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A RETROSPECTIVE STUDY OF CLOSED DIAPHYSEAL FRACTURES OF BOTH BONES FOREARM IN ADULTS TREATED WITH DIFFERENT MODALITISE

Orthopaedics

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ABSTRACT

INTRODUCTION:-this study was conducted to evaluate the result of diaphyseal fractures of both bones forearm in adults treated with different modalities .

METHOD:-In this retrospective study was conducted on 100 patients , who attended the Department of Orthopedics and Rehabilitation Research Centre, Dr S.N. Medical College, Jodhpur, Rajasthan, from a period of Feb. 2013 to February 2018,to evaluate advantages and disadvantages, early and late complications, resuts and Epidemiology of diaphyseal fractures of both bones forearm in adults treated with different modalities .

RESULT:-In our study out of 100 patients 78 were males and 54 had fracture due to indirect violence and majority of the patients were in the age group of 16-40 years with around 68% of the cases had fracture of the middle 3rd of the forearm bone. Out of these, 50 were treated by open reduction & small fragment DCP fixation, 30 patients were treated by open reduction and intramedullary fixation by Talwalkar's nail & 20 patients treated conservatively. Average time period for radiological union in cases treated by dyanamic compression plate was 9.4 weeks and for both closed reduction and I.M. nailing was 16 weeks. For assessment of our results we took grading by Hdden et criteria 1983. In our series we achieved results of plating is comparable with Hadden et al series but Nailing is inferior & closed reduction is further interior to nailing.

CONCLUSION:- The important factor that emerged from the above study is that for functional end results to be excellent to good, plating is the best mode of treatment for fracture forearm bones as 82% excellent to good results had achieved and nailing also have comparable results as achievement of 76% excellent to good results but as patients treated by closed reduction had 40% poor results, so this method is not justifiable for treating the patients of diaphyseal fracture forearm bones.

KEYWORDS

A.O. DCP, Hadden criteria ,Diaphyseal fracture

INTRODUCTION

The function of the forearm stems from a complicated gamut of movement of radius over ulna at the superior radioulnar joint at the elbow, at the inferior radioulnar joint and at the wrist. Fractures of the forearm, by disturbing this mechanism, cause 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[4]. The proximal fragment in diaphyseal fractures of ulna tend to displace towards the radius. Fractures of the distal radius tend to angulate towards the ulna due to the action of pronator quadratus & the pull of long forearm muscles. For these anatomical reasons and configuration of bones i.e. radius & ulna along with interosseous membrane and superior and inferior radio ulnar joints make them more vulnerable to malunion. Closed treatment[5] of diaphyseal fractures of both forearm bones is fraught with angulatory and rotational malalignment and the results are disappointing. A nowadays it considers that forearm bones fractures to be mortice fracture & stressed that these fractures have to be fixed with pretension small fragment DCP[1]. Therefore to achieve full return of function to prevent malunion & joint stiffness, to hasten convalescence, open reduction and rigid internal fixation remains the treatment of choice.

The results of treatment of diaphyseal forearm fractures reported by different authors are difficult to analyze due to many uncontrolled variables, such as location and type of fractures, proportion of open and closed injuries, number of acute fractures, extent of associated soft tissue injury and percentage of delayed union and non union, beside others.

AIMS AND OBJECTIVES

The aims and objectives of this retrospective study were:

1. Treatment of diaphyseal fractures of forearm bones by different modalities such as closed reduction, open reduction, plating and nailing etc.
2. To study the epidemiology of diaphyseal fractures of forearm.
3. To compare the results of different modalities of treatment.
4. To attempt to arrive at a conclusion as regards the best mode of treatment of diaphyseal fractures.

MATERIAL AND METHODS

The present retrospective study comprised of hundred selected patients belonging to either sex of adult age group, treated in the department of orthopedics and rehabilitation research center, Mahatma Gandhi Hospital , under Dr. S. N. Medical College , Jodhpur , for closed diaphyseal fractures of both bones forearm, from a period of Feb. 2013 to February 2018.

Closed reduction was the definitive mode of treament only in those patients with either acceptable position after reduction or fracture was undisplaced or patients could not be operated due to some reasons as refusal by patients for operative intervention.

Open reduction and internal fixation by plates and screws was the choice of treatment for all, unstable diphyseal fractures but some of the patients had segmental, comminuted long fragment of bone underwent intramedullary fixation by Talwalkar Nails .

CLOSED REDUCTION

Twenty patients were treated by closed reduction[5]. After assessing the satisfactory reduction clinically, above elbow anterior and posterior plaster of paris slabs were applied. Position of fracture was determined by check x-ray and if satisfactory reduction was achieved cast conversion of the slab was done within two to three days after subsidence of swelling.

The patient was reviewed at three week for radiological assessment. At six week follow up POP cast was removed and patients were assessed clinically and radiologically. Cast was continued for the period till clinical union was achieved.

OPEN REDUTION AND INTERNAL FIXATION BY TALWALKAR INTRAMEDULLARY NAILS[10].

Thirty patients treated by this method were included in this study. The following procedure was adopted. For both bones seperate incision were made, for ulna subcutaneous incision was made and for radius posterolateral approach was used. Talwalkar intramedullary nails were used for fixation of both the bones.

For ulna fracture was exposed through the short longitudinal incision over the subcutaneous border & antegrade nailing performed.For fracture for the radius, the radius was exposed posterolateral incision & retrograde nailing donr, through radial styloid process.

Post operatively a long arm cast was applied and intravenous antibiotics were given for 24 hrs. Stitches were removed on the fourteenth day of operation and external support was continued for 8-12 weeks.

OPEN REDUCTION AND INTERNAL FIXATION BY SMALL FRAGMENT DYNAMIC COMPRATION PLATE[6]

50 patients included in this study were treated by small fragment dynamic compression plate underwent following procedure:

For both bones, separate incisions were made, for ulna subcutaneous incision was made, for radius either anterolateral or posterolateral approach was used. The expose the fracture site separately, strip the periosteum from the bone sparingly, but do not dissect the muscles away from the periosteum since this probably diminishes its blood supply. Placing the plate beneath the periosteum on the bone will produce less injury to the local blood supply than placing the plate extraperiosteally.

Reduce the fracture as anatomically as possible, by carefully matching the fracture interdigitations. Reduce both fracture before fixing them either internally. After determining that both bone can be reduced easily select the fracture that has the most noncommunited and stable configuration. If there is any large butterfuly fragments carefully reduce it and secure them to the main fragment using the lag screw technique.

For most fracture of the forearm bones, a plate with at least six/seven holes were chosen. More communited or oblique fractures may require longer plates. Contour the chosen plate with contouring device. Next center the contoured plate across the tension, that is dorsal side of the bone. So that at least three holes on each side of fracture were fixed with the screws.

FOLLOW UP

At follow up examination interval between injury & this examination was recorded & than clinical & radiological examination were carried out and the end results were described as follow:- On the basis of grading by Hadden et al[8], 1983.

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

Criteria of comparison:

1. Clinical results
2. Radiological union
3. Functional Restoration

OBSERVATION

The maximum number of patients in this study belonged to the age group of 16-40 years, i.e. 76%. The maximum age was 72 years, while minimum age was 16 years. The average age was 32 years.The sex distribution, 78% cases were male and 22% were female. Out of 100 cases right side forearm that is dominant in most of the cases was involved 56 cases, whereas left side was involved in 44 cases. The commonest mode of injury were road traffic accident 46% where 54% injury was with indirect injury.

TABLE 1- SHOWING SITE OF FRACTURE

Site	No. of cases	Percentage
Proximal one third	14	14%
Middle one third	68	68%
Lower one third	18	18%
Total	100	100%

This table shows highest incidence of middle third fractures i.e. 68%, proximal third & lower third fractures are 14% & 18% respectively.

52% of the cases were of transverse fracture, 28% were short oblique to spiral, 18% comminuted & 2% cases of segmental fracture forearm bones.

TABLE 2- SHOWING TYPE OF FRACTURE PROCEDURE ADEPTED FOR TREATMENT

Method of treatment	No. of cases	Percentage
Close reduction	20	20%
Open reduction & intramedullary fixation by talwalkar's nail	30	30%
Open reduction & small fragment dyanamic compression plate fixation	50	50%
Total	100	100%

This table shows that total no. of 100 patients selected in this study, out of these 50 were treated by open reduction & small fragment dyanamic compression plate fixation, 30 patients were treated by open reduction and intramedullary fixation by Talwalkar's nail & 20 patients treated conservatively.

In present study due to delayed operative procedure or severe comminution. 8 cases were operated with primary bone grafting.

TABLE3- SHOWING IMMOBILIZATION PERIOD FOR PATIENTS TREATED BY CLOSED REDUCTION

No. of weeks	No. of cases	Percentage
0-2	0	0%
2-6	0	0%
6-10	2	10%
10-16	14	70%
16-20	4	20%
Total	20	100%

Table shows that most of the cases treated by closed reduction were immobilised for 10-16 weeks.

TABLE4- SHOWING IMMOBILIZATION PERIOD FOR PATIENTS TREATED BY INTRAMEDULLARY NAILS

No. of weeks of immobilization	No. of cases	Percentage
0-2	0	0%
2-6	22	73.3%
6-10	6	20%
10-16	2	6.7%
16-20	0	0%
Total	30	100%

This table shows that most of the patients 73.3% treated by inramedullary nails were immoblised for 2-6 weeks.

TABLE5- SHOWING IMMOBILIZATION PERIOD FOR PATIENTS TREATED BY SMALL FRAGMENT DCP

No. of weeks	No. of cases	Percentage
0-2	20	40%
2-6	26	52%
6-10	4	8%
Total	50	100%

This table shows that most of the cases treated by DCP were immobilised for 2-6 weeks i.e. 52%.

TABLE 6- Showing average time period for radiological union

Type of treatment	Time period	No. of patients
Closed reduction	16 weeks	20
I. M. nailing	16 weeks	30
D.C. plating	9.4 weeks	50
Total		100

Table shows that average time period for radiological union in cases

treated by dyanamic compression plate was 9.4 weeks and for both closed reduction and I.M. nailing was 16 weeks.

TABLE 7- SHOWING FUNCTIONAL END RESUTLS (BASED ON HADDEN ET AL CRITERIA)

Results	Present series			Hadden et al
	Closed Red.	Nailing	DCP	
Excellent	2 (10%)	17 (56.6%)	33 (66%)	60 (54.5%)
Good	6 (30%)	6 (20%)	8 (16%)	29 (26.4%)
Fair	-	2 (6.8%)	6 (12%)	11 (10%)
Poor	12 (60%)	5 (16.6%)	3 (6%)	10 (9.1%)
Total	20 (100%)	30 (100%)	50 (100%)	110 (100%)

This table shows comparison of functional end result between Hadden et al[8] different modalities of treatment of present series. Results of plating is comparable with Hadden et al series but Nailing is inferior & closed reduction is further interior to nailing.

DISCUSSION

The present study comprises of hundred selected cases of closed diaphyseal fractures of both bones forearm treated by closed reduction with plaster cast immobilisation, open reduction and intramedullary fixation by Talwalkar's nails & open reduction & small fragment dyanamic compression plating.

AGE INCIDENCE

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 32 years. The high incidence in this age group is due to their active routine.

SEX INCIDENCE

In the present series males constituted 78% where as females constituted 22% cases. The low incidence in males is due to their less hectic schedule & predominantly indoor lifestyle.

SIDE INVOLVED

In the present series, right side involvement is 56% and left side involvement is 44%. Predominantly right sides involvement may be due to the excess activity of the dominant upper extremity.

SITE OF FRACTURE

TABLE 8- COMPARISION OF LEVELS OF FRACTURES IN OTHER AND PRESENT SERIES

Authors	Level		
	Proximal (1/3rd)	Middle (1/3rd)	Distal (1/3rd)
Smith et al (1957)	20%	60%	20%
Merk et al (1961)	11.4%	62.9%	25.7%
burwell & Charnley (1964)	10%	75%	15%
Naiman et al (1970)	3.33%	56.67%	40%
Present series	14%	68%	18%

This table shows that there is high incidence of fracture of middle third segment. This is due to its position between two rotating group of muscles that is supinator proximally and pronator distally.

EXTERNAL IMMOBILISATION

In case of patients treated by dyanamic comression plating. duration of external immobilision was 2-6 weeks depending upon the type of fracture, rigidity of fixation and the intelligence cooperation and compliance of the patients.

Anderson[2] (1975) suggested that after compression plating the post operative regimen should be individulized according to the type of fracture, rigidity of fixation and cooperation of patients.

Grace et al[7]. (1980) studied early mobilization in cases of fracture forearm bones. They reported that there is no significant influence of early motion in cases of single bone fractures whereas in cases of dubble bone fractures patients regained significant rotation of forearm. They also reported that it decreases the chances of oedema, muscle atrophy, adhesions and joint contractures.

In cases of patients treated by intramedullary nailing, the duration of immobilisation was 3-6 weeks. Some difference of opinion exists about the use of plaster after internal fixation by intramedullary nails. Smith et al (1959) reported that nonunion is more common in fractures not treated in adequate plasters, while the speed of functional recovery in patients without plaster is very striking. The higher incidence of non- 1,-lion makes routine used of the method unjustifiable. Khare et al. (1988) used Talwalkar nail for fracture forearm in 46 cases with only two weeks plaster cast immobilisation and then gentle active elbow exercise was encouraged, forearm were supported in triangular sling till the indavidual regained normal strength and reported good results.

In the cases treated closed reduction plaster cast immobilisation was done for 12-20 weeks depending upon the signs of clinical and radiological union.

RADIOLOGICAL UNION

Radiological union was observed in 48 cases out of 50 patients treated by D C P. There were 2 cases of non--union, one case who developed deep infection and another case of non-union ulna in which severe communition was present.

One segmental fracture of radius treated by I. M. Nail developed non-union. Of the 20 patients treated by closed reduction, two patients developed non-union.

Average time for union in D C P cases was 9.4 weeks. Anderson has reported radiological union in 7.4 weeks, Rai and Sharma reported union in 6-8 weeks.

Average time for union in cases treated by I.M. Nail was 16 weeks. Patwa and Vaidya[10] (1990) reported average time of radiological union 15 weeks. Khare et al (1988) reported radiological union between 6 months and one year in cases treated by I.M. Nail.

Cases treated by closed manipulation average duration of union were 16 weeks as compared to 14 weeks reported by Evans et al (1951).

FUNCTIONAL AND RESULTS

Though union is an important aspect of the treatment, in course of time, the emphasis has shifted from achieving high rate 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. Different surgeons adopted different have criteria for assessing functional recovery.

In our series the criteria by Hadden et al[8] (1983) have been adopted in the results are as follows –

TABLE 9-SHOWING RESULT AS CRITERIA BY HADDEN ET AL (1983).

Results	Present series			Hadden et al
	Closed Red.	Nailing	DCP	
Excellent	2 (10%)	17 (56.6%)	33 (66%)	60 (54.5%)
Good	6 (30%)	6 (20%)	8 (16%)	29 (26.4%)
Fair	-	2 (6.8%)	6 (12%)	11 (10%)
Poor	12 (60%)	5 (16.6%)	3 (6%)	10 (9.1%)
Total	20 (100%)	30 (100%)	50 (100%)	110 (100%)

For plating poor results were obtained in three cases, with more than 30 degree loss of rotational movements in one case, and continuous pain in two cases (one with deep infection and another with non-union ulna). Fair results were achieved in 6 cases with 15-30 degree loss of rotational movements but occasional pain without activity. Excellent or good results were obtained in 41 i.e. 82% of the cases.

For patients treated by Talwalkar's 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 it continuous pain without activity). Fair results were obtained in 2 cases with loss of rotational movements between 15-30 degree but pain only after activity. Excellent or good results were obtained in 23 cases i.e. 76.6%.

In cases treated by closed reduction poor results were obtained in 12 cases i.e. 60%, with more than 70 degree loss of rotational movements, marked impairment in strength of grip in 10 cases and continuous pain in 2 cases. Excellent or good results in 8 cases i.e. 40%.

As compaired to various studies:-

Burwell and Charnley[3] (1964) reported 116 patients whose fixation remained intact, 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% developed non-union.

Anderson et al[2]. (1975) used dynamic compression plate and reported 59.74% excellent results, 30.94% satisfactory, 7.17% unsatisfactory and 3.13%. failure.

Grace[7] et al. (1980) reported 80% excellent or good results, 11% acceptable results, 9% unacceptable results.

Rai and Sharma[11] by Muller criteria reported 67.6% excellent results, 25.6% good results and 10.8% poor results.

Knight and Purvis[9] (1949) reported unsatisfactory results due to loose fitting nails which failed to maintain correct rotational alignment and angulation at the fracture site.

Sage[12] (1959) designed medullary nails of radius having present bow and reported 6.2% of non-union.

Talwalkar[13] (1967) designed square medullary nails and achieved union in all 72 patients.

SUMMARUY AND CONCLUSION

1. Average immobilision period for DCP cases was 9.4 weeks and for both nailing and closed reduction 16 weeks.
2. More than 30 degree loss of rotation was 2% in DCP cases 6.66% in nailing cases and 68% in cases treated by closed reduction.
3. Functional end results were 82% excellent to good in plating, 76% in nailing cases and 40% in cases treated b closed reduction.

Poor results were obtained in 6% of the cases treated by D C P. 16.6% in cases treated by nailing and 60% in cases treated by closed reduction.

The important factor that emerged from the above study is that for functional end results to be excellent to good, plating is the best mode of treatment for fracture forearm bones as 82% excellent to good results had achieved and nailing also have comparable results as achievement of 76% excellent to good results but as patients treated by closed reduction had 40% poor results, so this method is not justifiable for treating the patients of diaphyseal fracture forearm bones.

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