Original Research Article

Comparison of results of close fracture of both bones forearm treated with well-fitting intramedullary nail and dynamic compression plate

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Abstract

Background: The function of the forearm stems from a complicated movement of radius over ulna at the superior radioulnar joint at the elbow, at the inferior radio-ulnar joint and at the wrist. Closed treatment of diaphyseal fractures of both forearm bones is fraught with angulatory and rotational malalignment and the results are disappointing. This study is planned to compare results of close fracture of both bones forearm treated with well-fitting intramedullary nail and dynamic compression plate. **Material and Methods:** The present study comprised of 60 patients with close fracture both bones forearm belonging to either sex of adult age group, treated in the department of orthopedics and rehabilitation research center, from July 2011 to may 2013, under Dr. S.N. Medical College Jodhpur. Thirty patients treated by open reduction and internal fixation by (square) well-fitting intramedullary nails and another thirty patient treated by small fragment dyanamic compression plate. The end results were described on the basis of grading by Hadden *et al*. **Results:** The maximum number of patients in this study belogned to the age group of 16-40 years. The mean age was 35 years, male to female ratio was 3.6:1 and right side (55%) was more involvement as compared to left side (45%). The average time period for radilogical union in case treated by dyanamic compression plate was 9.5 weeks and I.M. Nailing was 16 weeks. The comparison of functional end result between Hadden *et al* different modalities of treatment and of our present study. Results of plating is comparable with Hadden *et al* sereis but Nailing is inferior. **Conclusion:** The important factor that emerged from the present study is that for functional end results to be excellent to good, plating is the best mode of treatment for fracture forearm bones as 83% excellent to good results had achieved but nailing also have comparable results as achievement of 76% excellent to good results.

Keywords: Fracture of Forearm, Radio-Ulnar Joint, Intramedullary Nails, Dynamic Compression Plates.

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INTRODUCTION

The forearm is the instrument in manoeuvering the hand in its optimum position to allow the latter to accomplish its dexterity of movements. The function of the forearm stems from a complicated movement of radius over ulna at the superior radioulnar joint at the elbow, at the inferior radio-ulnar joint and at the wrist. Fractures of the forearm, by disturbing this mechanism. Etiology of severe loss of function unless adequately treated to restore the above mechanism. The achievement and maintenance of reduction of diaphyseal fractures of forearm are hindered by deforming muscular forces. For these anatomical

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reasons and configuration of bones i.e. radius and ulna along with interosseous membrane and superior and inferior radio ulnar joints make them more vulnerable to malunion. Closed treatment of diaphyseal fractures of both forearm bones is fraught with angulatory and rotational malalignment and the results are disappointing. Therefore to achieve full return of function to prevent malunion and joint stiffness, to hasten convalescence, open reduction and rigid internal fixation by well-fitting intramedullary nail or dynamic compression plate remains the treatment of choice.[1]Intramedullary nailing was popular in the past. It has certain advantages and disadvantages, but was commonly used in past and with some indication in present scenario. After introduction of plate fixation for fracture forearm bones, especially dynamic compression plate by A.O group, the nailing of fracture forearm bones now given way to dynamic compression plating. But this too have some advantages and disadvantages.[1]As in our department still fracture of forearm bones are treated by both methods with certain indications. This study is planned to compare results of close fracture of both bones forearm treated with well-fitting intramedullary nail and dynamic compression plate. So in patients, whom intramedullary nailing for fracture forearm bones done, prognosis and results can be ascertained in comparison to dynamic compression plate. Though results of treatment of diaphyseal forearm fractures are difficult to analyze due to many variables, such as location and type of fractures, proportion of open and closed injuries, number of acute fractures, extent of associated soft tissue injuries

MATERIAL AND METHODS

The present study comprised of 60 patients with close fracture both bones forearm belonging to either sex of adult age group, treated in the department of orthopedics and rehabilitation research center, from July 2011 to may 2013, under Dr. S.N. Medical College Jodhpur. All cases included in this study underwent clinical and radiological examination at the time of admission; and type, site, displacement, rotation and angulation of fractures were determined. Open reduction and internal fixation by plates and screws was the choice of treatment for all unstable diaphyseal fractures but some of the patients who refused for plating due to cost of the plates and screws underwent well-fitting intramedullary fixation by square nail. Thirty patients treated by open reduction and internal fixation by (square) well-fitting intramedullary nails and another thirty patient treated by small fragment dyanamic compression plate.

Post Operative Care

Post operatively broad spectrum antiobioti was given for 48 hrs. Thereafter limb was kept elevated for next 24 hrs., with instructions to the patient for active finger movement. Any evidence of circulatory embarassments., i.e. swelling of the fingers. Ischemic pain, numbness, paraesthesia is checked. If there is presence of any of these, the slab is loosened, any encircling bandage is removed.On the 12th post operative day stitches were removed. Then depending on the state of compression, type of fracture. communitition and cooperation. of the patient further external support was applied. If the fracture are uncomminuted, good compression and rigid fixation acheived and patient is cooperative then after stitch removal a crepe bandage was applied and physiotherapy was started immediately. Patient was instructed not to carry out any strenous activities till the fracture was healed.The end results were described as follow: On the basis of grading by Hadden *et al*, 1983.[2] The range of movements of all joints were assessed with the help of goniometer and noted in the proforma .The result obtained in each group of patients were compared and finally a comparison was made**.** (table 1)Out of 60 patients, 14 patients had associated injury. Most common associated injury encountered in this study was shaft femur in 5 cases, followed by cerebral contusion in 3 case (table 2). 76% of the cases were treated within one week of injury and 3 cases were treated after 3 weeks (table 3).The average time period for radilogical union in case treated by dyanamic compression plate was 9.5 weeks and I.M. Nailing was 16 weeks (table 4).In Nailing cases 6.66% showed restricted rotational movements, by more than 30 degree and in plating case only 3.3% showed loss of more than 30 degre rotational movements. Other movement had not significantly affected irrespective of the type of treatment (table 5). The table no. 6 shows the comparison of functional end result between Hadden *et al*[2] different modalities of treatment and of our present study. Results of plating is comparable with Hadden *et al*[2] sereis but Nailing is inferior.

RESULTS

Excellent	No complaints, No impairment in the strength of grip, less than 15 degree loss of any movement.
Good	Pain only after activity, slight weakness in the strength of grip less than 30 degree loss of any movement.
Fair	Occasional pain without activity, Moderate weakness in the strength and grip, more than 30 degree loss of any movement
Poor	Continuous pain, marked weakness in the strength of grip, more than 30 degree loss of any movement

Table 1: Showing Demographic and Side involvement

Age Group (In Yrs)	No. of Cases	Percentage (%)
11-20	09	15.00
21-30	13	22.20
31-40	23	38.20
41-50	06	10.00
51-60	05	08.00
61-70	03	05.00
71-80	1	1.60
Total	60	100.00
Male: Female	3.6:1	
SIDE		
Right	33	55%
Left	27	45%

Table 2: Showing Associated Injuries

Associated Injuries	No. of Cases
Cereberal Contusion	03
Fracture Shaft Femur	05
Fracture Leg Bones	01
Contralateral Colles's Fracture	02
Ipsilateral Open Fracture Neck humerus	01
Ipsilateral Fracture Humerus	02
Total	**14**

Table 3: Showing Interval Between Injury and Treatment

Interval (In Weeks)	No. of Cases	Percentage (%)
0-1	46	76.66
1-2	7	11.66
2-3	4	6.66
3-4	2	3.33
>4	1	1.66
Total	**60**	**100.00**

Table 4: Showing Average Period For Radiological Union

Type of Treatment	Time Period	No. of Patients
I.M. Nailing	16 Weeks	29
D.C. Plating	9.5 Weeks	29
Total		**58**

Table 5: Showing Restricted Movement

Type of Treatment	Movement	0-15	15-30	>30
Intramedullary Nailing	Shoulder Joint			
	Flexion	30(100%)	-	-
	Extension.	30(100%)	-	-
	Abduction	30(100%)	-	-
	Adduction	30(100%)	-	-
	Elbow Joint			
	Flexion.	30(100%)	-	-
	Extension.	30(100%)	-	-
	RadioUlnar. Joint			
	Supination.	20(66.6%)	8(26.66%)	2(6.66%)
	Pronation	20(66.6%)	8(26.66%)	2(6.66%)
	Wrist Joint			
	Palm. Flexion	28(93.3%)	2(6.7%)	-
	Dorsi Flexion	28(93.3%)	2(6.7%)	-
Dyanamic Compression Plating	Shoulder Joint			
	Flexion	30(100%)	-	-

	Extension.	30(100%)	-	-
	Abduction	30(100%)	-	-
	Adduction	30(100%)	-	-
	Elbow Joint			
	Flexion	30(100%)	-	-
	Extension.	30(100%)	-	-
	RadioUinar. Joint			
	Supination.	23(76.66%)	6(20%)	1(3.33%)
	Pronation	23(76.66%)	6(20%)	1(3.33%)
	Wrist Joint			
	Palm. Flexion	29(96.66%)	1(3.33%)	-
	Dorsi Flexion	29(96.66%)	1(3.33%)	-

Table 6: Showing Functional End Results (Based On Hadden *et al*[2] Criteria)

Results	Present Study		
	Nailing	D C P	Hadden *et al*[27]
Excellent	17(56.60%)	20(66.60%)	60(54.50%)
Good	6(20.00%)	05(16.61%)	29(26.40%)
Fair	2(6.80%)	4(13.31%)	11(10.00%)
Poor	5(6.60%)	1(3.31%)	10(9.10%)
Total	30(100%)	30(100%)	110(100%)

DISCUSSION

Most of the patients in this series belonged to active age group of sixteen to fourty years. They constituted 69% of the cases. The maximum age group encountered was 72 years and the minimum, 16 years with an average of 35 years. The high incidence in this age group is due to their active routine.The age of the patients varied from fourteen to seventy eight years, in different series (Dodge and Cady, 1972[3]; Burwell and Charnley, 1964[4]) An average age of 29.3 years was reported by Dodge and Cady, 1972[3] and Anderson *et al*. 1975.[5]In the present series males constituted 78% where as females constituted 22% cases. Burwell and Charnley (1964)[4] and Dodge and Cady 1972[3] also reported a similar incidence. The low incidence females is due to their less hectic schedule and predominantly indoor lifestyle.In the present series, right side involvement is 55% and left side involvement is 45%. This is similar with studies of Burwell and Charnley (1964)[4], and Merk (1961).[6] Predominantly right sided involvement may be due to the excess activity of the dominant upper extremity.In this series 14 patients had associated injuries. Hadden etal. (1983)[2] reported 34% of cases with associated injuries. Marek (1961)[6] had reported 20.75% of associated injuries. Grace *et al* (1980)[7] reported 10.93% patients with multiple trauma whereas Chapman (1989)[8] reported 40% associated injuries. Different incidences of associated injuries in different studies show that it varies from one place to another.In this series 76% of the cases were operated within one week of injury and 3 cases were treated after 3 weeks of injury. Most of these cases had reported late for treatment. The importance of immediate rigid internal fixation using compression plate was stressed by Muller *et al* (1970)[9], they observed that immediate internal fixation, if not rigid, result was disastrous whereas, the timing of operation did not affect the union, if rigid internal fixation was used. Radiological union was observed in 29 cases out of patients treated by dynamic Compression Plate. There was 1 case of non-Union, one case who developed non-union ulna in which severe communition was present. One segmental fracture of radius treated by I.M.Nail developed non-union. It is difficult to determine roentgenographically when fracture is united. Whenever fracture is rigidly compressed, the fracture line is invisible on X ray and rarely external callus is formed. Anderson (1975)[5] had adopted as fracture has united if there is obliteration of fracture line and evidince of bridging trabeculae.Average time for union in DCP cases was 9.5 weeks, Anderson has reported radiological union in 7.4 weeks. Rai and harma[10] reported Union in 6-8 weeks. Average time for union in cases treated by I.M. Nail was 16 weeks. Patwa and Vaidya (1990)[11] reported average time of radiological union 16 weeks. Khare etal. (1998)[12] reported radiological union between 6 month and one year in cases treated by I.M.Nail.

Rotational Movements

Loss of pronation and supination of the forearm is an indicator of the quality of results. In patients treated by dyanamic compression plating 23 cases i.e. 76.6% showed less than 15 degree loss of supination and pronation. 20% i.e. 6 cases demonstrated a loss of 15-30 degree. while only one patient i.e. 3.3% showed loss movement of more than 30 degree. In patients treated by square intramedullary nail, loss of supination and

pronation was less than 15 degree in 20 cases i.e. 66.6%. Between 15-30 degree was in 8 cased i.e. 26.6% , and more than 30 degree in 2 cases i.e. 6.66%.

Functional End Results

Though union is an important aspect of the treatment, in course of time, the emphasis has shifted from achieving of union to achieving high rate of functional recovery too. Because without good functional recovery, even well united fractures will be a handicap for the patients. For plating poor results were obtained in one case ie 3.33%, with more than 30 degree loss of rotational movements and continous pain. Fair results were achieved in 4 cases with 15-30 degree loss of rotational movements but occasional pain without activity. Excellent or good results were obtained in 25 cases i.e. 83% of the cases. For patients treated by well fitting Square nail poor results were obtained in 5 cases i.e. 16.6% (in two cases rotational movements were restricted by more than 30 degree and in the other three cases with 15-30 degree loss of rotational movements but continuous pain without activity). Fair results were obtained in 2 cases with loss of rotational movement between 15-30 degree but occasional pain without activity. Excellent or good results were obtained in 23 cases,ie 76.6%.Burwell and Charnley (1964)[4] found excellent results in 69.8% , good in 15.5% fair in 13.8% and poor in 0.8%. 44 patients in whom fixation failed 47% doveloped non union.Anderson etal. (1975)[5] used dynamic compression plate and reported 58.74% excellent results. 30.94% satisfactory, 7.17'%. unsatisfactory and failure.Grace *et al*. (1980)[7] reported 80% excellent or good results, 11% acceptable results, 9% unacceptable results.Rai and Sharma[10] by Muller criteria reported 67.6% excellent results, 25.6% good results and 10.8% poor results.Chapman etal. (1987)[8] reported 91% excellent or satisfactory results and 7% unsatisfactory results with 2% failure.Knight and Purvis (1949)[13] reported unsatisfactory results due to loose fitting nails which failed to maintain correct rotational alignment and angulation at the fracture site.Sage (1959)[14] designed medullary -nails of radius having prebent bow and reported 6.21% of non-union.Merk (1961)[6] used square flexible, intramedullary nail and external splinage and claimed Union of all the fracture in patients. Talwalkar (1967) designed square medullary nails and achieved union in all 72 patients.Dana and Street (1985)[15] in a series of 137 nailed fractures - reported non-union rate of 7% with 69% of excellent results and 8% unsatisfactory results.Khare and Singh (1988)[12] using Talwalkar's intramedullary nail in-46 cases reported excellent in 42 cases and non-Union in 4.3%. Morgan W J, Brean T F(1999)[16] treated forearm fractures of adult age group with intramedullary nail. Poor results were obtained in 16% patients with 7% cases of non union.Lindvall, Sagi HC (2006)[17] found 97% union rate in compression plate in forearm with no refracture, no infection and no alteration of fixation. Sang KI Lee, Kap jung kim,Jae lee (2013)[18] found 100% union in compression plate group and one case of non union in intramedullary group.

CONCLUSION

The important factor that emerged from the present study is that for functional end results to be excellent to good, plating is the best mode of treatment for fracture forearm bones as 83% excellent to good results had achieved but nailing also have comparable results as achievement of 76% excellent to good results.

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