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Outcome of Comparative Study of Intramedullary Nailing Vs Plating for Forearm (RADIUS-ULNA) Shaft Fractures

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KEYWORDS :

INTRODUCTION

In the era of fast and active life, the main objective is to attain quickness in locomotion.

In day to day orthopedic practice fractures of the forearm bones is one of the commonest injuries. The injury is important because it affects mainly young and middle aged individuals engaged in heavy physical activity.

Results of conservative treatment for radius and ulna fractures were disappointing as angulatory and rotatory stresses on forearm could not be eliminated. These stresses frequently displace the fracture even if satisfactory reduction is obtained.

The main dreaded complication of "fracture disease" has posed problems to the surgeons and inspite of good physiotherapy the ultimate results were ungratifying.

External immobilization by plaster casts can be dispensed off with the use of internal fixation suggested by A.O. group in Switzerland.

Many methods of treatments for these fractures are available including the following:-

(1) conservation treatment

(2) Open reduction and internal fixation by

Intramedullary nail

Special plates like compression plates of various A.O. types

(3) External fixation with fixator

The concept of primary osteosynthesis by applying compression plating, intramedullary nailing is now well developed and allows early and active movements at muscles and joints of the limb.

The present series analyses and compares the functional results of forearm fractures (both radius and ulna) managed by dynamic compression plating and intramedullary nailing.

AIMS AND OBJECTIVES

To prospectively compare the results of open reduction and internal fixation with plating and intramedullary nailing in the treatment of diaphyseal (both radius and ulna) forearm fractures.

- To achieve accurate anatomical reduction for better healing.
- To study and minimize the chances of complications like infection, non union, delayed union, malunion etc.,
- To mobilize the adjacent joints early and prevent joint stiffness.

HISTORICAL ASPECTS AND REVIEW OF LITERATURE

The treatment of these fractures by methods of manual reduction and immbolization has been described in the Hippocratic test published in 1896.

Sir Arbuthnot[2] Lane and Hey Groves put the idea of metallic internal fixation with nails and plates.

Nicoloyson in 1897, first described the principles in medullary fixation of fracture of bones.

In 1912 Sherman and Gilfillon Tannseed developed early bone plates. These efforts were unsuccessful because fixation was not rigid and problems of severe electrolytic reaction and infection were encountered.

In 1936, Venable, Stuck and Beach worked on electrolysis of metals in vivo. Key in 1932 first mentioned use of compression for knee arthrodesis.

In 1934, Roger Anderson applied this principle to fresh fractures.
Sir John Charnley[5] proposed the method if compression arthrodesis for knee.

Freidenberg and Frend[8] in 1952, described beneficial effects of compression in fracture healing by spring loaded medullary devices.

Eggers in 1949 studied compression plate fixation in animals.
Schenk and Willinegger[23] in 1963 proposed that primary bone healing can occur with rigid compression. Subsequently, Rahn demonstrated that primary bone union will occur in the presence of full use of the extremity as long as rigid fixation is maintained.

Perren et al[19,20] studied interfragmentary compression to achieve rigid immobilization at osteotomy in sheep.

Plates used to secure the axial compression fixation of cortex compression decayed slowly due to necessary remodelling. Bone can tolerate very high compression (over 300 kg /cm^2) without undergoing pressure necrosis.

Knight J Purvis in 1949 analysed a series of one hundred patients by conservative and surgical management.

Perhaps, the first surgeon to use a true compression plate in the treatment of acute fractures was Danis[6] in 1949. He studied interfragmentary compression by a lag screw and axial compression along the axes of bone by compression plates. He noticed that bone tolerates compression to a high degree. He also noticed so far unknown healing property of cortical bone with minimal radiological evidence of callus. He termed this property as healing `Soudure autogene' or primary bone healing. Eggers devised a slotted plate and encouraged weight bearing for stabilization of broken bones. However, he was not able

to neutralize all variations of deforming forces.

In 1958 first nucleus of A.O. (Arbeitsgemeinschaft Fur Osteosynthesis Fragen) was started in Switzerland. Principles of this group were propagated in English speaking countries and named Association for Study of Internal Fixation (ASIF).

Maurice Muller[16, 17] propagated compression fixation of fractures avoiding external immobilization by using his own compression equipment which can be removed after application of compression. In 1961 Hicks published series of adult forearm bone fractures managed with rigid fixation producing union in sixty two of sixty patients.

Burwell (1964), Anderson (1965), Anderson and Sisk (1975), Dodge and Cady (1972) published their results demonstrating efficacy of this fixation over other.

Hertel R Pisan M and Lambert S[11] published a paper in which they have treated 134 forearm fractures in adults with dynamic compression plating with mean follow up for 10.2 years. This study confirms the efficacy of DC plate and its minimal complications. This study has the longest follow up with sufficient number of patients.

Development of dynamic compression plate is an improvement over previous compression plates. This requires less exposure and compression is graduated thereby reducing the drawbacks of compression devise. Rigid fixation with metallic plates causes stress protection osteopenia and early plate removal is liable to refracture. Special plates called carbon fibre reinforced polymer (epoxy-resin). CFPR plates have been designed to overcome this. With CFRP plates, it was noticed that the fractures healed rapidly with direct union with ensheathing callus and subsequent cortical atrophy was not seen. Recently, special plates have been developed for avoiding this stress protection phenomenon and are called LCDCP (Low contract dynamic compression plates).

Principles of intramedullary internal fixation for forearm bones were described as early as 1897 by Nicholaysen and later by Dilbet in 1906.

A paper by Venable, Stuck and Beach in 1936 on electrolysis of metal in vivo, overcame one great disadvantage of medullary internal fixation.

Rush LV, Rush HL in 1937 and 1939 used Steinmann pin as an intramedullary implant.

Lambrinudi in 1939 used Kirshner wires for internal fixation.

In 1940 Kuntscher introduced a snuggly fitting intramedullary device.

In 1957, Smith and Sage[26] reported a series of 555 fractures collected from all over the country in which some form of intramedullary fixation had been used.

The devices included Rush pins, Kirschner wires, Steinmann pins, Lottes nails and Kuntscher V nails.

Caden[4] reported a non union rate of 16.6% in forearm fractures treated with Rush pins.

In 1959 Sage[22] published his study of the anatomy of the radius and introduced Sage triangular forearm nails. Sage reported good results with his nails. Non union occurred in only 6.2% of fractures and delayed union in 4.9%.

In 1986, Street[27] published a report on a series of 137 forearm fractures treated with a square, reamed, intramedullary nail. Street reported a nonunion rate of only 7%. In addition, there were two delayed unions.

According to Sisk,[25] when medullary fixation is used for any forearm fracture, errors in selection of the proper length and diameter of the nails, in operative technique and in after treatment contributes to poor results.

Talwalkar AK[29] pioneered and popularized the use of square nails in the treatment of forearm fractures.

In 1989 Gaudenzi A, Bassi P, Mataloni L[9] presented a study in which they have studied 44 bifocal fractures of the forearm in adults. Their follow up was for 12 months and showed 54% excellent results with nailing and 80% excellent results with AO plates.

In 1999, Dolfi Herscovici, Cori A Collinge[7] presented a paper in American Academy of Orthopaedics. They have compared the results of plating vs nailing in diaphyseal forearm fractures in 37 cases. They have come to a conclusion that good functional results can be obtained with intramedullary nailing but open reduction and internal fixation of forearm fractures remains the treatment of choice.

Vander Reis WL, Otsuka NY, Maroz P[30] also presented a study in which they have compared the intramedullary nailing vs plate fixation for unstable forearm fractures in children.

Schemitsch[28] and associates demonstrated that intramedullary nails can maintain a forearm reduction, although not as well as accurate plating.

ANATOMICAL ASPECTS

Radius is a slightly curved bone with convexity dorsally and laterally which makes insertion of a nail difficult. Also the narrow medullary canal adds to the difficulty. Radius has rotating joints at either end. Ulna is relatively straight.

Proximal Radio Ulnar Joint:

It is an uniaxial pivot type of joint between radial heal and radial notch of ulna surrounded by the fibrosseous ring called as annular ligament. It forms 4/5th of the ring.

Interosseous membrane:

The fibres of this membrane slope downwards and medially from interosseous border of radius to that of ulna. This makes a fibrous syndesmotic type of joint. The lower third of this membrane is attached to the posterior of the two lines into which the interosseous border of radius divides. It is deficient above and is broader in the middle. The membrane is maximally stretched in mid prone position to that chance of radio ulnar synostosis is very less in this position.

This membrane acts as a hinge for the rotation of radius. Any encroachment on the interosseous membrane by ossification or malalignment will produce restriction of pronation and supination.

Distal Radio Ulnar Joint:

It is also an uniaxial pivot type between the convex and concave lower end of ulna and radius respectively. The articular surfaces are encloses in an articular disc attachments. The disc is a articular disc attachments. The disc is a thick firm fibroacrtilatenous plate of triangular outline, attached by its base to the distal margin of the ulnar notch of the radius and at the root of styloid process of ulna.

AXIS OF PRONATION – SUPINATION

It passes through Capitellum, radial head towards the lower end of ulnar styloid process and through the 5th metacarpal base (In pronation the radius carrying the hand is carried obliquely across the front of the ulna. In supination the movement is reversed and the radius lies lateral and parallel with ulna. Supination is more powerful than Pronation).

The lower end of ulna moves a variable amount along a curve convex backwards and internally during pronation and forwards and medially during supination.

Upper third of radius is governed by supinator force as against middle and lower thirds by pronator force. The entire V shaped area of the body of radius between anterior and posterior oblique line is appropriated by supinator.

The most important nerve in forearm in relation to the bones is posterior interosseous nerve. The deep branch of radial nerve springs from the main trunk at the level of lateral epincondyle of numerous and descends in front of the lateral part of radius under cover of brachioradialis. It disappears into supinator to reappear in the dorsum as the

posterior interosseous nerve.

APPLIED ANATOMY

The difficulty in realigning the fracture fragments during closed reduction is due to the strong muscle forces acting on relatively small bones at various levels of the bones. Both biceps and supinator are strong and inserted into upper third of the shaft of radius, the pronator teres to the middle third and pronator quadratus to the lower third.

Considering an example of fracture of shaft at junction between upper and middle thirds, the proximal fragment has only supinators and distal fragment only pronaters. So theoretically when reducing a fracture of upper third of shaft, immobilization should be with forearm supinated for good alignment and opposition of fracture fragment. If the fracture is in middle third of shaft, the proximal fragment has both supinator and pronator muscles attached to it. It thus takes up a midprone position.

A.O. CLASSIFICATION OF DIAPHYSEAL FRACTURE OF RADIUS AND ULNA

Simple fracture

A1 Simple fracture, of the ulna, radius intact

1. Oblique
2. Transverse
3. With dislocation of the radial head (Monteggia)

A2 Simple fracture, of the ulna, radius intact

1. Oblique
2. Transverse
3. With dislocation of the distal radio ulnar joint (Galeazzi)

A3 Simple fracture, of both bones0

1. Radius, proximal bones
2. Radius, middle zone
3. Radius, distal zone
4. Wedge fracture

B1 Wedge fracture, of the ulna, radius intact

1. Intact wedge
2. Fragmented wedge
3. With dislocation of the radial head (Monteggia)

B2 Wedge fracture, of the radius, ulna intact

1. Intact wedge
2. Fragmented wedge
3. With dislocation of the distal radio – ulnar joint (Galeazzi)

B3 Wedge fracture, of the one bone, simple or Wedge fracture of the other

1. Ulnar wedge and simple fracture of the radius
2. Radial wedge and simple fracture of the ulna
3. Ulnar and radius wedges
4. Complex Fracture

C1 Complex fracture, of the ulna

1. Bifocal, radius intact
2. Bifocal, radius fractured
3. Irregular

C 2 Complex fracture, of the radius

1. Bifocal, ulna intact
2. Bifocal, ulna fractured
3. Irregular

C3 Complex fracture, if both bones

1. Bifocal
2. Bifocal of one, irregular of the other
3. Irregular

MATERIAL AND METHODS

Over a period of one and a half years, 30 individuals with diaphyseal fractures both bones (radius and ulna) entered into this comparative study.

This study compares the result of diaphyseal fractures, of radius and ulna in age group from 15 to 60 years. The patients were followed up for a period of one and a half year, with a minimum of six months. Every case was assessed clinically and radiologically during the follow up.

Radomization about whether to do plating or nailing is decided on the basis of which unit the patient gets admitted in Unit I - plating and in Unit II - nailing was done.

The indications laid down for open reduction and internal fixation are:-

All displaced fractures of radius and ulna with angulation greater than 10^0 of each bone.

Open fractures (Gustilo Anderson upto Grade II)

PREOPERATIVE MANAGEMENT

Preoperative X rays of Radius and Ulna AP, Lateral view and oblique views

Above elbow slab and elevation and NSAIDS

After the patients were seen to be fit for anaesthesia, operative site was prepared and the patient was kept nil by mouth for six hours prior to surgery. Half an hour prior to surgery patients was given the pre-anaesthetic agent when general anaesthesia is required.

In compound fractures dibridement was done with normal saline, betadine, antibiotics were given and surgery done after primary wound healing.

Anaesthesia:

Regional anaesthesia (Brachial block) was used for all patients except four patients of polytrauma who underwent for fixation of multiple fractures with general anaesthesia. Pneumatic torniquet was used in all cases. The operation site was prepared with savlon, betadine, iodine successively and draped properly in sterile towels.

Techniques of plating:

Technique of operation for ulna:

Skin incision was made along the subcutaneous border of ulna and dissection was between flexor and extensor carpi ulnaris to expose the fracture site. Appropriate plate fixation was done on anterior or posterior surface depending upon the type of fracture. Ulna is more easy to operate upon due to easy exposure.

Technique of operation for radius

Thompson's approach

An incision was made along a line drawn from centre of the dorsum of wrist to a point ½" anterior to the lateral lumeral epicondyle. An interval was developed between extensor digitorum cummuins and extensor carpi radialis brevis. The abductor pollicis longus was retracted distally and fracture site was exposed by erasing supinator muscle subperiosteally.

The fracture is reduced by holding the fragments with Burn's bone holding forceps,. Rotational alignment is checked and nail was pushed into the proximal fragment and checked under image intensifier.

A DCP with 3.5mm of minimal thickness and atleast 6 holes was selected and secured to the bone fragments with A.O. plate holding forceps.

A 6 to 8 hole plate was also used in communitated fracture and bone grafts were put. The drill bit was of 2.5mm and screw of 3.5mm size and muscle were allowed to fall on plate. Deep fascia was not sutued. Tourniquet was later released, proper hemostasis achieved and subcutaneous tissue and skin were closed. A plaster of paris slab was given for temporary support in the immediate post-operative period only.

Later on depending upon the rigidity achieved at fracture site patient, started elbow and wrist movements after 10 days. Patient was not allowed to do heavy duty work .

Both the fractures were exposed and reduced prior to fixation. Always the radius fracture was plated first.

Due to difficulty to assess union radiographically with minimal of callus, clinical criterion like absence of pain was used for practical purposes to assess union. Trabecular crossing at the fracture site and range of movements of the joints were important guide for radiographic union.

Technique for dynamic compression plate:
The DCPs require the use of two drill guides. The neutral drill guide (green) has a central hole for the drill bit. It allows the screw to be inserted in the neutral position that is at the insertion of the two cylinders which makes up the screw hole. In this neutral position the drill guide results in 0.1mm loading so that even when inserted in neutral position and fully tightened, the screw cause a slight degree of axial compression.

The load guide (gold) has a eccentric hole for the drill bit which must be inserted away from the fracture. This results in the load screw being inserted initially 1mm away from the neutral position in the screw hole.

Both the screws across were tightened down alternately so that compression was achieved at the fracture side. The remaining screws were drilled and fixed in holes using a neutral drill guide. Here the compression device not required and the smaller exposure was necessary hence minimising the tissue trauma.

Post-operative Management:
It depended on various factors like type of fracture with amount of comminution, rigidity at fracture site after fixation site after fixation and patient compliance. As patients mostly were from low socio-economic background and illiterate, external immobilization in form of plaster of paris slab was advised for 2-3 weeks till pain subsided. Exercises which were gentle and more or pronation and supination were started. Patient was asked to avoid heavy work until fracture united clinico-radiologically. In uncooperative patients a cast was applied after stitch removal (upto two weeks) after vigorous physiotherapy in that period.

TECHNIQUES OF NAILING
Nails:
Ulna Nail: It is a square nail pointed at one end and with threads at the other end. The pointed end is for the perforation of the cortex and for introduction of nail threads around nailing help for extraction of the nail at a later date.

The length of the ulna nail is measured on the opposite forearm from tip olcenanon to the tip of ulnar styloid.

Radius Nail: It is a square nail bevelled at one end and with threads at the other end. The bevelled end is for sliding the nail into the medullary cavity of the radius when introduced from dorsal aspect.

Length of the radius nail is measured by deducting ½" from the length measured between the radial styloid and the head of the radius.

Diameter of the nail:
Diameter of the nail can be judged by the X-ray. Both the bones may not necessarily take the same size nail but the largest size nail should be used. Reaming of the medullary cavity is advocated by AO Group and Kuntscher but was not done in this series. Any nail which snuggly fits into the medullary cavity was used. When extremely large medullary cavity was encountered more than one nail was used (Stack nailing).

Nailing Techniques
Ulna Nailing: Ulna nailing was done first in all the cases because ulna is the longer of the two and it is the pivot around which the radius moves.

Incision was taken over the tip olecranon.
Skin, subcutaneous tissue dissected. Entry point for ulna was made with the owl.

Then ulna nail is mounted over the `T' handle and from tip of the olecranon was pushed in till fracture site.

Close reduction is achieved and under image intensifier the ulna nail is pushed into the distal fragment.

In those cases wherever closed reduction was not possible, fracture site was opened by taking incision over the subcutaneous border of ulna.

Fracture was reduced and then nail pushed into the distal fragment.

Radius Nailing:
Small incision about 1" was made on the lateral side of the lister's tubercele after retracting the tendons extensor polllicis longus and extensor digitorum communis medially and extensor carpi radialis brevis laterally.

An opening was made on the dorsal aspect of the radius with a bone awl. The bevelled end of the nail was introduced as nearby parallel to the long axis of the bone as possible and pushed down to the fracture site and checked under image intensifier. Closed reduction was tried and if reduction is achieved nail was pushed into the proximal fragment.

If reduction was not achieved then fracture site was exposed by Thompson's approach.

Whenever the fracture site was exposed, while doing radius and ulna nailing, the wound is closed with skin and subcutaneous tissue, deep fascia was never sutured. This helped in prevention of oedema, compartment syndrome, infection and contracture. Postoperative always above elbow slab and in comminuted fractures above elbow cast was given.

Special precautions taken during nailing:-
1. Exact length of nail measured before operation.
2. Less stripping of soft tissues and periostium.
3. Adequate size of nail taken so as to avoid impaction of nail.
4. Accurate reduction alter alignment and rotation.
5. Whenever medullary cavity is large stack nailing is done.
6. Scrupulus aspesis.

OBSERVATIONS
All the patients who had diaphyseal fractures of both bones radius and ulna attending O.P.D. or emergency at K.E.M. Hospital were treated by either plating or nailing, done over a period of 1.5 years were studied.

Present series include purely diaphyseal both bone i.e. Radius and Ulna fractures either simple or compound (upto Grade II injuries according to Gustilo Anderson classification).

Total No. of cases = 30.

Table 1 Age Distribution

Age (years)	No. of patients	%
15-20	04	13.3
21-30	16	53.3
31-40	07	23.3
41-50	01	03.3
51-60	02	06.7

Mostly, fracture occurs in the age group of 21 to 40 years.

Table 2 Sex distribution

Sex	No. of patients	%
Male	18	60
Female	12	40

Males are more affected than females.

Table 3 Side Distribution

Side	No. of patients	%
Right	19	63.3

Left	11	36.7
Bilateral	0	0

Fracture is more common on right side.

Table 4 Type of fracture

Type	Bone		%
	Radius	Ulna	
Transverse	14	12	43
Oblique	12	14	43
Spiral	03	03	10
Comminuted	01	01	4

Transverse and oblique fractures are more common.

Table 5 Site of fracture
(In relation to Diaphysis)

Site of fracture	Bone		%
	Radius	Ulna	
Upper third	06	08	23.33
Middle third	18	16	56.67
Lower third	06	06	20

Middle third fractures is more common than upper and lower third.

Table 6 Mechanism of Injury

Mechanism / Nature	No. of patients
Fall from height	08
Vehicular accident	18
Sport injury	02
Assault	02

Table 7 Nature of Injury

Type	No. of patient	%
Simple	26	86
Compound (upto type II)	04	14

Table 8 Associated injuries

Type of injuries	No. of cases
Fracture humerus	01
Fracture femur	02
Fracture tibia	02
Calcaneum	01
Head injury	02

RESULTS

The basic goal of management of diaphyseal both bone fracture of forearm is to achieve union and restore good function. Therefore, fracture union and function were considered to be the criteria to classify and compare the results of plating and nailing.

The radiological and clinical criteria for assessment of fracture union are difficult to establish in fracture treated by compression plating so more stress was given on functional recovery and early return to pre-fracture duties.

Criteria for deciding union, functional results were based upon that decided by Anderson.[21]

Criteria for union:

1. Union: When fracture united in less than 6 months. No local tenderness.
2. Delayed Union: Fractures which required more than six months to unite without operative intervention.
3. Non Union: Fractures which failed to unite without another operative procedure.

Functional Results:

Excellent

Fracture united (clinically and radiologically)

Less than 10 degree loss of flexion and extension at elbow and wrist.
Less than 25% loss of pronation and supination.

Satisfactory

Fracture united (clinically and radiologically)
Less than 20 % loss of flexion and extension
Less than 50 % loss of pronation and supination

Unsatisfactory

Fracture united (clinically and radiologically)
More than 30 degree loss of flexion and extension.
More than 50% loss of pronation and supination.

Failure

Fracture un-united
With or without loss of motion.
Functional Results

Result	No. of cases		%	
	Plating	Nailing	Plating	Nailing
Excellent	10	7	60.7	46.67
Satisfactory	3	4	20.0	26.67
Unsatisfactory	2	3	13.3	20.00
Failure	0	1	0	06.66
Total	15	15	100.0	100.0

(p >0.05)

Sufficient information to assess the function was judged at the end of six months. Function was excellent or satisfactory in 13 (80.6%) in plating and 11 (73.32%) in nailing. Function was unsatisfactory or poor in 2 (13.3%) in plating and 4 (26.66%) in nailing.

Radiological union was difficult to assess in these fractures as the fracture line was barely visible due to rigid fixation and minimal or no callus formation.

The absolute criteria for radiological healing was obliteration of fracture line and bridging trabecular pattern across the fracture site. Clinical union was easy to judge in case of plating.

Union

Status	No. of cases		%	
	Plating	Nailing	Plating	Nailing
Union	13	11	86.67	73.33
Delayed Union	2	03	13.33	20.00
Non Union	00	01	00	06.67

Out of 15 fractures of both radius and ulna where plating was done 2 fractures went in delayed union, but united at the end of 7th month.

Out of 15 fractures (diaphyseal) of both radius and ulna where nailing was done 3 went in delayed union and one went in non union.

All the three delayed unions united at the end of 7th or 8th month from the operative day by bone grafting.

One case went in non union inspite of bone grafting.

The total union rate on average in both plating and nailing was 79.99%.

Average period of immobilization for fracture of radius and ulna was 2-4 weeks in plating and 4-6 weeks in nailing.

Complications

Complications in 30 plated and 30 nailing done in 30 patients

Complication Type	No. of cases		%	
	Plating	Nailing	Plating	Nailing
Superficial infection	03	01	10.0	3.33
Delayed union	02	03	6.66	10.0
Non union	00	01	00	3.33

(

p>0.05)

Superficial infection treated with appropriate antibiotics and debridement.

DISCUSSION

Disphyseal fractures treated by the conventional conservative methods pose specific problems such as, `Fracture disease' and also the total time consumed during conservative treatment. This time includes that in which patient remains in the plaster cast for a long time and then taken for rehabilitation to bring the limb to the pre-fracture status.

The changes of `fracture disease' once set in are rarely completely reversible. The best preventive measure is physiological stimulus to the musculoskeletal unit i.e. early pain free mobilization. In forearm fractures in adults, it is mandatory to get early union in anatomical position and there must be no more than slight angular or rotational deformity.

Pronation and supination is an unique movement of the forearm and its loss is a sensitive indicator, which is used in this study and which in turn are directly related to method of fixation of fractures, severity of injury and post operative treatment.

Early motion does not have a significant influence on the functional results of single bone fracture, while both bones fracture have a significantly better results with early mobilization.

Disphyseal fractures of radius and ulna pose specific problems not encountered in other long bones. In addition to restoration of length, opposition and normal axial alignment, correct rotational alignment must be achieved if a good range of pronation and supination is to be restored. Further more there is a high incidence of malunion and non union because it is difficult to reduce and maintain reduction of two mobile bones in the presence of pronating and supinating muscles which exert angulatory and rotational forces.

The present study deals with 30 cases of diaphyseal both bone fractures of forearm bones. The randomization of cases done according to which unit patient gets admitted. The operative method included in this comparative study was dynamic compression plating (3.5mm DCP) and intramedullary nailing by Talwalkar radius and ulna nail.

The highest age incidence was found in the age group of 21 to 40 years and more common in males as compared to females.

Right side forearm is more involved than the left as right side dominance is more as compared to left. Transverse and oblique fractures were more common (total 86%) and middle third level was more common in about 56.66% of cases.

In this study vehicular accident and fall from height contribute to maximum number of cases (26). There were four compound fractures (upto Grade II compound) in this study, which were treated with debridement, antibiotics and wound was healed with primary intention.

Vehicular accidents were having more associated injuries and managed appropriately.

Comparison of functional results for both plating and nailing with other studies

For Plating

Series	Treatment	Delayed or Non union (%)	Avg. period of immobilization (wks)	Unsatisfactory results (%)	Total cases
Anderson	ASIF plating	2.7	6 - 8	20.32	228
Rai	ASIF plating	-	3 – 4	8.11	37
Present series	ASIF plating	6.66	2 - 4	13.33	15

(p>0.05)

For Nailing

Series	Treatment	Delayed or Non union (%)	Avg. period of immobilization	Unsatisfactory results (%)	Total cases
Smith & Sage	Nailing (Triangular)	20	12 weeks	15	81
Sage (1959)	Nailing	6.2	12 weeks	30.4	-
A.K.Talwalkar	Square Nailing	Nil	10 days	-	128
Present study	Talwalkar Radius / Ulna Nails	13.33	5 weeks	20	15

(p>0.05)

Comparison of plating v/s nailing

Treatment Modality	Functional Result		Delayed on Non union superficial Infection (%)	Avg. period of immobilization (%)	Time of operation (Average)	No. of cases
	Excellent + Satisfactory	Unsatisfactory				
Plating	80.16	13.3%	13.33%	2 – 4 weeks (Avg. 3.5 weeks)	1.9 days	15
Nailing	73.32%	20.0%	26.66%	4-6 weeks (Avg. 5.8 weeks)	1.7 days	15

(p>0.05)

In this comparative study of 30 cases of diaphyseal fractures of both radius and ulna plating versus nailing excellent results in plating were 80.6% as compared to nailing which was 73.32%. The results were evaluated on the basis of Anderson's functional scoring system. The main stress was given on the two movements pronation and supination.

Unsatisfactory results were more in nailing (20%) as compared to plating (13.3%).

In complications, superficial infection rate was more in plating (3 cases) nailing. Out of 3 cases at superficial infection 2 cases were primarily compound (one Grade I and another Grade II) fracture. Superficial infection was by debridement and appropriate antibiotics, none of the patients required implant removal. There were five cases of delayed union in which plating (2) and nailing (3). One case of plating and one case of nailing had compound fracture with comminution on admission. Delayed union cases of nailing were treated with bone grafting, immobilization in slab for few weeks and they finally unite at the end of 6 to 7 months. The delayed union cases of plating united without a bone graft.

One case of nailing was declared non union which was primarily compound comminuted fracture of ulna.

Thus, the complication rate was less in plating (13.33%) as compared to nailing which was (26.66%).

The average period for immobilization was less in plating (2-4 weeks) as compared to nailing (4-6weeks).

In this study we have prospectively collected data on patients randomized by unit system to treatment by plating or nailing.

As the number of cases and duration of study was small no statistical significance was found (p>0.05).

SUMMARY AND CONCLUSIONS

In these 30 cases of diaphyseal fractures of forearm bones (both Radius and Ulna) was undertaken at which 15 cases were managed with plating and 15 cases were managed with nailing.

Results of plating and nailing were compared with each other and with some standard series and are found satisfactory.

Functional results of plating and nailing are comparable.

While good functional results can be obtained with intramedullary nailing of forearm fractures, open reduction and internal fixation with plating remains the treatment of choice in most of the forearm fractures.

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