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Comparative study of closed intramedullary elastic nailing vs plate osteosynthesis in diaphyseal fractures of both bones forearm in adults

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Abstract

Background: In the current era, fractures of forearm bones have become more common. The forearm serves an important role in the functioning of the upper extremity. Hence aggressive management through good anatomical reduction and internal fixation of these fractures has become a necessity. Fractures of the radius and ulna occupy a large field of the modern traumatology. Therefore, these fractures are a major subject in modern orthopaedics and traumatology. The purpose of this study was to assess and compare functional results of plating and nailing in fracture stabilization.

Aims of Study: 1. To evaluate the results of internal fixation of diaphyseal fractures of both bones forearm treated by plate osteosynthesis and closed intramedullary elastic nailing. 2. To compare the functional results of the two groups treated with plate osteosynthesis and closed intramedullary elastic nailing.

Methods: Retrospective and prospective study with the sample size of 20 patients with both bone forearm fractures. 10 patients were treated with dynamic compression plating and remaining 10 with intramedullary elastic nails. Results were assessed by time for union, type of fractures, range of motion of elbow and wrist joint, complications and functional assessment were done by Grace- Eversmann Criteria and DASH questionnaire

Results: Average surgery time in plate osteosynthesis group was 70 minutes, and in closed nailing group was 50 minutes. In plate osteosynthesis group radius showed union in 9 (90%) patients and ulna in 10 (100%) of patients, and 1 deep infection in plate osteosynthesis closed nailing group both radius and ulna resulted in 100% union rate. In plate osteosynthesis group there was 1 deep infection, no implant failure, and 1 delayed union. Functional results in plate osteosynthesis group were excellent in 7 of patient, satisfactory in 2 of patients failure in 1. There was no unsatisfactory result in this group. In closed nailing group result were excellent in 7, satisfactory in 2, unsatisfactory in 1 and no failure

Conclusions: Our experience indicates that the advantage of closed intramedullary nailing for fractures of both bones forearm are that it allows high rate of osseous union, and it requires less surgical exposure and operative time, less risk of infection than plate osteosynthesis for diaphyseal fractures of both bones forearm in adults. The disadvantage of this system is that post-operative immobilization is required until bridging callus is observed at the fracture site. We conclude that closed intramedullary nailing is not superior to plate fixation but can be considered as an alternative to that method for diaphyseal forearm fractures in adults.

Keywords: both bone forearm fracture, forearm nailing, forearm plating

Introduction

Fractures of both radius and ulna are one of the most common fractures in adults in upper extremity In this era of active life, rapid industrialisation, increasing road traffic accidents, competitive sports; the incidence of fractures of forearm bones are increasing in frequency Forearm fractures are regarded as articular fractures as slight deviation in the spatial orientation of the radius and ulna significantly decreases the forearm's rotational amplitude and thereby impairs the positioning and function of the hand. Thus, the management of these fractures and their associated injuries deserve special attention It is essential to regain length, apposition, axial alignment and normal rotational alignment while treating diaphyseal fractures of the radius and the ulna to gain good range of motion For an optimal result, the basic rule is

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that a stable anatomical reduction with preservation of adjoining joint mobility must be achieved. Operative treatment is therefore the rule rather than the exception. No matter what the implants are used, the goal is to obtain sound union with excellent functional outcome and early mobilization. The aim of this study is to compare the results of closed intramedullary nailing and open reduction and plate fixation of displaced diaphyseal fracture radius and ulna in adults and to evaluate the anatomical and functional outcome of both procedures. Postoperative management: Patients who were operated by compression plates or titanium elastic nails are immobilised in the above elbow POP (plaster of Paris) slab immediately after the surgery, and the operated limb is elevated continuously and the distal neurovascular status is checked. Antibiotics are given IV for the first 5 days and then replaced with oral antibiotics till the 12th day after the surgery. Anti-inflammatory agents, analgesics and other supplements were given.

The post-operative dressing of the surgical wound is done on the 2nd, 5th day after the surgery. Sutures are removed on the 12th day after the surgery,

Patient Selection: Patients presenting to the OPD and Casualty with history of trauma to forearm and diagnosed as having fracture shaft of radius and ulna on X-ray.

Inclusion Criteria

1. Patients belonging to age group 18-60 years.
2. Both male and female gender.
3. Diaphyseal fracture of ulna and radius.
4. Patients fit for surgery.

Exclusion criteria

1. Fracture of forearm bones in children.
2. Pathological fractures.
3. Patient unfit for surgery and significant comorbidities affecting bone healing.
4. Open fracture

Discussion

Fractures of both radius and ulna are one of the common fractures in adults in upper extremity. Healing occurs relatively after closed treatment but mal-union with resultant decreased rotation of the forearm is common and has been associated with poor outcomes. Loss of rotation impedes the function of the upper limb and activities of daily living.

The treatment of displaced fractures of shafts of radius and ulna is primarily operative. The closed reduction and cast immobilisation for the displaced fractures should only be taken if there is a specific contraindication to operative treatment.

Open reduction and compression plate fixation have become the treatment of choice for diaphyseal fractures of forearm bones in adults. Compression-plate fixation gives a high rate of union, low rate of complications and the satisfactory return of rotation of the forearm. Thus excellent results of this mode of treatment have been reported in many series. The AO-group has reported the successful use of compression plate and screws in the forearm shaft fractures. Since then it is one of the widely used and well-established methods of treating forearm bone fractures.

Implants 1: Plating-Dynamic Compression Plate (DCP) and LC-DCP PLATE

The plate size was determined depending on the type of

fracture that was assessed with the help of X rays.

5 to 12 holed plates were kept for surgery. The cortical screw sizes were also assessed radiologically and made available at the time of surgery.

2: Nailing- titanium elastic Nails

The required nail length was determined by measuring the normal limb. The ulna was measured with a tape from the tip of the olecranon to the ulnar styloid. The radius nail size was difficult to measure clinically and was approximately 2.5 cm shorter than the ulna. One cm is subtracted from the measurement to avoid the risk of driving the nail through the end of bone. Nail diameter was determined by measuring the medullary canal size using X-ray. We routinely used 2.5mm-3mm diameter nails during the procedures though all sizes were kept available at the time of surgery.

Image intensifier was positioned over the affected limb. For ulnar nailing 1 cm longitudinal incision was made over the tip of olecranon, triceps insertion was incised. Entry portal was made with the straight awl at a point 5 to 8 mm from the dorsal cortex and 5 mm from the lateral cortex over the olecranon. Reaming was done with the reamer of successively increasing sizes after reducing the fracture by traction and manipulation under image intensifier. Distal fragment was reamed all the way to bone end. A nail of the proper size was selected and inserted in the canal and hammered after reducing the fracture, leaving only 5 mm outside the bone end. Fracture site was seen under image intensifier during hammering to avoid the distraction at the fracture site. Skin sutures were applied.

For radius nailing 1 to 1.5 cm incision was given extending distally from the dorsal margin of joint surface at a point just lateral to Lister's tubercle. The dissection was carried out between the extensor carpi radialis longus and extensor carpi brevis tendon. The entry portal was made with the straight awl directly in line with the medullary canal. At the dorsal margin of joint a straight awl was introduced at an angle of 45° to joint surface. After entering the bone 1 to 1.5 cm, the angle of the awl was dropped to the axis of bone and continued another 1 cm in line with the medullary canal of bone. Rest of the technique was same as used for the ulnar nailing except that the nail was bent regularly to approximate the bow of the radius prior to the insertion.

Operative Techniques

Plating: Henry approach for radius was used in 9 patients with distal fractures and dorsal Thompson approach [8]. For proximal and middle 3rd fracture radius was used in 1 patient. Ulna was approached throughout its length by taking linear and longitudinal incision over the subcutaneous border of the ulna.

The advantages of the plate and screw fixation are that the reduction is done under direct vision; the plates are applied so that there is compression at the fracture site. Bone grafting can be done if needed. The fixation is rigid, so postoperative immobilisation in a cast is not needed. The disadvantages being, the risks of any open surgical fixation, that is increased the chance of infection, disturbance of the soft tissues, periosteal stripping, and evacuation of fracture hematoma.

One important disadvantage is the risk of refracture after removal of the compression plate, which necessitates the forearm being protected in a splint for 6 weeks and from severe stress for 6 months.

Mechanically intramedullary nails offer several advantages over the plate and screw fixation. Intramedullary nails are

subjected to smaller bending loads than plates and are least likely to fail by fatigue. The reason is that they are closed to the mechanical axis than usual plate position on the external surface of the bone.

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Results

In this study, maximum age was 60 years and minimum age was 18 years. Mean age was 39 years. 18 patients were male. Most common nature of trauma was road traffic accidents as seen in 13 patients, followed by fall on outstretched hand in 5 patients. Right sided extremity was involved in 12 patients. Among 20 radius fractures, According AO classification, 12 fractures were of A32, 3 of B32, 2 fractures are of A31, 2 of B31 and 1 of fractures are B33. (Table 1) Surgery was performed within a week from the day of admission depending on fitness for surgery. All the cases were operated under brachial block and tourniquet control. Mean operation time was 70 minutes (range 40 to 95 min) with plate-screw fixation, and 50 minutes (range 35 to 85 min) with intramedullary nailing. The fracture was considered as united when there were no subjective complaints and fracture line was not visible on x rays. Arbitrarily, those radial and ulnar fractures which healed in less than 6 months were classified as united; those which required more than 6 months to unite and had no additional operative procedure were classified as delayed union and those which failed to unite without another operative procedure were classified as non-union. Of 20 patients, 18 patients had sound union in less than 6 months and 1 patient had delayed union and 1 patient had deep infection in plate oestrosynthesis.

Using the Grace-Eversmann scoring system 14 patients showed excellent results in which fracture union was present and had >90% of rotation

For comparison between two procedures, patients were divided into 2 groups and DASH questionnaire was applied.

Group 1 – patients treated with Plating.

Group 2 – patients treated with Intramedullary Nailing

The mean DASH score was 8.14 (range 5-20) in group 1 and 8.34 (range 5-25) in group 2 indicating no disabilities in both groups

Table 1: Type of fracture according to AO classification

AO Classification	NO. of Patients
A31	2
A32	12
B31	2
B32	3
B33	1

Table 2: Grace Everyman scoring system

Result	Number of patients
Excellent	14
Good	2
Acceptable	2
Unacceptable	2

Table 3: Radiological Union Table

Bone involved	Time of union
Radius and ulna	12 weeks
Only Radius	11 weeks
Only Ulna	12 weeks

On X ray radiological union of both radius and ulna took 12 weeks while radiological union of only radius bone was seen in 11 weeks and that of ulna was seen after 12 weeks

In conclusion, open reduction and internal fixation with compression plates with strict adherence to surgical technique is the gold standard method of treatment in both bones forearm fractures with excellent results than closed reduction, internal fixation with “Titanium elastic nail” which is also again a simple method with better results than conservative methods However our study shows that nailing was associated with more post-operative complications as compared to plating and plating provided better compression of fracture site and rigid fixation and hence permitted early mobilization. Also plating group had excellent outcome and satisfaction rate. Our study concluded that plating is a safer and preferable option of forearm bone fractures than nailing.



Pre- Op x-Ray

POST- OP x-Ray



One & Half Month x-Ray

Pre- Op X-Ray



Post- Op X-Ray

one & Half Months X-Ray

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