



A STUDY OF MANAGEMENT OF DIAPHYSEAL FRACTURES OF BOTH BONES FOREARM WITH DYNAMIC COMPRESSION PLATING

Orthopaedics

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ABSTRACT

The forearm serves an important role in the functioning of the upper extremity. Hence aggressive management through good anatomical reduction and internal fixation of these fractures has become important. The aim of treatment is to re-establish the normal anatomy and good functional outcome. Early rehabilitation started in the immediate postoperative period to prevent disability to a large extent. The aim of this study is to assess the results of fractures of shaft of both bones of forearm with dynamic compression plate (DCP). 30 patients with acute diaphyseal fractures of the radius and ulna were treated with open reduction and internal fixation with dynamic compression plate and screws at Osmania general hospital, between November 2016 and April 2019. Cases were taken according to inclusion and exclusion criteria i.e., Adults, both males and females with diaphyseal fracture of forearm bones above the age of 18yrs. Medically unsuitable and patients not willing for surgery were excluded from the study. In our series of 30 cases there were 25 males and 5 females, with average age of 32.6yrs. Good or full range of mobility of elbow and wrist joints with excellent, satisfactory results was present in 28 patients (94%), 1(3%) patient having restriction of elbow motion and pronation and supination and 1(3%) patient with ulnar non-union which recovered with bone grafting. With rigid/anatomical internal fixation, dynamic compression plate is a good fixation for displaced diaphyseal fractures of the forearm bones. Adherence to AO principles, strict asepsis, proper post operative rehabilitation and patient education are more important to obtain excellent results. Also, external immobilization was not required in co-operative patients.

KEYWORDS

forearm; fracture; diaphysis; internal fixation; dynamic compression plate; transverse; short oblique; non-union; delayed union.

INTRODUCTION

The forearm has an important role in the functioning of the upper extremity, facilitating positioning of the hand in space thus providing the upper limb with unique mobility (1) Fractures of the radius and ulna are commonest fractures of the upper extremity. A fall onto an outstretched hand is the most common mechanism of injury for fractures of the radius and ulna. (2) Understanding the anatomy and function of the radius, ulna, proximal and distal radioulnar joints is necessary for appropriate management. (3) Diagnosis can readily be made by examination and radiographs. (4)

There are many treatment modalities available for treating the fracture of diaphyseal bones of the forearm. They include cast immobilization, intramedullary nailing, external fixation and plate fixation. (5) It has been demonstrated that open reduction and plate fixation are the most traditional and commonly used techniques for the treatment of both-bone midshaft forearm fractures in adults (6,7) Non-union in clinical practice is most commonly associated with long bone fractures of the forearm (8,9).

According to AO (Arbeitsgemeinschaft für Osteosynthesefragen) / Association for the Study of internal fixation (ASIF), dynamic compression plate provides more secure fixation without cast protection. (10) the dorsal Thompson approach is recommended for more proximal fractures because deep dissection is avoided near the neurovascular structures. (11)

The functional outcome was certified using *Anderson et al, scoring system*. The variables taken into consideration were Union of the fracture, Range of elbow and wrist movements (10) and Extent of functional capacity reached.

To conclude, satisfactory reduction of displaced fractures of the forearm bones is difficult to achieve by closed methods and if achieved, it is hard to maintain. So, with open reduction and internal fixation using dynamic compression plate, it is possible to achieve perfect fracture reduction, rigid fixation, better bone healing and early mobilization. Cancellous bone grafting can be used whenever there is bone loss

MATERIALS AND METHODS

In this prospective study, analysis of functional and radiological

outcome after treatment 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. This study was conducted from November 2016 to April 2019 at Osmania General Hospital. The main objective of the study was to identify advantages and outcomes of using dynamic compression plate in diaphyseal fracture of both bones forearm. Inclusion criteria for the study was age between 18 and 65 years, who had fracture of both bones forearm. Exclusion criteria were age below 18 and above 65 years, presence of any other osteoporotic disorders or isolated fracture of radius or ulna which can influence functional outcome. In this study 30 patients were evaluated clinically according to Acute Trauma Life Support protocol. Methodical examination of injured forearm and hand to rule out fractures. General anaesthesia was used in 13 cases and brachial block in 17 cases. Henry's approach and Thompson approach were applied on the operating table.

Postoperatively above elbow slab was applied over the affected forearm or arm pouch was placed depending upon requirement. Suction drain was removed after 48 hours and Wound was inspected. Antibiotics and analgesics were continued till the time of suture removal. Patient was advised physiotherapy of shoulder, elbow, wrist and finger movements.

The patients were followed regularly at monthly interval for first three months then every three depending on outcome. Elbow and wrist movements were noted and union assessed radiologically.

The fracture is said to be united when there was presence of periosteal callus bridging the fracture site and trabeculation extending across the fracture line.



Fig 1: Exposure Fracture Site(ulna)



Fig 2: plate insitu and fracture reduced(ulna)



Fig 3: plate fixed with screws(ulna)



Fig 4: Reduction Of Fracture And Placement Of Plate



Fig 5: Pre-OP X-Ray of forearm

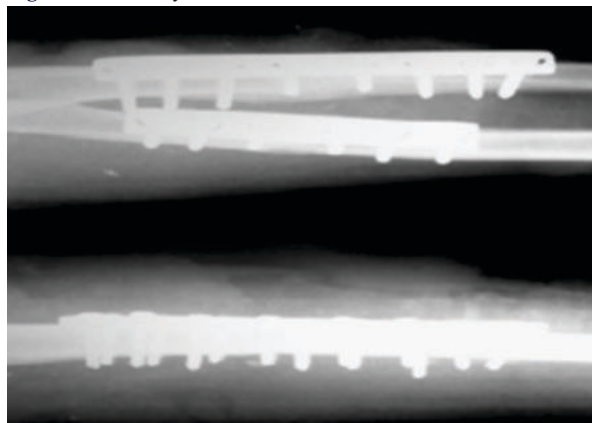


Fig 6: Post-OP(6 months) X-Ray of forearm

RESULTS

In our study 30 patients with closed diaphyseal fractures of both bone fractures were treated with open reduction and internal fixation with AO/ASIF 3.5 mm DCP and screw.

Around 10% belonged to 18-20 years, 40% belonged to 21-30 years, 30% belonged to 31-40 years, 13.33% belonged to 41-50 years and 6.66% belonged to 51-60 years. Out of 30 patients, 25 patients (83.33%) were males and 5 patients (16.66%) were females showing male preponderance because of working in fields, travelling, factories, and sports. The mode of injury was RTA for 14 patients (46.66%), fall on outstretched hand 11 patients (36.66%), assault 4 patients (13.33%) and fall of heavy object over forearm 1 patient (3.33%). Majority of the fractures were seen in the mid diaphysis of both bones of forearm with 22 (73.33%) patients had mid diaphyseal fractures, 3(10%) had proximal third fractures and 5 (16.66%) patients had lower third fracture of both bones of forearm. Among 30 radius fractures, 19(63.33%) were Transverse/short oblique type and 11(36.67%) were comminuted variety. Among 30 ulna fractures, 21(70%) were Transverse/short oblique type and 9(30%) were comminuted variety. 27 (90%) patients had sound union in less than 6 months, 2 (6.66%) patients had delayed union, and 1 patient (3.33%) had a non-union of ulna.

Table 1: Duration Of Fracture Union

Time of union	Number of patients	Percentage
<6 months	27	90
6 months-1year	2	6.66
Non union	1	3.33
Total	30	100

Using the Anderson et al scoring system we had 23(76.66%) patients with excellent results, 5 (16.66%) patients with satisfactory results and 1(3.33%) patient with unsatisfactory result and 1(3.33%) patient had failure. The failure was due to ulnar non-union which was later treated by open reduction and internal fixation with bone graft

Table 2: Results

Results	Number of Patients	Percentage
Excellent	23	76.66
Satisfactory	5	16.66
Unsatisfactory	1	3.33
Failures	1	3.33

We had complications in about 4(13.33%) patients with the following type.

Table 3: Complications

Complications	Number of cases	Percentage
Superficial infection	2	6.66
Deep infection	0	0
Radioulnar synostosis	0	0
Non union	1	3.33
Nerve injury-Posterior interosseous nerve injury	1	3.33
Bone shortening	0	0
Total	4	13.33

DISCUSSION

This study was conducted at our hospital with the aim to know the importance of rigid anatomical reduction and fixation of forearm diaphyseal fractures with 3.5 mm DCP. This in turn was reciprocated on the functional results obtained. The age of these patients ranged from 18-55 years and an average age of 32.6 years.

According to Chapman et al, average age was 33 years, 78% were males and 22% females, 53% of fractures were comminuted and 47% were transverse/short oblique, 59% and 61% of fractures were seen 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, 98% had union within 6 to 14 weeks, 86% patients had excellent results, 7% had satisfactory results, 2% had unsatisfactory results and 5% had failure (12).

Anderson et al reported that 50.9% cases had excellent results, 34.9% had satisfactory results, 11.3% had unsatisfactory results and 2.9% had failure (10). In our series we had 23 (76.66%) cases with excellent results, 5 (16.66%) satisfactory and 1 (3.33%) case of unsatisfactory

result and 1 (3.33%) case of failure due to ulnar 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.

In our series we had 2 cases of superficial infection. The wound was debrided, pus sent for culture. 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. Thereby we conclude that Diaphyseal fractures of forearm are seen most commonly in middle aged subjects and Males show high incidence of fractures as they are often engaged in agriculture, industrial work and motor vehicle driving. The cause of fractures is mostly due road traffic accident and fall on an outstretched hand. Majority of the fractures were transverse/short oblique in the middle third region of forearm.

With the use of AO/ASIF 3.5 mm DCP for acute diaphyseal fractures of forearm, rigid and anatomical fixation can be achieved. With use of DCP, distraction forces leading to separation fracture fragments like seen in interlocking nail for upper limb is not possible. It is better to use longer plates like a bridge plate in case of comminuted oblique fractures. Radius and Ulna are approached separately to avoid extensive soft tissue dissection and resulting complication. Post operatively with DCP fixation additional supportive measures may not be required after soft tissue healing and shoulder elbow and wrist movements can be started early. This helps prevent muscle atrophy and joint stiffness. It is very much possible in intelligent and cooperative patients. However, all patients should be curtailed from lifting heavy weights till union of fracture. Almost all fractures in our study united by 4-6 months. Non-union was treated with bone grafting and fracture united.

CONCLUSION

Closed diaphyseal fractures of both bone when treated with open reduction and internal fixation with AO/ASIF 3.5 mm DCP and screw had better outcomes accordance to Anderson scoring system and very minimal complications.

Conflict of Interest –None

Declaration Of Funding- None

REFERENCES

- Orbay JL, Cambo RA. Biomechanical Factors in Stability of the Forearm. *Hand Clin.* 2020 Nov;36(4):407-415.
- Patel DS, Statuta SM, Ahmed N. Common Fractures of the Radius and Ulna. *Am Fam Physician.* 2021 Mar 15;103(6):345-354.
- Macintyre NR, Ilyas AM, Jupiter JB. Treatment of forearm fractures. *Acta Chir Orthop Traumatol Cech.* 2009 Feb;76(1):7-14.
- Schulte LM, Meals CG, Neviaser RJ. Management of adult diaphyseal both-bone forearm fractures. *J Am Acad Orthop Surg.* 2014 Jul;22(7):437-46.
- Moss JP, Bynum DK. Diaphyseal fractures of the radius and ulna in adults. *Hand Clin.* 2007 May;23(2):143-51.
- Patel A, Li L, Anand A. Systematic review: functional outcomes and complications of intramedullary nailing versus plate fixation for both-bone diaphyseal forearm fractures in children. *Injury* 2014;45:1135-43.
- Lee SK, Kim KJ, Lee JW, Choy WS. Plate osteosynthesis versus intramedullary nailing for both forearm bones fractures. *Eur J Orthop Surg Traumatol* 2014;24:769-76.
- Mills LA, Aitken SA, Simpson AHRW. The risk of non-union per fracture: current myths and revised figures from a population of over 4 million adults. *Acta Orthop* 2017;88(Jul 4(4):434-9.
- Zura R, Xiong Z, Einhorn T, Watson JT, Ostrum RF, Prayson MJ, et al. Epidemiology of fracture nonunion in 18 human bones. *JAMA Surg* 2016;151(11):1-12.
- Anderson LD, Sisk D, Tooms RE, et al. Compression-plate fixation in acute diaphyseal fractures of the radius and ulna. *J Bone Joint Surg Am* 1975; 57(3):287-97.
- Jupiter J, Kellam J: Diaphyseal fractures of the forearm, in Jupiter J, Browner B, eds: *Skeletal Trauma*, ed 4. Philadelphia, PA, Saunders Elsevier, 2008, pp 1459-1502.
- Chapman MW, Gordon JE, and Zissimos AO Compression-plate fixation of acute fractures of the diaphysis of the radius and ulna. *J. Bone Joint Surg. Am.*, Feb 1989; 71: 159 - 169.