

COMPARISON OF SURGICALLY TREATED FRACTURE FOREARM BONES WITH PLATING IN BOTH BONE VERSUS PLATING IN RADIUS AND NAILING IN ULNA

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ABSTRACT

Background: Internal fixation of radius and ulnar shafts fractures are done by Plate & screw fixation and intra medullary nailing. The purpose of this study is to compare the functional results of both bone plating and combined plate and intramedullary (IM) nail fixation in BFBFs. **Material and methods:** 34 out of a test group of 52 patients underwent plate fixation only (group A) while 18 (group B) had combined plate and IM nail fixation. **Results:** According to Grace and Eversmann rating system, group A had 15 excellent, 14 good, one acceptable and one unacceptable result. Group B had 3 excellent, nine good, two acceptable and two unacceptable results. The average DASH score was 7.1 in group A and 15.1 points in group B. Three cases of nonunion achieved a bony union by additional procedures and the functional results of these cases improved to good or excellent. **Conclusion:** Overall results were a better with DCP fixation in both bones to combined square nail and DCP fixation, especially in case of lower 1/3 transverse fracture of the ulna.

Keywords: Internal fixation, forearm bones fracture, plating, nailing.

INTRODUCTION

The forearm represents a clinical, anatomic unit of the upper limb, permitting the effector organ of the upper limb, the hand, to be placed in any position to either grasp or support an object.

The forearm maintains a stable link between elbow and wrist serving as an origin for many of the muscles that insert on hand. The articulation is one of two bones, one rotating around the other, joined proximally and distally by radioulnar joints, and bound together in its mid-substance by

an interosseous membrane. The longitudinal axis of rotation of forearm passes uniquely through these structures; yet, during forearm rotation, the radius being curved bone rotates around the axis which is parallel to neither radius nor ulna.

In diaphyseal fracture of radius and ulna, normal rotational alignment is necessary if a good range of pronation and supination is to be restored and also regaining of length, apposition and axial alignment. Any axial or rotator malalignment or

change of interosseous space or encroachment of callus into it will cause a proportionate loss of supination and pronation (1,2).

In adults all fractures of both bones of the forearm should be treated surgically, management of diaphyseal fractures of forearm bones by Dynamic Compression Plates seems to satisfy the basic objectives of internal fixation namely anatomical reduction Preservation of vascularity, mechanically stable fixation, and Rapid pain-free mobilization. This method has some limitations in SFBFBs with extensive soft tissue damage, severe swelling, open fracture, segmental fracture, or a limited operation time due to associated injuries. The disadvantages of plate fixation include a relatively large skin incision, interruption of bloody supply due to wide periosteal dissection of the forearm bone, or refracture following plate removal (3, 4). In order to overcome these problems, intramedullary (IM) nail fixation can be used as an alternative method for treating SFBFBs.

The purpose of this study is to analyse the results and compare the functional outcome of diaphyseal fracture of both forearm bones treated by plating only and combined nailing and plating.

MATERIAL & METHOD:

This study was conducted in the Department of Orthopaedic Surgery, JLN Medical College and Hospital, Ajmer. The cases for the present study were selected from the patients attending emergency as well as the outpatient's department of Orthopaedics from December 2014- December 2016. A total of sixty cases are being included in this study. The inclusion criteria were age >17 yrs and diaphyseal fractures of both bones of the forearm. Open fractures and fractures with duration more than two weeks and pathological fractures were excluded. Two groups were formed, Group A treated by intramedullary nail

fixation in the ulna and DCP fixation in radius and Group B managed by DCP in both radius and ulna. Out of the total of 60 cases a majority of patients were males, 46 (76.7%), and females were only 14 (23.3%). Sex distribution in both groups of patients was 90% males in Group A and 63.3% males in Group B.

Out of the total of 60 cases, road traffic accidents alone accounted for 27 (45%) cases. A direct hit by a lathi and wooden log accounted for 13 (21.7%) cases. Fractures occurred due to fall is 13 (21.7%) cases, 4 cases (6.7%) occurred due to work accident and 3 cases (5%) due to Heavy Load Lifting. One patient got his forearm refractured through eighteen month's old healed fracture of ulna while lifting heavy weights. 33 (55%) fractures of the right forearm and 26 (43.3%) fractures of left forearm. One case had bilateral forearm fracture.

All cases were operated by a single surgeon using anterior Henry approach for Radius, and dorsal subcutaneous approach for ulna and tourniquet was applied in all cases. The postoperative POP posterior slab was implemented in all cases for at least two weeks.

Functional outcome was evaluated at the end of follow up using two criteria, Grace and Eversmann criteria (5) for fracture union and The Disabilities of Arm, Shoulder, and Hand (DASH) score (6).

RESULTS:

55 out of 60 cases achieve union, in upper ^{third} fractures in Group A, average union time was 19.1 weeks, and in Group B it was 10.9 weeks. For middle third fractures, the average time to union was 14.3 weeks in Group A and 9.3 weeks in Group B. For lower ^{third} fractures average time to union was 22 weeks in Group A and 15 weeks in Group B.

Table: 1 Distribution of patient according to fracture site

Site of fracture	Group A			Group B			Over All		
	No. of cases	of Time Union		No. of cases	of Time Union		No. of cases	of Time Union	
Upper 3rd	3	19.1		5	10.9		8	16.68	
Middle 3rd	23	14.3		19	9.3		42	14.24	
Lower 3rd	4	22		6	15.0		10	18.56	

In Group A 27 out of 30 patients achieve union with average union time of 18.4 weeks (7-32 weeks range). In Group B 29 out of 30 cases achieved union with average union time of 11.6 weeks (6-38 weeks range).

One case of nonunion in group B occurs due to deep infection which leads to removal of the implant. Three cases in group A leads to non-union of ulna out of which in one case intramedullary nail was removed and fixed with DCP and bone grafting yielding high functional results.

The average range of supination and pronation in all patients was 83° (range, 51° to 90°) and 79° (range, 51° to 90°), which was 91% and 88% of the contralateral rotation (mean supination of 90° and pronation of 88°), respectively. In group A, the average range of supination and pronation was 82° (range, 53° to 90°) and 79° (range, 57° to 90°), which was 94% and 89% of the contralateral rotation (mean supination of 90° and pronation of 89°), respectively. In group B, the average range of supination and pronation was 83° (range, 51° to 90°) and 82° (range, 51° to 90°), which was 85% and 83% of the contralateral rotation (mean supination of 89° and pronation of 88°), respectively. The range of supination (p =0.001)

and pronation (p=0.020) indicated a significantly higher recovery in group B than in group A.

According to the Grace and Eversmann rating system, group A showed an excellent result in 14 patients, good in 13 patients, unacceptable in 3 patients and acceptable in no patient. Group B showed an excellent outcome in 21 patients, good in 8 patients, unacceptable in 1 patient and acceptable in no patient. Group B showed more satisfactory results than group A in the Grace and Eversmann rating system (p=0.002).

According to the DASH score, group A had an average DASH score of 11.97 points (range, 0 to 27 points) and group B had an average DASH score of 9.7 points (range, 0 to 29 points)

COMPLICATIONS:

In our series of patients, in Group A, 3 cases of Non-Union were seen. Two cases were seen in lower third ulna fracture and one case in the middle third ulna fracture. All 3 cases of non-union have a transverse fracture of the ulna. One case of nonunion has a comminuted fracture of radius while other 2 has a transverse fracture of the radius. Radius was united, but ulna goes into

Non-Union in all 3 cases. After 10 Months Square nail was removed from ulna and open reduction internal fixation with DCP was done for ulna with bone graft taken from the ipsilateral iliac crest to achieve union. Four cases of olecranon bursitis with implant prominence were also seen. In

Group B 1 cases shows superficial infection of the suture line in fracture ulna, which was recovered after a course of antibiotics. One case shows deep infection with pus discharging sinus leading to the removal of the implant.

Table no.2 Clinical outcome of patients

Variable	Group A	Group B	Total	P-Value
Grace & Eversmann functional evaluation				0.002
Excellent	14	21	35	
Good	13	8	21	
Acceptable	0	0	0	
Unacceptable	3	1	4	
The range of motion (°), mean (range)				
Supination	82 (53-90)	83 (51-90)	83 (51-90)	0.001
Pronation	79 (57-90)	82 (51-90)	79 (51-90)	0.002
DASH score, mean (range)	11.97 (5-27)	9.7 (5-29)	10.81 (5-29)	0.001
Union time (wk), mean (range)	18.4 (7-32)	11.7 (6-38)	16.4 (6-38)	0.001

DISCUSSION:

Most of the authors recommend surgical treatment by open reduction and internal fixation for both bones of forearm fracture to achieve anatomic reduction for functional recovery of the forearm. Anatomic reduction is significant as malunion results in significant loss of forearm pronation and supination. According to Mathew et al. (2), residual angulation of less than 10° was associated with little loss of forearm rotation and residual angulation of 20° or more was associated

with a functionally significant loss of forearm rotation.

Sisk studied the principles of intramedullary fixation, where he found intramedullary fixation better when the fractures occurred through the narrow part of the medullary canal. (7) Smith and Smith and Sage (8), Maleck in their studies concluded the favourable results of intramedullary nail fixation. Whereas Dodge and Cady (10) Anderson et al. (11) Grace and Eversmann (5)

Hadden (12) supported fixation of forearm good results.

Bagby (13,14) and Denham (15) Allgower (16) suggested dynamic compression plates.

Plate fixation by achieving anatomic reduction helps to maintain the length of bones, rotational alignment, radial bowing, and interosseous space between the radius and ulna. Due to rigid fracture fixation, early mobility of forearm can be allowed and help in functional recovery. The disadvantage of DCP fixation is large skin incision, disruption of blood supply caused by extensive soft tissue dissection, or refracture after plate removal. IM nail fixation has advantages such as small skin incision, minimal soft tissue stripping, and short operation time. However, it is difficult to reduce anatomical relationships in comminuted or long oblique fracture with this technique. Other disadvantages include higher radiation exposure caused by closed reduction, longer duration of immobilization, and longer time to achieve complete union than plate fixation.

In this study, we evaluated the results of plate fixation only versus combined plate and IM nail fixation for treatment of both bones of forearm fracture. Plate fixation yielded more excellent results than combined fixation regarding the functional outcomes according to the Grace and Eversmann rating system, the rotation range of the forearm, the DASH score, and the time to union. Use of plating and IM nailing has been described in many works of literature. Because combined fixation is not a new fixation technique, there is no specific indication for combined fixation

Kim et al. (17) reported average DASH score of 7.1 points (range, 0 to 19.2 points) in the group of patients treated by DCP in forearm fracture and 15.1 points (range, 0 to 29.6 points)

in the group treated by square nail and plate. In our series According to the DASH score, group A had an average DASH score of 11.97 points (range, 0 to 27 points) and group B had an average DASH score of 9.7 points (range, 0 to 29 points).

CONCLUSION:

The range of rotational movements (supination and pronation) at forearm was significantly cases where DCP fixation was used as cases where square nail fixation was used.

In case of Tense compartment Square nail fixation of ulna and DCP fixation of the radius is safer than plating in both bones.

Overall results were a better with DCP fixation in both bones to combined square nail and DCP fixation, especially in case of lower 1/3 transverse fracture of the ulna.

The study meets the ethical standard according to **The Declaration of Helsinki, 1964**

Conflict of Interest: There is no conflict of interest relevant to this article.

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