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Comparison between the Dynamic Compression Plate and IM Nail in the Treatment of Mid Shaft Radius Ulna Fractures

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Abstract: Fractures fixation with open reduction and compression plates is frequently used in diaphyseal radius/ulna fractures because of advantages like proper alignment, maintaining length and rotational alignment. This study compares the outcomes of treatment of fracture cases with dynamic compression plates and intra-medullary nailing by a square nail in mid shaft radius/ulna fractures. The study was conducted in Rajiv Gandhi Institute of Medical Sciences, [RIMS] Adilabad during the period from March 2014-Dec 2017. The study involved n=55 cases of which n=31 were male and n=24 were female. The common age group involved was 31- 40yrs contributing to 41.81% (n=23) of cases followed by 23.63 % (n=13) cases in 21 -30 yrs age group and 20% (n=11) cases in 41 – 50 yrs age group. Most common type of fracture was Transverse type in 37 cases, oblique in 10 cases and comminuted in 8 cases. Dynamic compression plates were used in 61.82% (n=31) of cases, IM nail was used in 38.18% (n=24) of cases. Dynamic compression plate treated patients had overall 94.11% cases in Excellent and good results and 90.48% of the IM nail treated patients had excellent and good results. To conclude Treatment of diaphyseal forearm is challenging as it because of lack of censuses regarding treatment and it requires judicious selection of cases for using compression plates or IM nail. Within the limitation of the present study, it may be concluded that dynamic compression plate offers better overall outcomes in the treatment of diaphyseal radius/ulna fractures.

Keywords: Dynamic compression plates, IM nailing, mid shaft Radius Ulna fractures.

INTRODUCTION

The forearm is an important anatomical unit of the upper limb; it permits the hand to perform its multi-axial daily activities of living. The presence of the proximal and distal radio-ulnar joints in forearm allows pronation and supination movements [1-4]. Due to this functions and anatomical features the diaphyseal fractures of the forearm are different from diaphyseal fractures of other long bones and they are sometimes evaluated as intra-articular fractures with treatment planned accordingly [5, 6]. Various modalities of treatments have been introduced from time to time each having its oven advantage. Fractures of forearm bones may result in severe loss of function unless adequately treated. The numbers of forearm fractures are increasing due to rapid industrialization increased road traffic accidents and sports activities or fall and direct blows [7]. Open reduction and internal fixation with dynamic compression plate is a common procedure done for fractures of bones of forearm [8]. In spite of newer modalities of plate osteosynthesis such locking plate and limited contact plates introduced the dynamic compression plates is still the first choice for many surgeons [9]. The specific problems in relation to diaphyseal fractures of radius and ulna are the chances of malunion and nonunion are greater because of the difficulty of reducing and maintaining reduction of two parallel bones in the presence of axial movements and rotator movements. Loss of forearm pronation commonly occurs with radius/ulna diaphyseal fractures which may or may not be functionally significant. The open reduction offers best outcomes and therefore they are commonly preferred for treatment [10, 11]. The average undisplaced fractures of long bone take 6-8 weeks before it heals and displaced fractures take 3 -5 months for healing. Various authors have reported excellent results with plate fixation in displaced diaphyseal fractures of bones of forearm and few authors have focused on plate fixation in the management of open diaphyseal fractures of both the radius and ulna [12-16]. The advantages of operative management are early mobilization and patient comfort but operative management carries the risk of technical errors and post-operative complications like infections and nerve injuries etc [17, 18]. Generally, non-specific intramedullary (IM) implants have been used as an alternative treatment method. Because they do not have locking and compression features, these materials cause high rates of nonunion; therefore their use has been abandoned. Current IM forearm nails have emerged with locking and compression features. The use of this method in treatment is increasing with union rates

similar to those of ORIF and very good functional results [19-22] with this background we in the present study tried to evaluate the outcomes of the dynamic compression plates and IM square nail in the treatment of the diaphyseal fractures of radius and ulna.

MATERIALS AND METHODS

The study was conducted on 55 male and female patients of various age groups in the Department of Orthopedics, Rajiv Gandhi Institute of Medical Sciences [RIMS] Adilabad for a period of 2 years from Aug 2015 to July 2017. Institutional Ethical committee permission was obtained for the study. Inclusion criteria were male and female patients visiting the orthopedic and casualty with displaced diaphyseal fractures of both bones in the forearm or compound fractures of type I and type 2. Excluded patients were children with immature bone, injuries extending beyond diaphysis, extensive fractures involving head injuries, pathological fractures. Brief operative procedure for plating was, the patients were placed in supine position with arm extended on the hand table. An axillary nerve block with LA was obtained the radial approach was used to expose the radius and using a sharp or dull forceps the reduction of fracture was done, apply for compression plates with inter-fragmentary compression screws. Radiographs were taken to see the alignment and placement of screws. The ulna was approached by flexing the hand at 90° after exposure of ulna the fracture was reduced and 3.5mm dynamic compression plates were used and radiographs were taken to ensure perfect alignment. The wound was closed and drains were used if indicated. For radius/ulna nailing both closed/open reductions were done as needed. The radial nail has a bent at its head end in the forearm to facilitate the insertion up to 2/3rd of the bone length after which the nail is kept straight, the ulna nail is straight and inserted in the ulna. Radiographs were taken for ensuring proper placement and alignment and after 24 hours post, operative period physiotherapy with digital motions was applied followed by wrist and elbow motions applied after 4-5 days of surgery.

RESULTS

The study involved a total number (n=55) cases of which 31 cases were male and 24 cases were female. Most of the cases were from age group of 31 - 40 yrs (n=23) 41.85% followed by 21 -30 yrs (n=13) 23.63% of cases, (n=11) 20% cases were from 41 -50 yrs and 51 – 60 yrs (n=5) 9% and (n=3) 5.45% in age group of 18 -20 yrs shown in table 1.

Table-1: showing the age distribution of patients

Age Group	Male	Female	Total	Percentage
18-20	2	1	3	5.45
21-30	7	6	13	23.63
31-40	15	8	23	41.81
41-50	5	6	11	20.0
51-60	2	3	5	9.0
Total	31	24	55	100

The most common mode of injury was 45.45% of cases and falls in 36.36% cases, sports-related injuries in 12.72% of cases and Assaults in 5.45% of cases shown in figure-1.

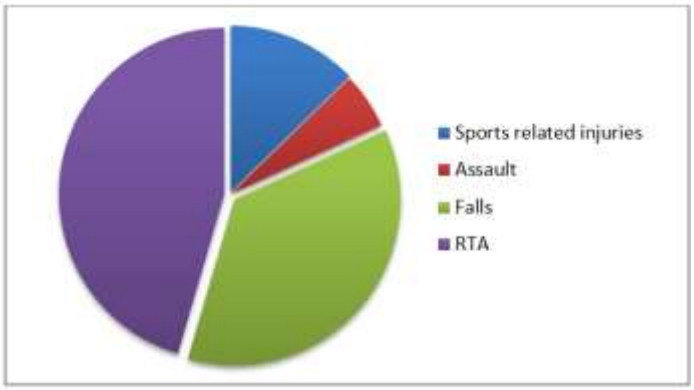

Fig-1: showing the modes of fractures

The most common type of fractures seen during the treatment was the Transverse fracture in (n=37) 67.27% of cases and oblique fractures were seen in (n=10) 18.18% of cases and comminuted fractures were seen in (n=8) 14.45% of cases shown in table-2.

Table-2: showing the type of fractures

Type of Fracture	Male	Female	Total	percentage
Transverse	22	15	37	67.27
Oblique	4	6	10	18.18
Comminuted	5	3	8	14.45

The dynamic compression plates [DCP] was used in (n=19) male and (n=15) female total number of 34 cases 61.82% of cases. IM nail was used in (n=12) and (n=9) female and a total number of 21 cases male 38.18% of cases shown in table 3.

Table-3: Showing the type of implants used in the treatment of cases

Use of Implant	Male	Female	Total	percentage
DCP	19	15	34	61.82
IM Nail	12	9	21	38.18
Total	31	24	55	100

The table-4 showing the results outcomes of the patients treated with DCP and IM nail. The results were based on Anderson *et al*. scoring system and modified from Morrey BF, *et al*., [23]. In the DCP treated cases 61.76% and 32.35% has excellent and good results. Unsatisfactory results were only seen in 1 male and 1 female (5.89%) of cases. In IM treated cases 66.67% had excellent results and good results 23.18% of cases and unsatisfactory results in 1 female patient (4.76%) and failure in 1 male (4.76%) of the case.

Table-4: Treatment outcomes of the patients

	DCP		Percentage	IM Nail		
Results	**Male**	**Female**		**Male**	**Female**	**Percentage**
Excellent	11	10	61.76	8	6	66.67
Good	7	4	32.35	3	2	23.81
Unsatisfactory	1	1	5.89	0	1	4.76
Failure	0	0	0	1	0	4.76
Total	19	15	100	12	9	100

DISCUSSION

In the present study we did plating in n=34 (61.82%) of cases and nailing in n= 21 (38.18%), the percentage of complication in DCP cases was 5.89 and in nailing it was 9.52% respectively. Fractures of forearm bones may result in severe loss of functions unless treated adequately. There is a complex functional relationship between radio humeral, radioulnar, ulnohumeral, radiocarpal, distal radioulnar joints and maintenance of interosseous space must be perfect, contrarily some functional impairment will be imminent [24]. Therefore one of the goals of treatment is to regain length, opposition, and axial alignment if a good range of pronation and supination is to be restored [25]. Open reduction and internal fixations is, therefore, the treatment of choice in the majority of fractures of both bone forearms in adults. It is important to correct the angulation radial bowing and rotational deformities during the reduction of fractures. The pre-bent radial nail cannot always restore the normal radial architecture correctly in all patients. But no significant functional impairment will result if forearm angulation is reduced to 10 degrees in any plane. The axis of rotation of forearm bones extends from center of the head of the radius to insertion of triangular fibrocartilage at the base of styloid process of the ulna. If the relation of the forearm axis is altered by angulation the mechanism of the radio ulnar joint are deranged and permanent limitations of the rotation occurs. Rotational deformities will also limit the radio- ulnar movement [26]. There are certain advantages of using IM nail also as this device does not require periosteal stripping and skin incisions are smaller and there is less soft tissue dissection resulting in the preservation of periosteal blood supply that aids in the union of fractures. In a similar study by Rajan KG *et al.*, [7] comparing the results of DCP and nailing in forearm found DCP offering excellent results in displaced diaphyseal fractures of forearm bones in adults agreeing with the results of our study. A Aggarwal *et al*., [27] recording the functional outcomes of plating versus nailing in midshaft fractures of radius/ulna found that the open reduction with plating had better overall outcomes lesser complications as compared to nailing. In the present study out of 34 cases treated with compression plates excellent results were seen in 61.76% of cases 32.35% were good unsatisfactory cases 2 (5.89%) no cases of failure. The time of union in our study was comparable to other similar studies done in this area [28, 29] the average periods of immobilization in DCP was (2-4 weeks) Early reductions and rigid fixations restores the stability of forearm earlier also limits the dead space produced as a result of shortening and malposition [30]. Dynamic plate produced compression causes the fracture to unite by primary bone healing if the fragments are rigidly fixed with the blood supply

disturbed as little as possible. The resorption and bone formation will occur in the fractures treated with compression and rigid fixation. The capillaries will grow into the medullary callus at an early stage in the healing process. The integrity of which is protected by rigid fixation. Therefore it indicates that dynamic compression plating is still the preferred method of choice for midshaft radius ulna fractures and nailing system is slightly inferior to it in spite of the availability of well-contoured intramedullary nailing system.

CONCLUSION

Treatment of diaphyseal forearm is challenging as it because of lack of censuses regarding treatment and it requires judicious selection of cases for using compression plates or IM nail. Within the limitation of the present study, it may be concluded that dynamic compression plate offers better overall outcomes in the treatment of diaphyseal radius/ulna fractures.

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