

**Research Article****“Comparative Study of Functional Outcome of Dynamic Compression Plating and Interlocking Nailing For Fracture Shaft of Humerus in Adults”**<sup>1</sup>Dr. Inder Sain Gupta, <sup>2</sup>Dr. Sheetal, <sup>3</sup>Dr. Anurag Chabra<sup>1</sup>Associate Professor, Dept. of Orthopaedic, MAMC Agroha<sup>2</sup>Associate Professor, Dept. of Anaesthesia, MAMC Agroha<sup>3</sup>HOD Dept. Orthopaedic, MAMC Agroha

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**ABSTRACT**

**Background:** The diaphyseal fractures of humerus were traditionally treated conservatively, but the needs of the patients warranted surgical fixation of these fractures now. The two most popular methods of fixation are Plate Osteosynthesis and Intra-medullary fixation with Inter-locking Nail. In this study we tried to compare these two methods of fixation to arrive at the ideal choice of implant for these fractures.

**Materials & Methods:** In this study we included 40 patients with diaphyseal fractures of humerus, who attended the department of Orthopedics and Traumatology MAMC Agroha. The period of study was 1 year's i.e, from September 2015 to September 2016.

**Results:** Forty two percent of cases were in the age group 31-40 years. The males outnumbered the females. The most common cause was motor vehicle accidents amounting to 64%. Right side was involved in 65% of all cases. All operations were done within 4-6 days of injury. In the twenty patients of plate group, the

**Complications were:** Infection-7.1%; delayed union-12%; movement restriction of shoulder-12%; movement restriction of elbow-7%. In the twenty patients of nail group, complications were: infection-6.7%; fracture end splintering-7.6%; delayed union-26.8%; movement restriction of elbow-7.6%; movement restriction of shoulder-14.3%; shoulder pain-48%. Maximum number of fractures (73.3% in plating group and 60% in nailing group) clinically united in 12 weeks but the results were statistically insignificant. Excellent results were obtained in 15 patients (73.3%) in locking plate group and 12 patients (60%) in locking nail group on functional assessment.

**Conclusion:** Both locking plating and interlocking intramedullary nailing provided statistically comparable results for patients requiring surgical treatment of mid shaft humeral fractures. But a higher rate of excellent and good results and a tendency for earlier union was seen with locking plating group in our study.

**Keywords:** Traumatology, Osteosynthesis

**I. INTRODUCTION:**

Fractures of the humeral shaft are common and accounts for 3% of all fractures(20% of all humerus fractures)<sup>1</sup>.Fractures of humeral shaft have traditionally been regarded benign, with high percentage of primary healing with conservative methods, using either a hanging arm cast or functional brace. However loss of reduction in the plaster cast invariably leads to malunion. Operative treatment for humerus fractures has usually been reserved for the treatment of nonunion, associated with fractures of forearm,

for polytrauma patients, and for those with neurovascular complications. The advantages of operative management are early mobilization. But, operative management carries the risk of technical errors and post operative complications infections, nerve injuries etc. Most of the studies have used fracture union as the major determinant of the outcome and very few studies have examined the functions at the shoulder and elbow joints. The optimal method of humeral shaft fracture fixation remains in debate. Two techniques under study include intramedullary nailing and plate osteosynthesis. Plating provides satisfactory

results but requires extensive dissection, and meticulous radial nerve protection. The plate may fail in osteoporotic bone. With the dynamic success of intramedullary fixation of fractures of the femur and tibia, there was speculation that intramedullary nailing might be more appropriate for humeral shaft fractures than plating. The theoretical advantage of intramedullary nailing included less invasive surgery, an undisturbed fracture hematoma and use of a load sharing device support. However, the phenomenal success of interlocking nailing in long bones like femur and tibia is not seen in humerus. According to recent studies the preferred method of fixation of humeral fractures is by plate osteosynthesis. The purpose of this study is to compare the outcomes of each method of fixation ( plating and interlocking nailing) for, the fracture shaft of humerus and to analyse statistically significant difference in the results of these two methods.

**Aims:** To compare the results of plate osteosynthesis and interlocking nailing in the treatment of fracture shaft of humerus with reference to,

- ✚ Rate of healing
- ✚ Functional outcome
- ✚ Complications and
- ✚ Morbidity.

**Classification:** There is no universally accepted classification for humeral shaft fractures Classically they have been classified on the basis of factors that influence treatment like

**Fracture location:** Based on the part of the diaphysis involved it is classified as

Proximal-third

1. Middle-third.
2. Distal-third.

**Direction and character of fracture line:**

1. Transverse
2. Oblique
3. Spiral
4. Segmental
5. Comminuted

**AO/ASIF Classification:** In this the fractures are divided into 3 types with further subdivisions.

- ✚ A - Simple fracture.
- ✚ A 1 - Spiral Fracture.
- ✚ A 2 - Oblique fracture.
- ✚ A 3 - Transverse fracture.
- ✚ B - Wedge fractures.
- ✚ B 1 - Spiral wedge.
- ✚ B 2 – Bending wedge
- ✚ B 3 – Fragmented wedge
- ✚ C- Complex Fractures
- ✚ C 1 – Complex spiral
- ✚ C 2 – Complex segmental fractures
- ✚ C 3 – Complex irregular fractures

This classification has prognostic value because higher fracture types have greater risk as they are high energy fractures. Classification of the fracture guides us in choosing the treatment modality. A simple oblique fracture yields good results with conservative management. A transverse fracture precludes the use of hanging arm cast due to risk of distraction and potential complications<sup>2</sup>. spiral fractures in the distal third also called as Holstein – Lewis fracture is often complicated by Radial nerve palsy either primarily or post closed reduction<sup>3</sup>. Segmental fractures usually need internal fixation. Comminuted fracture is better managed by closed means. Osteopenic boned are better managed by intramedullary nailing than by plating

**Operative Treatment:** Though majority of the simple fracture are managed non operatively, specific indications exists for operative treatment<sup>4</sup>.the indications can be divided into fracture indications, associated injuries, and patient indication

**1. Fracture indications:**

a) Failure to obtain and maintain adequate closed reduction.

- Shortening greater than 3centimeter.
- Rotation greater than 30 degrees.
- Angulation greater than 20 degrees.

b) Segmental fractures

- c) Pathologic fractures.
- d) Intra-articular extension.
  - Shoulder joint
  - Elbow joint.

## 2. Associated injuries:

- a) Open wound.
- b) Vascular injury.
- c) Brachial plexus injury.
- d) Ipsilateral forearm fractures.
- e) Bilateral humeral fractures.
- f) Lower extremity fractures requiring upper extremity weight bearing (Crutch walking). Burns.
- h) High velocity gunshot injury.
- i) Chronic associated joint stiffness of shoulder or elbow.

## Patient indications:

- a) Polytrauma.
- b) Head injury (Glasgow coma scale lesser than 8).
- c) Chest trauma.
- d) Poor patient tolerance.
- e) Unfavorable body habitus Ex:-Morbid obesity.
- f) Parkinson's disease and other neurological diseases<sup>5</sup>

## The main methods employed for internal fixation of humeral shaft fractures are

1. Plate and screws
2. Intramedullary nailing.
3. External fixation.

## Plate Osteosynthesis

This is the gold standard for fixation of humeral shaft fractures<sup>6</sup>. Plating is associated with high union rate, low complications rate and rapid return to function. The plate is applied on the tension side of the bone in accordance with the tension band principle. In humerus the most commonly used plates are the Dynamic compression plate (DCP).

## Intra Medullary Interlocking Nail Fixation

Closed medullary nailing of fractures of the humeral shaft is rapidly becoming the treatment of choice in multiple trauma patients, fractures with overlying burns, patients with osteoporotic bone, pathological fractures and segmental fractures. Interlocking medullary humeral nail fixation can be used in the treatment of fractures 3cms proximal to the olecranon to within 2cms of the surgical neck of the humerus. The interlocking nail can be inserted retrograde or ante grade and is designed for reamed and non reamed insertion. The nail is available in diameters of 7, 8 and 9mm. 7mm is solid, 8 and 9mm nails are cannulated.

## ❖ Complications

### ❖ Malunion

### ❖ Nonunion

### ❖ Infected nonunion

### ❖ Non unions with bone loss

### ❖ Neurological complications

### ❖ Vascular complications

**Materials and Methods:** This study was conducted in the Department of Orthopaedic surgery and traumatology at MAMC Agroha between September 2015 to September 2016.

During the above period patients with diaphyseal fractures of the humerus with indications for surgical management were included in the study.

## Inclusion criteria:

1. All fractures of diaphysis of humerus indicated for surgical treatment.
2. Patients of age 18 years and above

## Exclusion criteria:

1. Fracture of upper and lower ends of humerus
2. Patients treated with other than plate osteosynthesis or interlocking nail
3. Patients with pre existing shoulder and elbow problems.
4. Pathological fractures

### **5. Patients who were lost to follow up or died before the fracture union.**

The patients who met the inclusion and exclusion criteria were included in the study after taking informed consent. A thorough history and clinical examination was done. The status of radial nerve injury was recorded. Roentgenogram of the arm with shoulder and elbow was taken in both antero-posterior and lateral views. Additional roentgenograms were taken if any other injury was suspected. The humeral shaft fracture was temporarily immobilized with a U-slab and arm pouch.

## **II. Materials and Methods**

Data was collected from 40 Adult patients with fracture shaft humerus attending to Dept. of orthopaedic MAMC Agroha Medical College Hospital during the period from September 2015 to September 2016. Patients were randomized into two groups using odd or even hospital numbers. They were evaluated pre-operatively and the functional results was assessed post-operatively. The patients were evaluated as per mode of injury and the history. Necessary radiological investigations and hematology profile was done on admission itself. Post-operatively Xray and patient were evaluated. All the cases were called up for radiological and clinical evaluation at 2 weeks, 6 weeks,

12 weeks, 6 months, 1 year and in between if required for any morbidity and mortality.

### **Study type:**

Analytical Study of functional outcome following dynamic compression plating and interlocking nailing for fracture shaft humerus in adults. A sample of size of 40 patients was divided into two groups based on odd or even hospital numbers.

20 patients underwent dynamic compression plating.

20 patients underwent inter-locking nailing.

### **Inclusion Criteria:**

1. Patient aged 18 years and above.
2. Only the diaphyseal humeral fractures.
3. Fresh fractures.

### **Exclusion criteria:**

1. Fracture of upper and lower ends of humerus.
2. Patients treated conservatively.
3. Patients who lost to follow up
4. Open fracture
5. Pathological fractures.
6. Vascular injury
7. Brachial plexus injuries

### **Collected data was analyzed by Chi-Square test:**

Operative technique: all patients were operated after proper pre anaesthetic check up. An ante grade interlocking technique was done with maximum care not to damage of the rotator cuff at the time of nail insertion. Anterolateral approach was used for plating of the fracture; the biceps was medially retracted with minimal periosteal stripping soft and tissue dissection. Precautions were taken to minimize radial nerve damage.

Post-op period: All patients were encouraged to start postoperative shoulder and elbow exercises immediately. Radiographs at proper intervals were assessed for union. At each visit, the overall rating of excellent, good, fair and poor outcomes based on scores of elbow and shoulder movements along with pain and disability was done after the procedure. Follow up: follow was done routinely for rehabilitative exercises and clinical assessment. Xrays were taken at 2 weeks, 6 weeks, 3 months, 6 months, 12 months, 18 months and in between if required.

### **III. Results:**

42% of cases were in the age group 31-40 years. The males outnumbered the females. The most common cause was motor vehicle accidents, amounting to 64%. The right side humerus accounted for 65% of all cases. All patients were operated within 4-6 days of injury. In the twenty patients of plate group, the complications were: Infection-7.1%; delayed union-12%; movement restriction of shoulder-12%; movement restriction of elbow-7%. In the twenty patients of nail group, complications were: fracture end splintering-7.6%; infection-6.7%; delayed union-26.8%; movement restriction of shoulder-14.3%; movement

restriction of elbow-7.6%; shoulder pain-48%. Maximum number of fractures (73.3% in plating group and 60% in nailing group) clinically united in 12 weeks. Mean time of union in plate group was 13.7 weeks and nail was 14.1 weeks. There was no significant difference between the two groups. The Functional grading system of SICOT scoring was used to analyse the results. On functional assessment, excellent results were obtained in 15 patients (73.3%) in locking plate group and 12 patients (60%) in locking nail group. There was no significant difference between the locking plate and locking nail group (P value 0.631).

#### IV. Discussion:

When options for surgical treatment for shaft of humerus fracture was assessed, locking plating and interlocking intramedullary nailing both provide statistically comparable results but a higher rate of excellent and good results and earlier union was seen with locking plating group in our study. Various surgical approaches are mentioned in the literature for ORIF of mid shaft fracture of humerus but we, in our study, we have done plating of fractures through anterolateral approach, by medially reflecting the biceps with minimum soft tissue dissection and periosteal stripping and with maximum care for radial nerve, specially at spiral groove. In our study, no post operative radial nerve palsy occurred for both plating group and nailing group. Humerus nailing was done in all cases of our study through antegrade route. Rotator cuff injury was prevented as much as possible by being careful at entry site selection. In our study no radial nerve palsy, fracture ends splintering occurred for the nailing group. But we had, inspite of strict aseptic precaution 13.3% infection in plate group and 6.6% in nail group, which included superficial skin infection. Majority of the plating group had radiological union before 16 weeks (73.3%) when compared to nailing group (66.6%). So healing as such was not a problem but cases of early healing were more in plate group. Results of our study were comparable to the study by Singiseti K et al 2010. In that study 20 patients were operated with interlocking nailing and 16 patients with plating. They too noticed a higher rate of excellent and good results and a tendency for earlier union with the plating group. Putti et al 10, in 2009, studied and followed up 34 patients with humeral shaft

fractures who were randomized to undergo locked ante grade intramedullary nailing and plating. They concluded that the complication rates were higher in the intramedullary nailing group, whereas functional outcomes were equally good in both modalities. Raghvendra S et al 11 followed up 36 patients in a prospective study. There was no significant difference between plating or nailing in terms of time to union, compression plating is the preferred method in the majority of fractures of the shaft of the humerus with better preservation of joint function and lesser need for secondary bone grafting for union.

#### V. Conclusion:

For patients requiring surgical treatment of mid shaft humeral fractures, locking plating and interlocking intramedullary nailing both provide statistically comparable results but a higher rate of excellent and good results and a tendency for earlier union was seen with locking plating group in the present series.

Further prospective, randomized comparative study is warranted.

#### References:

1. Rose SH, Melton LJ, Morrey BF, Ilstrup DM, Riggs BL. Epidemiologic features of humeral fractures, Clin.Orthop Relat Res. 1982 Aug; (168): 24-30.
2. Rockwood CA, Bucholz RW, Green DP, Heckman JD, Rockwood and Green's Fractures In Adults, Vol 1, 4th Edition, Lippincott Raven; 1996.
3. Buckholz RW, Heckman JD, Rockwood, Green's. Fractures in Adults.Vol 1, 5th Edition.Lippincott Williams and Wilkins; 2001.
4. Rockwood CA, Bucholz RW, Green DP, Heckman JD, Rockwood and Green's Fractures In Adults, Vol 1, 4th Edition, Lippincott Raven; 1996
5. Gustilo RB, Kyle RF, Templeman D fractures and dislocations. 1st edition Mosby publications; 1993.
6. Rockwood CA, Bucholz RW, Green DP, Heckman JD, Rockwood and Green's Fractures In Adults, Vol 1, 4th Edition, Lippincott Raven; 1996
7. Atroshi I, Gummesson I, Andersson B, Dahlgr E, Johansson A. The disabilities of the arm, shoulder and hand (DASH) outcome

- questionnaire. *Acta Orthop Scand*, BMC Musculoskelet Disord. 2006;7:44.
8. Gummesson C, Atroshi I, Ekdahl C. *BMC Musculoskeletal Disorders* 2003,4:11.
  9. Michael MW, Tracy I, Winston, Vucy, Schemitsch. Functional Outcome Following Surgical Treatment of Intra-Articular Distal Humeral Fractures through a Posterior Approach. Volume 82-A (12), December 2000, 170111707.
  10. Ruedi T, Moshfeigh A, Pfieffer K, Allgower M. Fresh fractures of the shaft of the humerus. - Conservative or operative treatment? *Reconstruction Surg and trauma*. 14:65-74. 1974
  11. Foster RJ, Dixon GL, Bach A W, Appleyard RW, Green TM. Internal Fixation of fractures and non union of the humerus shaft *JBSJ*; Vol 67A; No. 6, July 1985; 857-64
  12. Bell MJ, Beauchamp, Kellam JK and McMurtry. The Results of Plating Humeral Shaft Fractures in Patients with Multiple Injuries, the Sunny Brook Experience. *JBSJ Am* 1985; Vol- 67; 293-296
  13. McCormack RG, Brien D, Buckley RE, McKee, Powell J, Schemitsch EH. fixation of fracture of shaft of humerus by dynamic compression plate or Intramedullary nail, *J Bone Joint Surgery (Br)* Toronto Canada, 2000; 82- B: 336-9.
  14. Naiman PT, Schein AJ, Siffert RS. Use of ASIF compression plates in selected shaft fractures of the upper extremity. A preliminary report *Clin Orthop*. 71:208-2.16. 1970
  15. Pollock FH, Drake D, Bovill EG, et al. treatment of radial neuropathy associated with fracture shaft of humerus. *JBSJ (A)* 1981; 63: 239-243
  16. Dabezies EJ, Banta CJ, Murphy CP, d'Ambrosia RD. Plate fixation of the humeral shaft for acute fractures with or without radial nerve injuries. *J Orthop Trauma*: 1992;6:10-13
  17. Heim D, Herkert F, Hess P, Regazzoni P. surgical treatment of humeral shaft fractures: the Basel experience. *J Trauma*: 1993; 35:226-232
  18. Rommcsns PM., Verbrungen J, Bros PL. Retrograde locked nailing of humeral shaft fractures. *J. Bone Joint Surg (Br)* 1995; 77B: 84-89.
  19. Ruedi T, Moshfeigh A, Pfieffer K, Allgower M. Fresh fractures of the shaft of the humerus. - Conservative or operative treatment? *Reconstruction Surg and trauma*. 14:65-74. 1974
  20. Hems TE, Bhullar TP. Interlocking nailing of humeral shaft fractures: the Oxford experience 1991-1994. *Injury* 1996;27:485-489
  21. Crolla RMPH, deVries LS, Clevers CJ. Locked intramedullary nailing of humeral fractures injury 1993; 24: 403-455
  22. Ingman AM, Waters DA. Locked intramedullary nailing of humeral shaft. fractures. *JBSJ Br* 1994:76-6: 23-24
  23. Garcia AJ, Laeck BH. Radial nerve injuries in the fractures of the shaft of the humerus. *Am J Surg*. 1960:99:625-627
  24. Kettlekamp DB, Alexander H. Clinical review of radial nerve injury. *J trauma*. 1967; 7:424-432
  25. Rathbun JB, Macnab L. The microvascular pattern of the rotator cuff. *JBSJB*: 1970: 52-B. 540-553
  26. Muller ME, Allgower M, Schneider R, Willenegger H. *Manual of internal fixation*. Springer- Verlag. 3rd Edition; 1991
  27. Bain G, Sandow M. treatment of humeral shaft fractures with the Seidel intramedullary nail. *JBSJ Br*. 1992; 74-b supp. I. 39-40
  28. Titze A, the operative treatment of the fractures of the shaft of the humerus, *Reconstruction Surg. & Traumatol* 1974;14:75-83.
  29. Robinson CM, Bell KM, Court-Brown CM, McQueen MM. Locked nailing of humeral shaft fractures. *JBSJ (A)*: 1992: 74-A: 558-562