



ORIGINAL RESEARCH PAPER

Orthopaedics

INTERLOCKING NAIL VERSUS PLATE OSTEOSYNTHESIS IN FRACTURE SHAFT OF HUMERUS: A PROSPECTIVE STUDY

KEY WORDS: Diaphyseal shaft humerus fracture, open reduction, plate fixation, closed reduction, interlocking nail, comparative study

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ABSTRACT

Diaphyseal fractures of humerus accounts for 3 % of all fractures. With increasing automobile accidents it is likely to be more in future. Fractures of the shaft of humerus have been treated conservatively since very long time. However, conservative treatment has its own demerits. Secondly it cannot be recommended in every cases. The operative treatment includes open reduction of fracture and internal fixation with plate osteosynthesis or closed reduction and intramedullary Nail. In this study we compared between open reduction and plate fixation with close reduction and Interlocking Nail fixation over a period of eighteen months. We included Sixteen patients for Interlocking and Fourteen patients for plate Osteosynthesis after considering all inclusion and exclusion criteria. We follow-up our patients for nine months on average. After doing prospective assessments and comparison between two series we have found that Interlocking group done marginally better in respect of time of union and functional outcome (though not statistically significant) with less postoperative complication (statistically significant) than Plate Osteosynthesis.

INTRODUCTION:

Trauma is the leading cause of mortality and morbidity since the last century. The person procuring bony injury, faces prolonged immobilization which leads to absence from workplace which further increases bearing on family members. The patient also has complication of stiff joints and functional disability. Early restoration of joint motion, return to the normal physiologic function and minimal morbidity is now regarded as the ideal fracture treatment. Diaphyseal fractures of humerus accounts for 3% of all fractures [1],[2]. With increasing automobile accidents it is likely to be more in future. Fracture of humerus is one of the most challenging fracture of upper limb. Irreparable damages can occur if fractures are not understood and treated properly. This fracture can be managed both conservative and operatively. Fractures of the shaft of humerus have been treated conservatively since very long time with good result. Sir John Charnley in his thesis "The closed treatment of common fractures" states, "It is perhaps one of the easiest major long bone fractures to be treated by conservative methods"[3]. However, conservative treatment has its demerits such as prolonged limb immobilization, the need for constant co-operation, repeated hospital visits and other plaster related complications. Secondly it cannot be recommended in very case like unstable fractures, comminuted fractures, segmental fractures, pathological fractures, open fractures, Floating elbow, Polytrauma patient, fractures with delayed union or non-union and fractures with radial nerve injuries or vascular injury. Such fractures require operative line of treatment. The operative treatment includes open reduction of fracture and internal fixation with plate osteosynthesis or intramedullary implant. Both these procedure has some merits and demerits. Here we compare these two procedure to find out which one is better.

MATERIAL AND METHODS:

It was an institutional based prospective study. The study was conducted at Medical College and Hospitals, Kolkata after obtaining Ethical Committee approval. Patients were divided in two groups. One was treated with plating and other group with interlocking nail. In this study there were only cases no controls. Study was conducted for 24 months (September 2017 to September 2019). In first 18 months there was patient recruitment. Patients were followed for 11 months on average (ranging from 7-3months. There was total 30 patients, Random

and quality divided in two groups ;(1) Interlocking Nail (2) Plate Osteosynthesis

Sample Design:

The study was conducted among the adult patients who attended Orthopaedics out-patient department and emergency of Medical College and Hospital, Kolkata with primary fracture of shaft of humerus.

Inclusion Criteria were (1) Patients between 18-60 years, (2) Closed fracture, (3) Non-compliant patient for conservative treatment, (4) Polytrauma patient, (5) Segmental fracture, (6) Unacceptable reduction for conservative treatment, (7) Obesity, (8) Pendulous breast and **Exclusion Criteria** were (1) Age below 18 and above 60 years, (2) Associated previous surgery of humerus, (3) Pathological fracture and (4) Open fracture. After proper examination 30 patients were included. 16 patients was randomly assigned for Inter locking nail and rest 14 for open reduction and plating. Radiological valuation at the time of fracture include a good antero- posterior view and a lateral view of the humerus which included the shoulder and elbow joints.

Based on this X-Rays the fracture was classified by the AO system of classification. The patients were followed up for an average period of 11 months (ranging from 7-23 months). Each case was reviewed clinically and radiologically during the follow up period. Non operative or surgical treatment depended on the clinical findings, radiological findings and associated injuries. Only operative cases were selected.

Indications of operative treatment included:

1. Polytrauma patients who require early mobilization.
2. Unacceptable reduction after Conservative trial.
3. Patients insist for early return to work, where prolonged immobilization was not possible.
4. Comminuted, short oblique or spiral fractures which could not be reduced by closed methods.
5. Fractures associated with radial nerve or brachial artery injuries.
6. Floating elbow (associated fractures of forearm) and
7. Obesity.

At the primary visit, patient was evaluated by ATLS protocol. After ruling out any other injuries, patient was given a u-slab

with analgesics and antacid with tetanus prophylaxis. Following this patient was admitted. Pre-operative check-up done for operative fitness. After proper counselling and taking informed consent, patient was taken for operation.

Plate osteosynthesis was done through anterolateral approach of Henry. After reduction fracture was fixed with a narrow 4.5 mm dynamic compression plate (DCP) with minimal of 6 cortices on either side with screw. After thorough saline wash Vacuum drain given. Wound closed in layers. Post operatively check X-Ray was taken and patient was called for follow up visit at OPD level.

Antegrade Humerus nail was done either under scalene block or general anaesthesia. - Patient was kept supine with the head turned on contralateral side and a sand bag under the scapular blade. - A counter traction sling was given in ipsilateral axilla. - Proper scrubbing, draping and painting were done. - Small incision over the anterolateral acromion was made. Deltoid muscle fibres carefully dissected to avoid unnecessary damage to rotator cuff and greater tuberosity was approached. - Entry point with the help of a curved awl, entry point is created just postero-medial to the greater tuberosity under fluoroscopy guidance. Following this a hand reamer of 6 mm was introduced and proximal segment was reamed up to fracture site.

Then a guide wire was introduced into the reamer. And with reamer used as reduction tool to manipulate proximal fragment, fracture reduction achieved. Following this guide wire was introduced into distal fragment. After this distal portion was reamed up to 2 cm above the proximal border of olecranon fossa. Then further sequential reaming was done up to 1 mm more than the desired nail size. Nail length was determined under fluoroscopic guidance. Then the desired Nail fitted with proximal jig was introduced over the guide wire with gentle manipulation and without any hammering.

Proximal end Nail of was kept 2-5 mm submerged in the humeral head. Distal end was kept 2 cm above proximal margin of olecranon fossa. The position was confirmed with fluoroscopy. Distal locking was done with minimal two cortical bolt under fluoroscopy guidance. Then gentle back hammer was done. Under fluoroscopy the compression at fracture site was evaluated. After this proximal locking was done with the help of the guide jig. Proximally second and third hole was locked as they took better purchase. Later the fracture site stability was checked by internal and external rotation. Entry site was properly irrigated and incisions closed. Postoperatively a sling was given to the patient and called for follow up visits at OPD.

Follow up visits

1st visit – 2 week after surgery. Stitch removal was done and the shoulder and elbow mobilization was advised. 2nd visit – 6 weeks following surgery. During this visit both shoulder and elbow movements were evaluated. Tenderness at fracture site noted. Repeat X-Ray – to see for sign of fracture union. If evidence of union was seen full mobilization was advised.

Patient was further followed up at 12th and 24th week. Then once in every three month.

Results And Analysis

Specific objective 1: To describe the demographic and clinical profile of the adult patients attending Medical College & Hospital, Kolkata for primary surgical fixation of non- pathological closed fractures of the humeral shaft. Demographic profile of the study participants

AGE

Table 1. Distribution Of The Participants According To Age

| Age (yrs.) | No. of Patient | Percentage(%) |
|------------|----------------|---------------|
| 18-20 | 2 | 6.7 % |
| 21-30 | 7 | 23.3 % |

| | | |
|-------|---|--------|
| 31-40 | 9 | 30 % |
| 41-50 | 7 | 23.3 % |
| 51-60 | 5 | 16.7 % |

Comment: Among the patients included, majority (30%) were within the age group of 31 – 40 years. The mean age of the participants was observed to be 27.87 years (standard deviation: 11.26 years). The youngest patient was aged 19 years and the oldest patient was aged 59 years. The median age here was observed to be 38 years.

GENDER

Table 2. Distribution Of The Participants According To Gender.

| Gender | Number | Percentage % |
|--------|--------|--------------|
| Male | 19 | 63.3 % |
| Female | 11 | 36.7 % |

Comment: Majority of the study participants were male (63.3%) and female patients comprised of 36.7%

Table 3. Distribution Of The Participants According To Age Groups And Gender.

| Age(Years) | Sex | | | P-value (χ ² value, df) |
|------------|-----------------------|-------------------------|------------------------|--|
| | Male Number (%) | Female Number (%) | Total Number (%) | |
| ≤ 20 | 0 (0.0%) | 2 (18.2%) | 2 (6.7%) | 0.212 (5.83, 4) |
| 21 – 30 | 5 (26.3%) | 2 (18.2%) | 7 (23.3%) | |
| 31 – 40 | 7 (36.8%) | 2 (18.2%) | 9 (30.0%) | |
| 41 – 50 | 5 (26.3%) | 2 (18.2%) | 7 (23.3%) | |
| 51 - 60 | 2 (10.5%) | 3 (27.3%) | 5 (16.7%) | |

Comment: Among the male participants majority (36.8%) were within the age group of 31 – 40 years. While 26.3% of the males belonged to 21 – 30 years and 41 – 50 years age groups individually, only two patients were older than 50 years. Among the female patients in each of the age groups of ≤ 20 years, 21– 30 years, 31 – 40 years, 41 – 50 years there were two patients (18.2%), with three patients (27.3%) were aged more than 50 years. However, this difference in proportions of participants according to gender and age was not significant statistically, implying no statistical difference in the distribution of male and female patients according to different age groups.

Table 4. Distribution Of The Study Participants According To Side Of Fracture.

| Side | Number | Percentage(%) |
|-------|--------|---------------|
| Right | 17 | 56.7 % |
| Left | 13 | 43.3 % |

Comment: Among the patients included in the current study, majority (56.7%) sustained injury to the right side.

Table 5. Distribution Of The Study Participants According To Mode Of Injury.

| Mode of injury | Number | Percentage(%) |
|-----------------------|--------|---------------|
| Road traffic accident | 14 | 46.6 % |
| Fall from height | 9 | 30.1 % |
| Blunt Trauma | 7 | 23.3 % |

Comment: Majority of the patients presented following road traffic accidents (46.6%). Second most common cause being fall from height (30.1%), followed by blunt trauma (23.3%).

Table 6. Distribution Of The Study Participants According To Site Of Fracture.

| Site of fracture | Number | Percentage(%) |
|------------------|--------|---------------|
| Upper third | 5 | 16.6 % |
| Middle third | 18 | 60 % |
| Lower third | 7 | 23.3 % |

Comment: Sixty percent of the patients sustained fracture at the middle third of the humerus. Proportion of fractures at

upper third and lower third are comparable (16.6% and 23.4% respectively).

Table 7. Distribution Of The Study Participants As Per AO Classification Of The Injury Sustained. (n=30)

| AO Classification | No of Patient | Percentage(%) |
|-------------------|---------------|---------------|
| A1 | 5 | 16.6 % |
| A2 | 6 | 20 % |
| A3 | 9 | 30 % |
| B1 | 5 | 16.6 % |
| B2 | 2 | 6.66 % |
| B3 | 0 | 0 % |
| C1 | 2 | 6.66 % |
| C2 | 1 | 3.33 % |
| C3 | 0 | 0 % |

Comment: Majority of the patients (30%) had injury of class A3 as per the AO classification. While 20% had A2 injuries, 16.6% of the patients had injury of class A1. Comparable of A1 injuries, another 16.6% patients sustained B1 class of injury. No patients sustained C3 or B3 class of injury.

Table 8. Distribution Of The Study Participants According To Presence Of Associated Injuries.

| Associated injury | No of Patient | Percentage |
|------------------------------------|---------------|------------|
| Head Injury | 1 | 3.33 % |
| Chest Injury | 0 | 0 % |
| Abdominal Injury | 0 | 0 % |
| Rib Fracture | 1 | 3.33 % |
| Hip fracture | 2 | 6.66 % |
| Pelvis injury | 1 | 3.33 % |
| Lower limb fracture | 2 | 6.66 % |
| Ipsilateral Upper limb fracture | 2 | 3.33 % |
| Contra lateral upper limb fracture | 0 | 0 % |

Comment: Most of the patients (70%) did not sustain any clinically significant associated injury. Two patients sustained associated hip fracture, two had ipsilateral upper limb fracture and another two lower limb fractures. Associated head injury, rib fracture and pelvis injury was observed in one patient each.

Specific Objective 2: To assess the safety and efficacy of interlocking nail and plate osteosynthesis for the primary surgical fixation of non-pathological closed fractures of the humeral shaft in adults.

Table 9. Distribution Of The Patients According To Indications Of Operative Intervention.

| Indication | Number of patients | Percentage |
|---------------------|--------------------|------------|
| Polytrauma | 9 | 30% |
| Unstable fracture | 6 | 20% |
| Oblique fracture | 2 | 6.66% |
| Obese | 4 | 13.3% |
| Poor skin condition | 4 | 13.3% |
| Pendulous breast | 3 | 9.99% |
| Non-compliant | 2 | 6.66% |

Comment: Among the patients, 30% were operated following the indication of poly-trauma and another 20% were unstable. Four patients (13.3%) were operated because of poor skin condition. Similar number of patients were obese. While 10% patients had pendulous breast, two patients had oblique fracture leading to intervention.

Table 10. Distribution Of The Patients According To Type Of Operative Intervention Performed.

| Type of surgery | Number | Percentage(%) |
|-----------------|--------|---------------|
| Plating | 14 | 46.7 % |
| Nailing | 16 | 53.3 % |

Comment: Marginally higher number of patients, 16 patients (53.3%) underwent nailing in comparison to 14 participants

(46.6%) receiving plate osteosynthesis. Safety and efficacy of interlocking nail

Table 11. Distribution Of Patients With Interlocking Nail According Time Interval Required For Union.

| Union time (Nailing) in weeks | Number | Percentage |
|-------------------------------|--------|------------|
| <12 | 6 | 37.5 |
| 13-16 | 9 | 56.25 |
| 17-20 | 1 | 6.25 |
| 21-24 | 0 | 0 |

Comment: Majority of the patients (56.3%) required 13 – 16 weeks for union of fracture following interlocking nail. However, 37.5% of the patients required 12 weeks or less for union. Only one patient took more than 16 weeks for union of fracture following surgical intervention.

Distribution of patients with interlocking nail according to ASES score at 24th week.

Table 12. Distribution Of Patients With Interlocking Nail According To Different ASES Score Groups At 24th Week.

| ACES score categories | Number Of Patient | Percentage(%) |
|-----------------------|-------------------|---------------|
| <40 | 2 | 12.5 % |
| 40-44 | 2 | 12.5 % |
| 45-49 | 10 | 62.5 % |
| >50 | 2 | 12.5 % |

Comment: The mean ASES score at 24th week after interlocking nail was 45.56 (± 3.9), with minimum score 37 and maximum was found to be 50. The median score was 46.5. Majority of the patients with interlocking nail had an ASES score at 24th week of 45 – 49 (62.5%).

Table 13. Distribution Of Patients With Interlocking Nail According To Post-operative Complications.

| Post-operative complications | No. of patients | Percentage % |
|------------------------------|-----------------|--------------|
| No complication | 12 | 75.0 % |
| Superficial infection | 2 | 12.5 % |
| Shoulder stiffness | 2 | 12.5 % |

Comment: Majority of the patients with interlocking nail (75%) did not suffer any complications following surgery. Two patients suffered superficial infection. Another two patients sustained shoulder stiffness.

Table 14: Functional Assessment Of Shoulder Joint In Interlocking Nail Cases At 24th Week.

| Constant Murley Score | No. of Patient | Percentage |
|-----------------------|----------------|------------|
| 55-66 | 6 | 37.5 % |
| 50-54 | 7 | 43.75 % |
| 45-49 | 2 | 12.5 % |
| 40-44 | 1 | 6.25 % |
| <40 | 0 | 0 |

Comment : Using the Constant Murley score for shoulder evaluation, at 24th week 37.5% of patients who underwent an antegrade interlocking nail had the score between 55-66 (excellent shoulder function). No patient had the score less than 40.

Table 15. Distribution Of Patients With Plate Osteosynthesis According Time Interval Required For Union.

| Union Time for Plating | No. of Patient | Percentage (%) |
|------------------------|----------------|----------------|
| <12 | 4 | 18.5 % |
| 13-16 | 6 | 42.85 % |
| 17-20 | 2 | 14.2 % |
| 21-24 | 0 | 0 % |
| 25-30 | 2 | 14.2 % |

Comment: Majority of the patients (35.7%) required 13 – 16 weeks for union of fracture following plate osteosynthesis. However, 28.6% of the patients required 12 weeks or less for union. Two patients took more than 24 weeks for union of fracture following surgical intervention. The mean time required for union after plate osteosynthesis was 16.14 weeks (± 4.9 weeks), with minimum duration 11 weeks and maximum was found to be 29 weeks. The median duration of time required for union was 16 weeks.

Table 16. Distribution Of Patients With Plate Osteosynthesis According To ASES Score At 24th Week.

| ASES score category | No. of Patient | Percentage(%) |
|---------------------|----------------|---------------|
| <40 | 2 | 14.3 % |
| 40-44 | 2 | 14.3 % |
| 45-49 | 5 | 35.7 % |
| >50 | 5 | 35.7 % |

Comment: Majority of the patients with plate osteosynthesis had an ASES score of 45 – 49 (62.5%). A score of 50 or more was observed in 2 patients. A score below 40 was observed in another two patients.

Table 17. Distribution Of Patients With Plate Osteosynthesis According To Post-operative Complications.

| Post-operative complications | Number | Percentage % |
|-------------------------------|--------|--------------|
| No complication | 5 | 35.7 % |
| Superficial infection | 3 | 21.4 % |
| Deep infection | 2 | 14.3 % |
| Non-union | 2 | 14.3 % |
| Iatrogenic Radial Nerve Palsy | 2 | 14.3 % |

Comment: Majority of the patients with plate osteosynthesis (35.7%) did not suffer any complications following surgery. Around 21.4% suffered superficial infection.

Specific objective 3: To compare the safety and efficacy of both the methods for the primary surgical fixation of non-pathological closed fractures of the humeral shaft in adults.

Table 18. Comparison Of Mean Operating Time

| Type of Surgery | Interlocking Nail | Plate Osteosynthesis |
|---------------------|-------------------|----------------------|
| Mean Operating Time | 100.12 min | 139 min |

Comment: Mean operating Time is less in case of Interlocking nail than plate Osteosynthesis.

Table 19. Comparison Of Interlocking Nail And Plate Osteosynthesis As Per Time Required For Union Of The Fracture.

| Time interval for union of fracture (weeks) | Type of surgery | | | P-value |
|---|--------------------------------|-----------------------------------|--------------------|---------|
| | Interlocking nail [Number (%)] | Plate osteosynthesis [Number (%)] | Total [Number (%)] | |
| ≤12 | 6(37.5%) | 4(28.6%) | 10(33.3%) | 0.335 |
| 13-16 | 9(56.3%) | 5(35.7%) | 14(46.7%) | |
| 17-20 | 1(6.3%) | 3(21.4%) | 4(13.3%) | |
| >20 | 0(0.0%) | 2(14.3%) | 2(6.7%) | |
| Total | 16(100.0%) | 14(100.0%) | 30(100.0%) | |

Comment: While comparing the time required for union of fracture following surgery it was observed that proportion of patients with interlocking nail having early union. However, this trend of proportions were not significant statistically

Table 20 : . Comparison Of Interlocking Nail And Plate Osteosynthesis As Per ASES Score.

| ASES score category | Type of surgery | | | P-Value |
|---------------------|--------------------------------|-----------------------------------|--------------------|---------|
| | Interlocking nail [Number (%)] | Plate osteosynthesis [Number (%)] | Total [Number (%)] | |
| <40 | 2 (12.5%) | 2 (14.3%) | 4 (13.3%) | 0.216 |
| 41 – 44 | 2 (12.5%) | 2 (14.3%) | 4 (13.3%) | |
| 45 – 49 | 10 (62.5%) | 5 (35.7%) | 15 (50.0%) | |
| ≥ 50 | 2 (12.5%) | 5 (35.7%) | 7 (23.3%) | |
| Total | 16 (100.0%) | 14 (100.0%) | 30 (100.0%) | |

| | | | | |
|---------|-------------|-------------|-------------|-------|
| <40 | 2 (12.5%) | 2 (14.3%) | 4 (13.3%) | 0.216 |
| 41 – 44 | 2 (12.5%) | 2 (14.3%) | 4 (13.3%) | |
| 45 – 49 | 10 (62.5%) | 5 (35.7%) | 15 (50.0%) | |
| ≥ 50 | 2 (12.5%) | 5 (35.7%) | 7 (23.3%) | |
| Total | 16 (100.0%) | 14 (100.0%) | 30 (100.0%) | |

Comment: The proportion of patients at 24th week with higher ASES score were comparable for both the surgical procedures. Majority of the patients (50% overall) were having ASES score of 45 – 49. However, the observed differences in proportions were not statistically significant in this case as well (P-value 0.216). Comparison of safety of interlocking nail and plate osteosynthesis

Table 21. Comparison Of Interlocking Nail And Plate Osteosynthesis As Per Post-operative Complications.

| Post-operative complications | Type of surgery | | | P-value |
|-------------------------------|--------------------------------|-----------------------------------|--------------------|---------|
| | Interlocking nail [Number (%)] | Plate osteosynthesis [Number (%)] | Total [Number (%)] | |
| No complication | 12(75.0%) | 5(35.7%) | 17 (56.7%) | 0.035 |
| Superficial infection | 2(12.5%) | 3(21.4%) | 5(16.7%) | |
| Deep infection | 0(0.0%) | 2(14.3%) | 2(6.7%) | |
| Shoulder stiffness | 2(12.5%) | 0(0.0%) | 2(6.7%) | |
| Non-union | 0(0.0%) | 2(14.3%) | 2(6.7%) | |
| Iatrogenic Radial Nerve Palsy | 0(0.0%) | 2(14.3%) | 2(6.7%) | |
| Total | 16(100.0%) | 14(100.0%) | 30(100.0%) | |

Comment: Interlocking nail was documented to have higher proportions of patients without any complications as compared to plate osteosynthesis. While shoulder stiffness was observed with interlocking nail, plate osteosynthesis in the current study did not document any post-operative shoulder stiffness. The differences in proportions of complications was observed to be statistically significant (P-value 0.035). This implies that the proportion of no post-operative complications in nailing is statistically significantly higher compared to osteosynthesis.

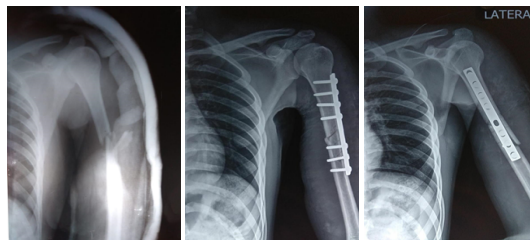


Figure-1: showing Preoperative, postoperative And Union Radiographs For Plate Osteosynthesis

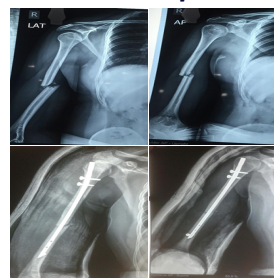


Figure-2: Showing Preoperative, postoperative And Union Radiographs For Interlocking Nail

DISCUSSION

The main goal of the present study is to evaluate the results of plating and interlocking nailing in the treatment of the closed fractures of shaft humerus. While discussing this, the rate of union, the final functional recovery, early return to pre-fractured state and the complications of individual methods were compared.

In this study 53.3% of patients were in the 2nd and 3rd decade, the commonest age group affected. The range of this series can be compared to the Lal et al [4]. This age group represents the actual earning period, in the life time of the individual. They need early mobilization to gain full range of movements at an early for minimal loss of productivity.

Males formed the majority of patients in this series, which is comparable to the series of McCormack, Rommens and Lin [5],[6],[7]. In this study the Right side of the humerus was involved more often, which corresponds with the other studies [7],[8]. Majority of the fractures (46.6%) were caused by road traffic accidents followed by fall from a height (30%). This is comparable with most reported series [4],[8],[9]. In this series the commonest fracture type was A3 (simple transverse fracture). The second commonest was type B2 (bending wedge fracture) followed by A2 (simple oblique fracture). This corresponds with most of the reported series [6],[8],[9],[10].

Nonunion, Radial Nerve palsy, Shoulder and elbow stiffness, Infection – these are the main points of concern in humerus fracture treatments. These points are compared.

Most of the fractures treated with interlocking nail in this series (90%) united in < 16 weeks with average time of 13.69 weeks. No case of non-union was observed in the series with interlocking nail. This results coincides with, Lal et al, Ye Fan et al, LMPH Crolla et al. [4],[10],[11].

In case of plate osteosynthesis union rate was 85.8% with only 2 patients going into non-union and all 2 patients were later revised by interlocking intramedullary nailing with bone grafting. Here the rate of union is less than that of interlocking intra medullary nailing .

There was no preoperative radial nerve palsy in this study thus not comparable with other series. There was no case of Iatrogenic radial nerve palsy in case of Interlocking nail. But there was 2 cases of Radial nerve palsy in case of plating which is comparable with other series [7],[9],[12],[13]. These 2 cases recovered gradually with out any intervention.

Shoulder stiffness It is the commonest complication of antegrade interlocking intra medullary procedure.

Robinsons et. al. [14] reported 17% ,in the series of Srivastava et. al [15] 15% and 11% in Lin's [7] were the patient with shoulder stiffness. In the present series, 2 patients (12.5%) of the had shoulder stiffness as assessed by Constant Murley score. The present series is comparable with other series [7],[9],[14],[15]. The average time of return of full shoulder function was twelve weeks with adequate compliance to the rehabilitation. The causes of stiffness are protrusion of nail at the entry point, damage to the rotator cuff at the time of nail insertion inadequate removal of bone debris after nailing from the entry point ,proximal migration of nail and lack of patient's cooperation with the postoperative physiotherapy regimen. In the present series, of the 2 patients ,who suffered shoulder stiffness ,one patients had protrusion of nail at entry point. The other had minimal shoulder movement restriction which improved after adequate physiotherapy and rehabilitation. Riemer et al [16] state that residual irritation or thickening of the rotator cuff tendon or coracoacromial ligament is the cause of shoulder stiffness. Shoulder stiffness was not encountered in any patient with

plating in our series. The proportion of patients at 24th week with higher ASES score were comparable for both the surgical procedures. Majority of the patients (50% overall) were having ASES score of 45 – 49. However, the observed differences in proportions were not statistically significant in this case as well (P-value 0.216).

Complication regarding infection ; both Superficial and deep ,is more common in plating than interlocking. In the present series, in plating 2 patients (14.2%) had deep seated infection for which later implant removal was done and treated with debridement , reaming of medullary canal and insertion of gentamycin impregnated PMMA beads. Later the cases were revised by interlocking nailing once the infection settles. Three patients (21.4%) had superficial infection which settled with local dressing. It is comparable with the series done on plating [17],[18]. In the series by Lin [7], Lal et. al [4] and Rommens et. al [6] there was no deep seated infection, while Robinson et al [14] reported 7% of cases with deep seated infection treated with nail in situ. In McCormack et. al [19]. series only one patient (5%) had deep infection which improved after removal of the nail and debridement.

In case of interlocking intramedullary nailing in the present series there were no case of deep seated infection . Only two patients (12.5%) had superficial infection which was also a grade 2 compound fracture case, which settled with local dressing.

Thus the result of this series coincides with that of the others. Higher infection rate in plating is due to extensive exposure for plating, excessive periosteal stripping and longer operating time. Different author reported delayed union in plating ranging from 15%-30% [8],[9],[19],[20][21]. In the series by LMPH Crolla et. al .[11] on interlocking nailing, he encountered 9% cases of delayed union. In the present series, in plating as well as in interlocking intramedullary nailing there were no patients who showed delayed union.

Non union ,In the series of humerus interlocking done by different authors, was reported between 8%-10% [4],[14],[19]. In the present series there was not a single case of non-union in the interlocking series.

In the present series 2 patients (14.4%) from plating group went into non-union both were revised with interlocking nailing with bone grafting. Thus the plating series is comparable with those of others [17],[22],[23].

Regarding Nonunion and Delayed union the results of this series does not coincides with that of others in case of nailing but corroborate in case of plating. This may be due to gradual improvement in operative technique, better instrumentation and medication.

In the present series there were no cases of iatrogenic radial nerve palsy in the interlocking group but 14.2% in the plating group which is comparable with other studies [5],[17],[19],[24],[25].

Though many author reported about elbow stiffness, in our study no cases of elbow stiffness were noted in both the series.

Anaesthesia in regimental badge area was encountered in Lal et. al. [4] in one case (4.5%). This complication is encountered due to damage to the upper lateral cutaneous nerve of the arm while performing proximal locking. No case in the present series of interlocking had anaesthesia in the regimental badge area. Proper precaution have to be taken to avoid such complication. The Wheelless Textbook of Orthopaedics states that the nail should ideally be counter-sunk 5 mm below the entry point. If the nail is counter sunk more than 1 cm below the articular surface, the proximal

interlocking screw comes at the level of axillary nerve and risks the nerve. One should therefore be sure that the proximal locking screw should be above the surgical neck of the humerus to avoid this complication. This complication was neither seen in the plating series.

CONCLUSION

Humerus shaft fracture is more common in male (63.3%) than female (36.7%). The mean age of patients being 27.87 years and median being 38 years. Commonest mode of injury is Road Traffic accident and Commonest fracture type was A3.

Operating time in Interlocking Nail was less than Plating. Mean time of union was less for interlocking nail comparative to the plating but this difference of proportion did not differ in a statistically significant way.

ASES score was marginally higher for nailing series than plating but in this case also difference of proportion did not differ in a statistically significant way.

Post-operative complication was higher in plating series than nailing and it was statistically significant. So from conclusion it may be stated that, though plate osteosynthesis is considered as gold standard in treatment of fracture shaft humerus, but in our series we found that closed internal fixation with interlocking nail is equally effective with less post-operative complications.

Conflict Of Interest: None to Declare

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