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ORIGINAL ARTICLE

A CLINICAL STUDY OF COMPRESSION PLATE FIXATION IN DIAPHYSEAL FRACTURE OF RADINS AND ULNA

Munin Borgohain[1], Deepika Lahon[2]

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ABSTRACT: Compression plate fixation for definitive management of diaphyseal fracture of radius and ulna has a long history. Danis.[1] of Belgium was probably the first surgeon to use a compression plate in the treatment of acute fractures. **AIM:** In India, there have been limited number of published clinical studies on this subject so far and probably none from North eastern region. It is our humble hope that this work would throw some light on this demanding, resource consuming problem and its management in our set up and with our scarce resources. **MATERIALS:** Thirty Seven patients with 61 fractures were taken for dynamic compression plate fixation in diaphyseal fractures of radius and ulna who admitted in the department of Orthopaedic Surgery, Gauhati Medical College under me in the year 2007 and 2008. There are average follow up of 2 years. **METHODS:** The fracture in distal radius were exposed through Anterior Henry approach, dorsal Thompson approach for proximal third and in the middle third either approach was used-The fractures of ulna were exposed through an incision along the Subcutaneous border. **RESULT:** 61 of 62 fractures (98%) found united and only non-union was found in ulnar bone. Excellent functional result in 51% cases, Satisfactory in 32%, Unsatisfactory in 14% and failure in 3% cases and data is Comparable to Anderson et al.[2] **CONCLUSION:** In View of the excellent and Satisfactory result in 84 percent cases with fewer Complications, dynamic Compression plate fixation, merits Continued use in Cases of diaphyseal fractures of radius and ulna.

KEYWORDS: Diaphyseal, Fracture, Radius, Ulna, Dynamic Compression plate, Reduction.

INTRODUCTION: Diaphyseal fractures of radius and ulna are commonly encountered and constitute many therapeutic problems regardless of the method of treatment. Open reduction and internal fixation is frequently associated with Complications such as post-operative infection, delayed union, Non- union and failure of fixation while close reduction tends to result malunion and loss of function. The pronating and supinating muscles of forearm exert angulatory as well as rotational forces which make difficult to reduce and to maintain the reduction of two mobile parallel bones. Restoration of length, apposition, normal axial alignment and correction of rotational alignment are necessary for restoration of pronation and supination of forearm.

If reduction is not maintained in plaster cast a late decision to operate has to be made. The decision may not be easy, particularly when displacement has occurred slowly over a period of weeks as quoted by Watson jone.[3] Murray.[4] found that delayed operation is distressing to the patient and technically more difficult for the surgeons because of shortening of muscles and organization of exudates Hughston,[5] accepted that close method of treatment for displaced diaphyseal fractures of forearm bones produce unacceptable result. Studies carried out by Naiman et al,[6] Dodge and cady,[7] Anderson el at showed that the more rigid the fixation used, lower the incidence of delayed union and non-union.

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Allgower.[8] developed dynamic compression plate which seems to satisfy the basic objectives of internal fixation, namely anatomical reduction, preservation of vascularity, mechanically stable fixation and rapid mobilization of joints in proximity.

METHODS: Thirty seven cases with 61 fractures were studied regarding the age, Sex, Side involved, Mode of injury, Type of fracture, Bone involved, Region of bones affected, Associated injuries, Degree of Comminution, Time interval between injury and Surgery, Size of plates, number of holes for screw in plates, use of bone graft, Duration of post-operative plaster of paris immobilization, Complications, period of radiological union, result in terms of union and functional result. Pre-operative radiographs were examined to assess the type of fracture and degree of comminution. Post-operative radiographs were done to assess the accuracy of reduction and technical quality of fixation. Follow up radiographs were done to assess the time of radiological union. Follow up of patients carried out at an interval of 3, 8, 12 and 15 weeks and then at 2 months interval. As stated by chapman et al,[9] we fixed in all adults with displaced fractures of the shaft of radius and ulna with more than 10 degree of angulations' or with subluxation of the proximal or distal radio-ulnar joint. Results were evaluated in terms of union and functional results according to criteria of Anderson et al.

OBSERVATION AND RESULTS: Majority Cases (78%) were between the age group of 11 to 29 years with mean age 29 years (Table I) in our Study, male far outnumbered the females (78:22) (Table II). Right sided fractures (54%) and there was no bilateral cases (Table III). The factures were commonly occurred due to fall on ground (49%) (Table IV). Transverse fractures were Common than oblique and Comminuted fractures (Table V) Fracture in both bones of forearm were common than single bone fractures (Table VI). Most of the fractures were found in the middle third region (49%) (Table VII). Cerebral Concussion (5%) Transient Neuroprexia (5%) were some associated injuries in our study (Table VIII). 74% fractures had no Comminution and rest of bones had slight and moderate degree of comminution (Table IX). Most cases (62%) were reported to the hospital between 1 to 3 weeks of time (Table X). 3.5mm dynamic Compression plate were used in 52 of 61 fractures with an incidence of 62% (Table XI). 5 hole plates (61%) were used in maximum number of fractures (Table XII). Illiac crest bone graft was used in 40% cases (Table XIII) Post-operative plaster of Paris immobilization was used for 3 weeks in 62% cases. (Table XIV).

We encountered Complications like Superficial infection (2 Cases), Non-union in 1 Case, Transient Neuroprexia of posterior interosseous nerve in 2 Cases, loosening of screw in 1 case, Radio-ulnar synostosis in 1 case (Table XV). 26 number of fractures were united radiologically at 12 weeks with equal number at 15 weeks (Table XVI). 60 of 61 fractures (98%) found united and only non-union was found in ulnar bone (Table XVII).(Fig I) Excellent functional result found in 51% cases, Satisfactory functional result in 32% Cases, Unsatisfactory in 14% cases and failure in 3% cases (Table XVIII) & (Fig. 2, 3, 4, 5).

DISCUSSION: Majority Cases were in the age group of 11 to 29 years with mean age 29 years which is comparable to authors like Hidaka and Gustilo.[10] Male outnumbered the females as males mostly engaged in outdoor activities and data is Comparable to Chapman et al. Right Sided fractures were more and had no bilateral cases and data can be compared to Marek,[11] fall on ground was common mode of injury which can be compared to Moore et al.[12]

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Transverse fractures were Common and is similar to Mudgal el, al.[13] both bone fractures were Common than single bone fractures and data is comparable to Dodge and cady. Fractures mostly occurred in middle third region and can be compared to Mudgal et al. Cerebral Concussion, Transient Neuroprexia were some associated injuries in our study and is comparable to marek et al. In our study, 74% fractures had no Comminution and others had mild to moderate degree of Comminution which can be compared to Anderson et al. Most cases reported to the hospital between 1 to 3 weeks and data is comparable to Smith.[14] 3.5mm dynamic compression plate was used in 62% cases which is similar to Chapman et al. 5 hole plate was used in maximum number of fractures and can be compared to Moore et al. Illiac crest bone graft was used in 40% cases according to criteria of Burwell and charnley [15] and when fractures were more than 3 weeks old. In 62% cases, post-operative plaster of paris immobilization was used for 3 weeks and data is similar to Moore et al.

We encountered superficial infection in 2 cases which healed after antibiotic coverage, Non-union in 1 Case which was due to technical failure, transient Neuroprexia of posterior interosseous nerve in 2 cases, which recovered subsequently, loosening of screw in 1 case but did not hampered in healing, radio-ulnar synostosis in 1 case after excision of radial head and data can be compared to Moore et al. 26 number of fractures were united radio logicaly in 12 weeks with equal number in 15 weeks and can be compared to Naiman et al. 60 of 61 fracture (98%) found united and only non-union was found in ulnar bone and is comparable to Anderson et al. Excellent functional result found in 51% cases, Satisfactory in 32% cases, unsatisfactory in 14% and failure in 3% cases and data is comparable to Anderson et al.

In view of the excellent and satisfactory result in 84% cases with fewer complications, Dynamic Compression plate fixation merits continued use in case of diaphyseal fracture of radius and ulna.

Group	Age (Years)	No. of Cases	Percentage
I	1-19	11	29.79%
II	20-29	10	27.03%
III	30-39	8	21.62%
IV	40-49	4	10.80%
V	50-59	2	5.41%
VI	60-69.	2	5.41%
	Total	**37**	**100.00%**

Table 1: Incidence of Age

Sex	No. of Cases	Percentage
Male	29	78.37%
Female	8	21.63%
Total	**37**	**100.00%**

Table 2: Incidence of Sex

Side	No. of Cases	Percentage
Right	20	54.05%
Left	17	45.95%
Total	**37**	**100.00%**

Table 3: Incidence of Side

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Type of Fracture	No. of Cases	Percentage
Transverse	28	45.90%
Oblique	17	27.80%
Comminuted	16	26.23%
Total	**61**	**100.00%**

Table 4: Type of Fracture

Bone Involved	No. of Cases	Percentage
Radius alone	5	13.5%
Ulna alone	8	21.6%
Both bones	24	64.9%
Total	**37**	**100.00%**

Table 5: Bone Involved

Region	No. of Fractures	Percentage
Upper1/3rd	16	26.23%
Middle 1/3rd	30	49.18%
Lower 1/3rd	15	24.59%
Total	**61**	**100.00%**

Table 6: Region of bones affected

Associated Injuries	No. of Cases	Percentage
Cerebral Concussion	2	5.41
Transient Neuroprexia	2	5.41
Cut injury of Scalp	2	5.41
Cut in jury of Contralateral forearm	1	2.70
Superficial burn over scapular Region and lacerated wound over the occiput	1	2.70
Ipsilateral Clavicular fracture	1	2.70
Total	**9**	**24.33**

Table 7: Associated Injuries

Degree of Comminution	Fractures	
No. Comminution	No.	Percentage
Slight	45	73.78%
Moderate	12	19.67%
Severe	0	0%
Total	**61**	**100.00%**

Table 8: Degree of Comminution

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Time Duration (Wks.)	No. of Cases	Percentage
Up to 1 week	3	8.11%
1-3	23	62.16%
3-5	9	24.32%
5-7	2	5.41%
Total	37	100.00%

Table 9: Time Interval Between Injury and Surgery

Dynamic Compression Plates	No. of Plates		Total
	Radius	Ulna	
3.5	24	28	52
4.5	5	4	9
			61

Total 10: Size of Plates

No .of Holes for Screws in Plates	Bone Fractured		Total Fractures
	Radius	Ulna	
7	3	5	8
6	7	5	12
5	18	19	37
4	1	3	4
Total			**61**

Table 11: No of hole for screws in plates

No. & Percentage of Cases where Bone Graft was used	No. of cases	Percentage
	15	40.54%

Table 12: Incidence of Graft

Duration of Post-operative Immobilization (wks.)	No. of Cases	Percentage
3 Weeks	23	62.16%
3-4 Weeks	2	5.41%
4-5 Weeks		
5-6 Weeks	12	32.16%
Total	**37**	**100.00%**

Table 13: Duration of post-operative plaster of peris immobilization

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Complications	No. of Cases	Percentage
Superficial infection	2	5.4
Non-union	1	2.7
Transient neuroprexia	2	5.4
Loosening of screw	1	2.7
Radio-ulna synostosis	1	2.7

Table 14: Incidence of Complications

Bone fractured	Time for Radiological union [in Weeks]			No. of fractures
	9th	12th	15th	
Radius [alone]	0	2	3	5
Ulna[alone]	0	2	5	7
Both bones :				
radius-	4	11	9	24
Ulna	4	11	9	24
Total :	**8[13.33%]**	**26[43.33%]**	**26[43.33%]**	**60**

Table 15: Period of Radiological Union

Ulna				Radius		
Original number	8	24	32	5	24	29
Union-6mons	7	24	31	5	24	29
Delayed union-6mons	0	0	0	0	0	0
Non- union	1	0	1	0	0	0
Percentage union	96.87	100	98.43	100	100	100

Table 16: Results in terms of Union

Ulna				Radius		
Original number	8	24	32	5	24	29
Union-6mons	7	24	31	5	24	29
Delayed union-6mons	0	0	0	0	0	0
Non- union	1	0	1	0	0	0
Percentage union	96.87	100	98.43	100	100	100

Table 17: Results in terms of Union

FRACTRES	RESULTS			
	Excellent	Satisfactory	Unsatisfactory	failure
Ulna only [8]	4	1	2	1
Radius only[5]	2	3	0	0
Both bones [24]	13	8	3	0

Table 18: Functional Results

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Fig. 1

Fig. 2

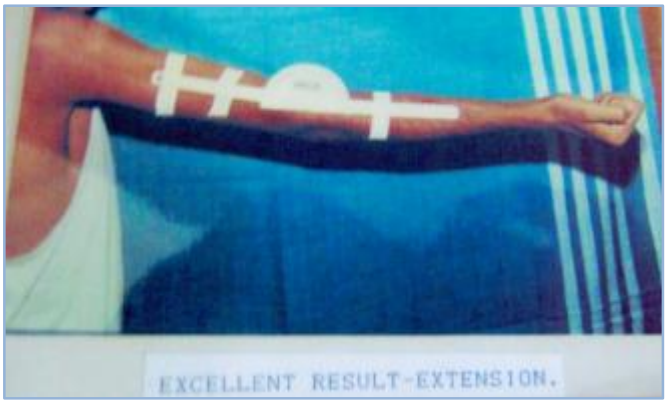

Fig. 3

Fig. 4

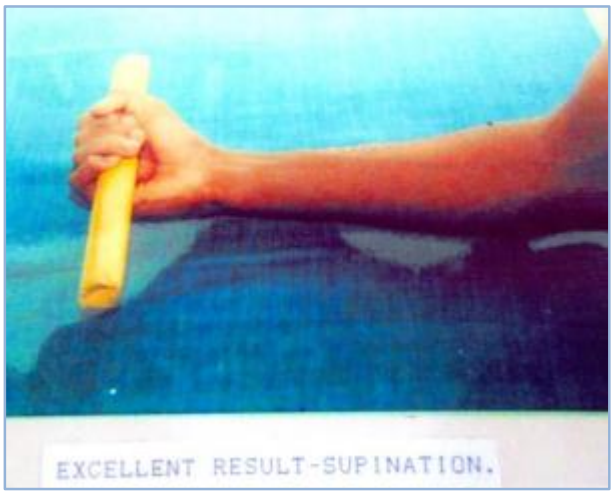

Fig. 5

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AUTHORS:

1. Munin Borgohain
2. Deepika Lahon

PARTICULARS OF CONTRIBUTORS:

1. Associate Professor, Department of Orthopaedics, Fakruddin Ali Ahmed Medical College and Hospital, Jotigaon, Barpeta, Assam.
2. Associate Professor, Department of Bio-Chemistry, Gauhati Medical College and Hospital, Guwahati, Kamrup, Assam.

NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Munin Borgohain,
Bahniman Path,
House No. 8 (Near Jayanagar L. P. School),
Beltola, Guwahati-28, Assam.
E-mail: deepikagmc08@gmail.com

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