperative complications such as Superficial Infections (4%) and radioulnar synostosis (4%) were noted in two patients each.

Table 4: Functional outcome according to Anderson scoring system

Results	Union	Flexion / Extension at	Supination and pronation	N	Percentage
Elbow joint					
Excellent	Present	<10° loss	<25% loss	42	84
Satisfactory	Present	<20° loss	<50% loss	6	12
Unsatisfactory	Present	>20° loss	>50% loss	2	4
Failure	Non-union with / without loss of motion			0	0

Using the Anderson scoring system, at 6 months follow-up, 84% patients had excellent results, 12% patients had satisfactory results and 2 (4%) patients had unsatisfactory result (radioulnar synostosis).

Discussion

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. 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. [7] 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. [8,9]

It is important to achieve compression at fracture site, rotational stability, achieve length. If rotational alignment is altered, it affects function of elbow and forearm movements. Early mobilization of joint is important to prevent stiffness of joints. And also it is important to retain periosteal blood supply, less soft tissue damage at fracture site to achieve early union of fracture. Open reduction and internal fixation with dynamic compression plate is a common procedure done for fractures of both bones forearm. [10] Even newer modalities of plate osteosynthesis such as locking plate and limited contact plate have been introduced however the DCP is still a choice for many surgeons. [3] The age of these patients ranged from 18-60 years, had mean age of 36.04 ± 8.84 years. 72% were male and 28% were females. In present study right sided injuries (64%) were common, common mode of injury was RTA (66%). Majority of the fractures were seen in the middle 1/3rd (46%), were simple fractures (52%) and closed (86%). Majority of fractures were healed in less than 4 months (72%), followed by 4-6 months (20%). Mean time required for fracture union was 16.34 ± 3.78 weeks. 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. [11] In a comparative study by Venkataraman S et al [12] 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.

Postoperative complications such as Superficial Infections (4%) and radioulnar synostosis (4%) were noted in two patients each. Using the Anderson scoring system, at 6 months follow-up, 84% patients had excellent results, 12% patients had satisfactory results and 2 (4%) patients had unsatisfactory result (radioulnar synostosis). Kamlesh Jaswani [13] 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. According to Andersons scoring system, 25 (83.33%) patients had excellent results, 4 (13.33%) patients had satisfactory results and 1 (3.3%) had unsatisfactory result (radioulnar synostosis). Superficial infection 2 (6.66%) posterior interosseous nerve injury 3 (10%) and Radioulnar synostosis 1 (3.3%) were complications. Meeravali SK [14], 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. 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.

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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