ORIGINAL RESEARCH PAPER

Volume-8 | Issue-7 | July - 2019 | PRINT ISSN No. 2277 - 8179

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

FRACTURES OF BOTH BONES FOREARM – A COMPARATIVE STUDY ON FIXATION TECHNIQUES AND FUNCTIONAL OUTCOME BETWEEN INTRAMEDULLARY NAILING AND PLATE OSTEOSYNTHESIS

Orthopaedics

Dr. J. Maheswaran* MS Ortho, Assisstant professor of Orthopedics' , Madurai Medical college , Madurai
*Corresponding Author

Dr. S. Nithyanand Junior Resident, Department of Orthopaedics, , Madurai Medical college , Madurai

ABSTRACT

The diaphyseal fractures of both bone fractures of forearm is one of the most common fracture pattern occurring in adults. These fractures are routinely fixed by plate osteosynthesis with 3.5 mm Asian DCP efficiently and successfully. Since this system is of load bearing type which necessitates distruption of fracture hematoma during fixation, the choice of intramedullary nail fixation for forearm fractures comes into play.This study includes 20 cases (10 cases of plate osteosynthesis, 10 cases of titanium elastic nails), all of whom were adults. The diaphyseal fractures of both radius and ulna were selected. The outcome was analysed with special emphasis on rotatory stability at the fracture site and time taken for full range of motion to occur. Even though, plate osteosynthesis is still the most commonly used form of fixation in adult both bone forearm fractures, titanium elastic nail fixation is a relatively newer technique which offer a viable and more efficient alternative especially in fixation of fractures involving shafts of radius and ulna.

KEYWORDS

Fracture, forearm , diaphyseal fracture , outcome ,nail fixation

1.INTRODUCTION

Increasing incidence of road traffic accidents, natural disasters and industrial accidents together with assault leads to multiple fractures and higher incidence of morbidity. They form the major epidemic of modern era. 0f these, the fractures involving both the bones of forearm form an important part. Even though these fractures can be treated successfully by surgical methods, the anatomical reduction of fracture fragments becomes absolutely essential for effective postoperative function. Delayed hospitalization, use of indigenous bandages and associated vascular and nerve injures contribute to increased incidence of morbidity.Traditionally majority of adult forearm fractures are treated by traditional bone setters leading to various complications. Awareness about the role of various types of surgical fixation and their role in successful management of forearm fractures is absolutely essential for preventing this practice. For effective pronation and supination to occur, the maintenance of interosseous space becomes mandatory while fixing the fractures involving radius and ulna. Presence of comminution, the anatomy of fracture pattern and presence of rotatory malalignment significantly contribute to the postoperative morbidity in these fractures. Better understanding of the injury patterns, availability of better implants, the concept of early surgical fixation and exact post operative protocol all have convincingly improved the functional outcome of the patient to a larger extent. The successful management of these fractures demands familiarity with the character of fracture, technical aspects of fracture fixation, the varieties of implants available for fixation and the art of postoperative management.

2.AIM OF STUDY

Even though fractures of both bones of forearm is one of the most common fractures occurring in adults, they are also one of the most common fractures to be mismanaged. Even today most of these fractures are treated by traditional bone setters leading to increased morbidity and infection. Traditionally, these fractures are treated by plate osteosynthesis using AO Dynamic compression plate (Asian) very efficiently. The aim of our study is to compare the functional outcome of fixation of both bones of forearm using plate osteosynthesis with that of Titanium elastic nail. This study aims to stress the need for rigid fixation of forearm fractures and to evaluate the early restoration of movements of wrist, elbow and forearm.

3.MATERIALS AND METHODS

Design of the study : Prospective study

This is a prospective study of 20 cases of diaphyseal fractures of both bone of forearm in adults treated by surgical fixation with various implants. It includes all diaphyseal fractures of both bones of forearm in adults. Comminuted, segmental fractures are included in this study. All compound fractures, malunited fractures, bones with medullary canal diameter of less than 2mm and fractures in children are excluded from this study.

Inclusion Criteria :

1. Diaphyseal fractures of both bones of forearm in adults >18 years
2. Comminuted and segmental fractures

Exclusion Criteria :

1. Compound fractures
2. Malunited fractures
3. Bones with narrow medullary canal < 2 mm in diameter

PROCEDURE AND POST OPERATIVE PROTOCOL:

All the patients were received in the casualty department and were resuscitated. If there were any other major associated injuries, they were treated accordingly at first. After the general condition of the patient improved, radiographs (AP View and lateral view) were taken. The fractures were reduced in closed manner at first under sedation and an above elbow slab was applied. Fractures with comminution were taken for fixation with plate osteosynthesis. Other cases were fixed with intramedullary devices.Most of the cases were taken for elective fixation before 5th day. The patients who had associated major injuries were taken up for surgery between 5th and 7^{h} day.

Open reduction and internal fixation with Dynamic Compression plate:We routinely used tourniquet during surgery.The radius was opened first. We always used Henry's approach for exposing the radius. The cleavage between flexor carpi radialis and brachioradialis was developed. The FCR was retracted medially along with radial artery and vein. The branchioradialis was retracted laterally along with the sensory branch of radial nerve. The fractured ends were identified and with minimal periosteal stripping, they were mobilized. The medullary cavity was cleared of any hematoma and the fractured fragments were reduced by carefully matching the interdigitations using bone holding forceps. An Asian DCP of appropriate length was selected and applied to the radius on the volar side and fixed with 3.5mm cortical screws. All the fractures were fixed such that there were at least six cortical purchases on either side of the bony fragment. Then the ulna was opened on its subcutaneous border, centering over the underlying fracture. The interval between flexor carpi ulnaris and extensor carpi ulnaris was identified and developed. The periosteum over the ulna was incised, the fracture fragments were reduced and fixed with an Asian DCP similar to that of radius. Thorough wash of both wounds done. The deep fascia was not sutured; skin closure was done. Compression bandage was applied. Tourniquet was released and an above elbow slab was applied.

POST OPERATIVE PROTOCOL:

In the immediate post operative period the upper limb was immobilized in an above elbow slab, and kept elevated till the edema of fingers subsided. The wound was inspected on the II POD and then

suture removal was done on Xth POD. The upper limb was immobilized depending upon the rigidity of fixation. At the end of 4th and 6th weeks check X rays were taken to visualize callus response.. The pronation and supination movements were started by the end of 6th week.

Closed Reduction and Fixation with Intra meduallary nailing:
Most of the fractures of Muller type A were fixed with this implant.

(A)Titanium elastic Nail fixation: The patient is placed supine and the forearm is kept in a hand table compatible with C arm. Tourniquet was not used. The width of the medullary canal of radius was measured and an appropriate sized nail was selected such that, the nail should occupy at least 60% of the medullary space. The entry was made on the distal radius just medial to Lister tubercle, beneath the extensor pollicis longus tendon about 5 mm proximal to wrist joint, with a 3.2 mm drill bit. The medullary canal was entered with a curved awl and the position was confirmed with C arm. The selected titanium elastic nail was introduced and passed into the medullary canal of radius and gently pushed till it reaches the fracture site. The fracture fragments were reduced by gentle manipulation and the nail was entered into the distal fragment by gently rotating the tip. The position of the nail was continuously confirmed with C arm. The nail was passed till it reached the radial neck. The nail was then slightly withdrawn and cut. The cut end of the nail was gently hammered so that the tip lies flush with the bone. The ulna was entered from the olecranon and an appropriate nail was inserted, fracture fragments reduced and the nail gently manipulated into distal fragment. The tip of the nail was cut and buried. The wounds were sutured.

Post operative protocol: The upper limb was kept elevated. Wound inspection was done on II POD. Suture removal was done on Xth POD, and above elbow cast was applied. After 3 weeks the cast was removed and a below elbow cast was applied, after obtaining check X rays. Active elbow mobilization exercises were started at the end of 3rd week. By the end of 6 weeks, the cast was discontinued and active pronation and supination exercises were started.

4.RESULTS

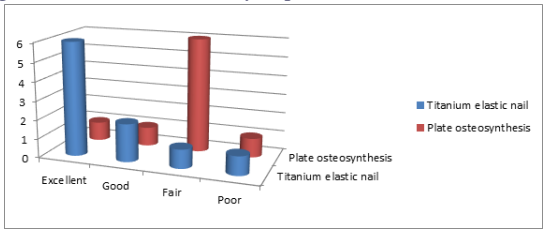
Average time of fracture healing was 8 weeks. In patients who had undergone plate osteosynthesis, it was 9 weeks whereas in patients who had undergone nail fixation it was 6 weeks. Muller Type 22 A3 fracture united by 11 weeks. Other fracture patterns healed between 6 and 9 weeks.4 patients had restricted pronation & supination. Three patients were treated with plate osteosynthesis and one patient with intramedullary nailng had restricted supination pronation due to cross union. 4 patients treated with plate osteosynthesis gave excellent results with regard to pronation & supination.4 patients developed post operative stiffness of elbow joint. 3 patients were treated with plate osteosynthesis and one patient with Titanium elastic nail However, all these patients eventually had fair range of motion by the end of 12 weeks following intense physiotherapy.The patient who had sustained fracture of radial styloid process during titanium nail fixation following far lateral entry point developed stiffness of wrist joint. With active exercises, the ROM was increased.Restoration of pronation & supination activities were possible by the end of 6th week using intramedullary nailing whereas they were possible by the end of 9th week using plate osteosynthesis

The Analysis was done using modified GRACE AND EVERSMANN RATING SYSTEM and the following results were obtained.

Table No:1 -overall Results

Grading	Number of Cases	Percentage
Excellent	7	35
Good	3	15
Fair	8	40
Poor	2	5

Figure No1: Overall Results By Implants Used



Statistical Analysis The mean value of Modified Grace and eversmann score in Patients who underwent nailing is 9.6 and in plating is 6.2 . Standard deviation being 2.17 and 2.15 for patients who underwent nailing and plating respectively.The P value was found to be 0.002 hence the study supports that Titanium elastic nailing is superior to Plate osteosynthesis.

5.DISCUSSION

The aim of this study is to compare the results of treating diaphyseal fractures of both bones in adult forearm using plate osteosynthesis with that of titanium elastic nail fixation. We selected 20 cases of diaphyseal fractures involving both the bones in the forearm in adults. The period of study was between Sep 2012 and Sep 2014. Most of these patients fell into middle age, group with majority of them being males. The mode of violence is either due to RTA, assault or due to accidental fall. The patients who had simple Muller's A3 fracture pattern were fixed with intramedullary nail fixation and the fractures with comminution and segmental pattern were fixed with Intramedullary nailing. Compound fractures were excluded from our study. A satisfactory device for internal fixation must hold the fracture rigidly, eliminating as completely as possible angular and rotatory motion. This can be accomplished by either a strong intramedullary nail or AO dynamic compression plate. During plate osteosynthesis, to minimize further injury to blood supply of the bone, the periosteum was stripped sparingly with a periosteal elevator and only sufficiently for applying a plate. The fragments were carefully reduced with interdigitating bone spicules being fitted properly. Comminuted fragments were fitted accurately in place. The plates were selected such that at least there were six cortical purchases on either side of fracture fragments. The plates were contoured before they were applied to the bone. Our study has showed good fracture union occurred in 80% of cases. Earlier studies have reported an alarming refracture rate of 40% when the plates were removed before 1 year. It is well established that the cortex beneath a rigid plate weakens because of stress shielding, becoming thin, atrophic and almost cancellous in nature. If soft tissue stripping has been extensive, osteonecrosis and revascularization weakens the cortex further. In our series involving 10 cases treated with plate osteosynthesis, we did not have refracture in any of our patients. While using intramedullary device for fixing the adult forearm fractures involving both bones, rotational control in fractures near the metaphyseo-diaphyseal junction was difficult because of wide medullary canal. Interference fit nails do not maintain bone length if associated with bone loss. When an intramedullary fixation is used, errors in selecting the proper diameter or length of the nail and operative technique contributed to poor results. In case of the titanium elastic nail, the distal end of nail must abut subchondral bone to prevent shortening. The lower modulus of elasticity of titanium nails allow easier insertion and provide more load sharing with the bone. Titanium elastic nails produced interference fit which was responsible for the return of forearm rotation and grip strength. Our study had showed that good to excellent union occurred with 90% of fractures fixed with titanium elastic nail. We compared the results of plate fixation with that of intramedullary fixation. Apart from the incidence of infection we did not have any complications while treating forearm fractures with plate osteosynthesis. All the cases healed well on controlling the infection We had technical difficulties while using both titanium elastic nail. While fixing fractures of radius involving distal 3rd shaft, the titanium elastic nail did not provide with adequate stability of fracture fragments because of wide medullary canal. While using titanium elastic nail we had entry point fracture at radius, since the entry point was shifted far laterally. That led to the fracture of styloid process of radius which was treated conservatively. In another case, there was avulsion of tendon of extensor pollicis longus by a drill bit. This occurred following failure of separation of soft tissue upto the bone with a curved artery forceps after skin incision was made. Earlier, intramedullary devices like K wires, square nails and Rush nails were used for fixing radius and ulna. These implants did not provide with rotational stability at the fracture site. This lead to higher incidence of non union. But titanium elastic nail, provided with excellent rotational stability of fracture fragments. We used tourniquet in fractures fixed with plate osteosynthesis. One case of tourniquet palsy occurred but recovered eventually. Since tourniquet was not used during intramedullary fixation, the chance for occurrence of this neurological complication was totally eliminated. Closed Intramedullary fixation offers the following advantages when compared with plate osteosynthesis.

a) No periosteal stripping is required
b) Smaller operative wound

c) Bone grafting not necessary
d) No potential for diaphyseal refracture after implant exit.

In our study, the rehabilitation time was much shorter for fractures fixed with intramedullary nail when compared with that of plate osteosynthesis. The average time required for functional recovery is more than 9 weeks when plates are used, and about 6 weeks when intramedullary nails are used. The duration of hospital stay post operatively was also less (on an average of 5 days for intramedullary devices and 12 days for plate osteosynthesis).Intramedullary fixation provides for short operating time, short hospital stay and early rehabilitation .Intramedullary fixation excels better than plate osteosynthesis especially in cases of segmental fractures and Comminuted fractures if closed reduction is possible.Even though, plate osteosynthesis is still the most commonly used form of fixation in adult both bone forearm fractures, titanium elastic nail fixation is a relatively newer technique which offer a viable and more efficient alternative especially in fixation of fractures involving shafts of radius and ulna.

6.REFERENCES :

1. Anderson LD, Bacastow DW: Treatment of forearm shaft fractures with compression plates, Contemp orthop 8:17 1984.
2. Anderson LD, Sisk TD, Tooms RE: Compression plate fixation in acute diaphyseal fractures of radius and ulna, JBJS 57A: 287 1975.
3. Bedner DA, Grandwilewski W: Complications of forearm plate removal. Can J Surg 35:428 1992.
4. Chapman MW, Gordon JE, Zissimos AG: Compression plate fixation of acute fractures of the diaphysis of radius and ulna, JBJS 71A: 159, 1989.
5. Charnley AD, Burwell HN,: Treatment of forearm fractures in adults with plate fixation, JBJS 25B: 404, 1964.
6. Crenshaw AH Jr, Zinar DM, Pickering RM: Intramedullary nailing of forearm fractures, Instr course lect 51:279, 2002
7. Crenshaw AH Jr: Surgical technique manual, Memphis
8. Duncan R, Geissler W, Freeland AE et al: Immediate internal fixation of diaphyseal fractures of forearm, J Orthop trauma 6:25 1992.
9. Eggers GWN: The internal fixation of fractures of long bones: Monographs on Surgery 1952.
10. Grace TG, Eversmann WW Jr: Forearm fractures –treatment by rigid fixation, JBJS 62A: 433 1980.
11. Grace G, Eversmann WW Jr: The management of segmental loss associated with forearm fractures; JBJS 62A 1150, 1980
12. Hadden WA, Reschauer R, Seggl W.: Results of AO plate fixation of forearm shaft fractures in adults, Injury 15:44 1983
13. Hidaka S, Gustilo RB: Refracture of bones of forearm after plate removal, JBJS 66A: 1241, 1984.
14. Jinkins WJ, LockhartED, Eggers GWN: fractures of forearm in adults, South Med J 53:669, 1960
15. Jones DJ, Henley MB, Schemitsch CH: A biomechanical comparison of two methods of fixation of fractures of forearm, J. Orthop trauma 9:198 1995.
16. Knight RA, Purvis GD: Fractures of both bones in adults, JBJS 31A – 755, 1949.
17. Mclaren AC, Hedley A, Magee F: The effect of intramedullary rod stiffness in fracture healing. Paper presented in OTA, Toronto, 1990.
18. Mih AD; Cooney WP, Idler RS et al: long term follow up of forearm bone diaphyseal plating, Clinc Orthop 299: 256, 1994
19. Sage FP: Medullary fixation of fractures of forearm, a study, JBJS 41A: 1489, 1959.
20. Sisk TD: Compression plate fixation for fractures of radius and ulna, Strat Orthop 2:1, 1982.