

**A Hospital Based Cross Sectional on Management and Outcome of Fractures Both Bones of the Forearm by Plate and Screw Fixation**Puneeth<sup>1</sup>, Abrar<sup>2</sup>, Jainath<sup>3</sup><sup>1</sup>Consultant Orthopaedic Surgeon, Sanjay Gandhi Institute of Orthopaedics and Trauma, Bengaluru<sup>2</sup>Fellow Arthroplasty, Sanjay Gandhi Institute of Orthopaedics and Trauma, Bengaluru<sup>3</sup>Associate Professor, Sanjay Gandhi Institute of Orthopaedics and Trauma, Bengaluru

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**Abstract:**

**Background:** The forearm fractures contribute around 10-14% amongst all the fractures occurring in the body which are secondary to trauma of high intensity energy. Patients with retained plates following open reduction and internal fixation, refractures mostly occurred at the site where the edge of the plate is located. This study was taken up to evaluate the results of internal fixation of diaphyseal fractures of both bones of the forearm treated by screw osteosynthesis.

**Methods:** The study is a Hospital based Prospective Interventional. A total of 30 cases were considered.

**Results:** In the present study, most fractures were seen in third and fourth decade of life. 60% of study participants were males, female patients were 40%. 53.3% of patient had excellent and 33.3% as satisfactory results. 20% patients had superficial infection, 6.7% cases had elbow stiffness and none had delayed union.

**Conclusion:** Based on our analysis of complication rate and severity, radiographic measurements, including the time of union; it is suggestive that open reduction and internal fixation of plate as well as screw fixation is safer and effective mode of treatment for fractures of both bones of forearm.

**Keywords:** Plate and Screw Fixation, Fractures of the Forearm.

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**Introduction**

The forearm fractures contribute around 10-14% amongst all the fractures occurring in the body which are secondary to trauma of high intensity energy.[1] Most of the both bone fractures are treated by fixing the plates.[1,2] However, there is common observation that, post fracture healing there is insist to remove the implants from the patient either due to symptoms or priority from patient to get it removed.[3,4]

Ideally, the surgeon generally waits minimum for 12-24 months period post initial surgery before the removal of plate.[5-7] Most common indication for removal of implant is pain or discomfort, followed by infection and restricted motion.[3,4] Many studies stated rates ranging between 3.9% and 26%[1,3,8] reported implant removal on a routine basis raised the chances of refracture.

However, it is still not clear whether this is the cause for refracture. It is observed that patients with retained plates following open reduction and internal fixation, refractures mostly occurred at the site where the edge of the plate is located.[8] whereas, in patients in whom plates gotten removed mostly the refractures occurred at the site of prior

screw. It was noted an interesting point that there was no difference between nailing and plating statistically. It was concluded that, even though good functional results could be obtained secondary to intramedullary nailing of forearm fractures, open reduction and internal fixation of fracture stays the treatment of choice for most forearm fractures adhering to AO principles.9 thus, this study was taken up to evaluate the results of internal fixation of diaphyseal fractures of both bones of the forearm treated by screw osteosynthesis.

**Objectives**

To evaluate the results of internal fixation of diaphyseal fractures of both bones forearm treated by screw osteosynthesis

**Materials and Methods**

The study is a Hospital based Prospective Interventional Study conducted on patients admitted to Khaja Bandanawaz Teaching and General Hospital attached to Khaja Banda Nawaz University, Kalaburagi, in the Department of Orthopaedics with fracture both bones of the

forearm in adults. The current study was conducted during the period of January 2019 to June 2021 (18months). A total of 30 cases were considered and an informed consent was obtained from each patient. Patients above 18 years of age irrespective of gender with radiologically diagnosed forearm fractures (Diaphyseal fractures of both bone forearm), patients with open fractures or fractures with compartment syndrome needing fasciotomy, and patients needing vascular repair were excluded from the study.

**Sample Size**

Sample size was calculated, by considering union rate as 97.9 according to a study by Khateeb MKN et al.[10] Using Open Epi 2.3.1 software, and power of 80% the sample size was calculated to be 14, which was rounded off to 15. Approval for the study was obtained from the Institutional Ethics Committee.

**Course in the Hospital**

After satisfying the inclusion/ exclusion criteria, a detailed history was taken from the patient and/or attendants to understand the mechanism of injury as well as severity of the trauma. Clinical examination of the patients was performed to evaluate their general condition and local injury. Local examination of injured forearm was conducted. In this, any nerve injury noted. Radiographs of the radius and ulna i.e., both antero-posterior and lateral views were taken. The view in the radiographs was taken to include the elbow and wrist joints in each view. The limb was then immobilized, with above elbow plaster of Paris Slab with sling. The patient was taken for surgery following the routine investigations.

**Operative Procedure:** Operative procedure was started with brachial block in 11 cases and general anaesthesia in 4 cases. Application of pneumatic tourniquet, time was noted. Painting and draping of the part was done.

The Radius bone was approached using either Dorsal Thompson/Volar Henrys approach. Dorsal Thompson Approach was preferred for proximal radius and mid shaft fractures, whereas, Volar Henry’s approach was initiated for distal radius fractures. Ulna bone was approached directly over the subcutaneous border. The less comminuted

bones which were more stable were fixed on priority and then the other bones was fixed.[11] Fracture ends were identified and cleaned without elevating the periosteum. Reduction of fracture ends were done with reduction clamps and also held in the position. Following the procedure of contouring the plate was then applied as per the requirement. Basically, at least 6 holes plate was preferred for fixing the fracture ends. When in need for such as in case of spiral, segmental and comminuted fractures longer plates were preferred. Fixation of the plates was done dorsally in case of upper 1/3<sup>rd</sup> radial fractures; dorsolateral fixation of plates was for middle 1/3<sup>rd</sup> and volar side fixation of the plate was done for distal radial fractures. In case of fractures of the ulna, on the posterior surface of the ulna plates were fixed.[12]

A 3.5 mm locking screws which were self-tapping then inserted. Drilling the screw hole for axial compression was done after adapting the fracture fragments, thus it forms an acute angle near the plate. A local guide was used with the pointed arrow directing towards the fracture line to be compressed. Following this, for axial compression to maintain, a lag screw was inserted following the drilling (3.5mm) near cortex thereby creating a gliding hole. All screws were inserted. Wound closure was done in layers, once hemostasis was achieved meticulously as well as after ensuring the stable fixation. A suction drain was placed and sterile dressing applied.

**Post-operative management:**

Application of crepe bandage over the affected forearm with arm pouch support was given postoperatively. Limb elevation, movement of fingers and elbow joint was instructed to the patient. Removal of suction drain was done 24-48 hours later post-op. 3-4 days later post-op inspection of the wound was done. A cover of antibiotics as well as analgesics was given until removal of suture. Thus, 14<sup>th</sup> day post-op sutures/staples were removed, and post-op check x-ray was obtained in both antero-posterior and lateral views. Discharging the patient was done post removal of sutures/staples and inserting the arm pouch support. Patient was advised for movements of shoulder, elbow and fingers. An exertional lifting of heavy weights was not encouraged and advised them to avoid.

**Table 1: Showing Distribution of Age, Gender, Side, Mode of Injury, Time of Surgery and Type of Injury in Both the Groups**

	Plating
<b>Age</b>	
<30	4(26.7%)
>30	11(73.3%)
Total	15(100%)
Mean ± SD	41.8±13.85
<b>Gender</b>	<b>Plating</b>

Female	6(40%)
Male	9(60%)
Total	15(100%)
<b>Side of Injury</b>	<b>Plating</b>
Left	8(53.3%)
Right	7(46.7%)
Total	15(100%)
<b>Mode of Injury</b>	<b>Plating</b>
ASL	1(6.7%)
DN	3(20%)
RTA	10(66.7%)
SPR	1(6.7%)
Total	15(100%)
<b>Time of Surgery in Days</b>	<b>Plating</b>
1-3	5(33%)
4-6	9(60%)
7-10	1(6.7%)
Total	15(100%)

**Table 2: Showing Distribution of Subjects According to Union Time, the Range of Motion, Complications, Duration of Hospital Stay and Final Outcome in Both the Groups**

	<b>Plating</b>
<b>Union Time In Weeks</b>	
6-8 weeks	0(0%)
9-11 weeks	11(73.3%)
12 weeks	4(26.7%)
>12 weeks	0(0%)
Total	15(100%)
<b>Range of Motion (In Degree)</b>	<b>Plating</b>
ROM Supination	77±15.33
ROM Pronation	62.67±13.61
ROM Flexion	71±5.41
ROM Extension	65.67±6.23
<b>Complications</b>	<b>Plating</b>
No	11(73.3%)
Yes	4(26.7%)
Yes	Delayed Union
	0(0%)
	Elbow Stiffness
	1(6.7%)
	Infection
	3(20%)
Total	15(100%)
<b>Recovery Satisfaction</b>	<b>Plating</b>
Unsatisfactory	0(0%)
Poor	2(13.3%)
Satisfactory	5(33.3%)
Excellent	8(53.3%)
Total	15(100%)

**Table 3: Showing Mean Values of Age, Time of Surgery, Union Time in Weeks and Hospital Stay**

<b>Variables</b>	<b>Plating</b>
Age (Years )	41.8±13.39
Time Of Surgery (Days)	4.2±1.47
Union Time (Weeks )	10.2±1.21
Hospital Stay (Days )	12.13±2.06

In the present study it was seen that, maximum patients were 30 years and above which was 73.3% and below 30 years were 26.7%. Mean age was 41.8 ±13.39 years. Male patients were 9 (60%) and

Female patients were 6 (40%). Patients with left sided fracture were more 8 (53.3%). Right sided fracture was 7 (46.7%). The current study observes that, RTA is the most common cause of fracture of

both bones forearm in adults which accounts to 10(66.7%) cases. Fracture due to falls which include domestic nature injury and sports accounts to 4(26.7%) cases followed by fracture due to direct blow in cases of assault which constitutes 1(6.7%) cases. There was no statistical significance between the side and types of injury.

Present study observes that, A3 type of fractures were more 10 (66.7%), B3 and C3 type fractures were 4 (26.7%) and 1 (6.7%) respectively. Present study observes that, most patients were operated within 4-6 days 9 (60%) and 5 (33%) patients within 1-3 days. In 1 (6.6%) case, surgery was taken up in 7-10 days. The present study found that none of the patients had radiological union by 6-8 weeks, 11 (73.3%) of the patients had 9-11 weeks and 4 (26.7%) of them had 12 weeks of union time.

In our study none of the patients had delayed union, and it was seen that the average supination range to be  $77\pm 15.33$  degrees, pronation of  $62.67\pm 13.61$  degrees, flexion at wrist to be  $71\pm 5.41$  degrees and extension at wrist to be  $65.67\pm 6.23$  degrees. Our Study observes that, 12 (80 %) didn't have any infection, 3(20%) patients had superficial infection and 1(6.7 %) developed elbow stiffness and non of the patients showed delayed union.

The average hospital stay was  $12.13\pm 2.06$  days in patients operated with plating. In our study it was observed that, 8(53.3%) of the patients showed excellent recovery, 5(33.3%) showed satisfactory results, none of them showed poor results and 2(13.3%) of them showed unsatisfactory results. Patients showed an appreciable and statistically significant improvement in the functional outcome at 6 months follow-up period as evidenced by Anderson et al criteria. The current study showed that, the mean time for union was  $10.2\pm 1.21$ ,  $4.2\pm 1.47$  days was mean time of surgery; whereas,  $12.13\pm 2.06$  was the mean duration of hospital stay in days.

### Discussion

In the present study, it was observed that, the most fractures were seen in third and fourth decade of life, the average age was  $41.8\pm 13.39$  years. Similar results were noted in the study conducted by Frankle Leung and Shew Ping Chow.[13] Another study by H. Nevile Burwell and A. D. Charnley showed that, half of the patients were between second and third decade and had an average age 44.8 years.[14] Most of the current study participants were males, who made up 60% of study participants and 40% were female patients. Similar findings were noted in a study conducted by Dodge. In his study it was noted that, there were about 89% males and 11% females [15]. Michael Chapman found similar results in his study, which showed 78% males and 22% females [16]. In the

current study, 66.7% cases suffered the road traffic accidents, 26.73% had falls which was domestic in nature. A study by Grace et al., as well as Smith found similar distribution of cases. M. W. Chapman reported that, majority of fractures of both bones noted in right extremity;[16] whereas, the current study reported that, about 53.3% of fracture both bones were noted in left extremity.

Mean duration of fracture healing in the current study was 9-11 weeks. Chapman, in a study had 98% union with range of 6 to 14 weeks. The average union time was 12 weeks.[16] Another study noted an average union time of 10.7 weeks with range of 5 to 18 weeks.[13] It had 97.3% union rate.

In a study by Marcheix, who studied the complications of adult forearm fractures which was treated with plate fixation; nonunion was reported in 2-10% of cases, with a bone union rate of 100% and 91.5% respectively. Surgical management of these fractures resulted in a high level of complications like, 9% postoperative neurological lesions, 7% malunion cases, and 4% radioulnar synostoses.[17] In another study by A.C. Masquelet, union of forearm fractures was obtained in 122 patients with mean duration of 4.6 months ( $\pm 2.6$  months). In nine patients, nonunion was observed (6.9%) [18].

In the present study, by determining the range of motion and also by using Anderson et al, scoring system functional outcome was assessed.[19] In a study by Anderson et al, it was reported that 50.9% cases had excellent outcome, 34.9% as satisfactory, 11.3% as unsatisfactory and 2.9% as failure.[19] In another study by Chapman et al, it was reported that 86% cases had excellent outcome, which was more than the current study (53.3%), 7% satisfactory, 2% as unsatisfactory and 5% as failure.[11] The present study had 53.3% excellent and 33.3% as satisfactory results which is comparable to the previous studies. In the present study, overall, 20% patients had superficial infection, 6.7% cases had elbow stiffness and none had delayed union. The superficial infection was managed by usage of appropriate antibiotics after getting culture and sensitivity and one case had elbow stiffness got recovered considerably by physiotherapy. In another study by A.C. Masquelet, it was noted that, the ulnar site which evolved toward septic nonunion was successfully treated with two surgeries over 18 months using the Masquelet technique.[18]

### Conclusion:

Based on our analysis of complication rate and severity, radiographic measurements, including the time of union; it is suggestive that open reduction and internal fixation of plate as well as screw

fixation is safer and effective mode of treatment for fractures of both bones of forearm.

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