



Orthopaedics

COMPARATIVE STUDY OF ANTEGRADE HUMERUS INTERLOCKING NAIL VERSUS MINIMAL INVASIVE PLATING OSTEOSYNTHESIS THROUGH ANTERIOR APPROACH FOR TRANSVERSE, SHORT OBLIQUE AND COMMINUTED MIDSHAFT HUMERUS FRACTURES

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ABSTRACT

Introduction: Fractures of the humeral shaft are relatively common injuries, Humeral shaft fractures lead to significant burden on society due to its bimodal distribution with a peak in young males due to high energy trauma (road traffic accidents, fall from height, trauma to arm and gunshot wounds) and a other peak in older females usually by simple falls , There are several methods of fixation available, namely-plate fixation, intramedullary nailing with Rush nail or Ender nails, locked intramedullary nailing, and external fixation. Out of which very popular and good prognosis was seen in anterograde nailing and minimal invasive plate osteosynthesis (MIPO) plate methods. **Material And Methods:** 40 patients with transverse, short oblique and comminuted midshaft humerus were treated with intramedullary nailing and MIPO plating between MAY 2022 – MAY 2024, out of which 20 were operated with humerus interlocking nail, 20 patients were operated with MIPO plate and compounding fractures, fractures with neural palsy were excluded from study. **Results:** Out of 20 operated cases of nailing, 12 patients had excellent ASES score whereas 18 patients out of 20 had excellent ASES score in plating group, no post operative infections were noted, no non-union cases was noted, no significant difference in surgery time, blood loss, mean duration of hospital stay was noted. **Conclusion:** Minimal invasive plate osteosynthesis (MIPO) plate had advantage over nailing in respect to shoulder function and early physiotherapy, no significant difference in surgery time, blood loss, mean duration of hospital stay were noted.

KEYWORDS : Minimal invasive plate osteosynthesis (MIPO) plate, comminuted, Ender nail, Nailing, Humerus

BACKGROUND OF THE STUDY

Fractures of the humeral shaft are common injuries⁽¹⁾ accounting for approximately 3 percent of all fractures and 14 percent of all fractures of the humerus, according to literature estimates.⁽¹⁾, in young males usually due to RTA, in older females due to simple falls.⁽²⁾

Non-operative treatment is successful in more than 90 percent of patients with humeral shaft fractures.⁽²⁾ Conservative methods, such as the U-shaped slab, hanging plaster cast, body bandage, prefabricated functional braces, and a simple sling⁽¹⁻²⁾ are frequently utilized. Nonetheless, there are indications for surgical intervention, including inadequate alignment following closed reduction, multiple injuries, radial nerve palsy following manipulation, bilateral humeral fractures, segmental fractures, and open fractures.⁽³⁻⁶⁾

Various fixation methods, such as plate fixation, intramedullary nailing with Rush rods or Ender nails, locked intramedullary nailing, and external fixation,⁽⁷⁻⁹⁾ are available and the choice depends on several factors, including soft tissue condition, fracture location and configuration, bone quality, canal diameter, available facilities and resources, and the expertise of the surgical team.⁽¹⁰⁻¹¹⁾

While external fixation is primarily reserved for open fractures or closed injuries with severe soft tissue compromise, both plating and intramedullary nailing can be used for most humeral shaft fractures.⁽¹⁰⁾ Locked intramedullary nailing offers the advantage of smaller incisions and less soft tissue trauma, but has drawbacks such as shoulder and elbow joint pain, impingement at the insertion site, nonunion, iatrogenic comminution, and potential neurovascular injury during distal locking screw insertion.⁽⁷⁻⁸⁾

On the other hand, plate fixation provides stable fixation and excellent control of rotation, length, and angulation.⁽¹²⁾ However, it is a technically demanding procedure that requires extensive exposure and soft tissue dissection, and carries a risk of infection, blood loss, and iatrogenic nerve injuries. Elective plate removal after bone union also poses a significant risk of nerve insult.⁽¹³⁻¹⁴⁾

AIMS AND OBJECTIVES

The aim of this work was to compare the clinical and radiological results of minimally invasive plate osteosynthesis through anterior approach versus intramedullary nailing for fixation of midshaft

humerus shaft fractures in adult.

MATERIALS AND METHODS**Ethical:**

Ethical committee's approval was duly taken. Data was collected in the department of Orthopaedics from the bed side tickets of the patients after taking a short history and informed consent from the patient.

Source Of Data:

The prospective study was conducted on 40 patients of which 20 cases treated with interlocking nail and 20 cases with plating osteosynthesis in Maharani Laxmi Bai Medical College, Jhansi between MAY 2022 to MAY 2024.

Inclusion Criteria:

- Patients between 18-60 years.
- Fracture middle third of humerus
- Closed fracture.
- Noncompliant patients for conservative treatment.
- Polytrauma patients.
- Patient refusal for conservative treatment.

Exclusion Criteria:

- Age below 18 and above 60 years.
- Fracture proximal and distal third of humerus
- Associated previous surgery of humerus.
- Pathological fracture
- Open fracture
- Nerve palsy.

Study Design: Prospective study.

Sample Size:

A total of 40 (20 each group) consecutive patients was included in this study. The patients were divided into two groups:

Group A {Odd numbered} patients: INTERLOCKING NAIL

Group B {Even numbered} patients: MINIMAL INVASIVE PLATING OSTEOSYNTHESIS

PROCEDURE & METHOD:

MINIMAL INVASIVE PLATING OSTEOSYNTHESIS:

All procedures were conducted while the patients were under general anesthesia or brachial anesthesia, in a supine position with the injured arm on a radiolucent arm board. In patients undergoing the MIPO technique, two incisions were utilized. A 3 cm proximal incision was made approximately 6 cm distal to the anterior part of the acromion process, and a 3 cm incision was made along the lateral border of the biceps muscle, approximately 5 cm proximal to the elbow's flexion crease. A sub-brachialis, extra-periosteal tunnel was created by passing the plate deep to the brachialis from the distal to the proximal incision, with the assistance of the locked sleeve. To prevent injury to the radial nerve at the lateral aspect of the distal humerus, the plate was passed along the anterior or slightly antero-medial aspect of the humerus. The plate was then secured to the proximal humerus with one screw or a K-wire. Reduction of the fracture was typically achieved through manipulation under image intensifier. After positioning the plate over the center of the anterior surface of the distal humerus, one screw was inserted distally. The alignment was reassessed using the image intensifier, and if deemed satisfactory, fixation was completed with a minimum of three screws in each fragment.



Figure 1. Plate positioning & Plate fixation with screw MIPO plate

ANTEGRADE INTERLOCKING NAILS:

For patients undergoing the locked intramedullary nail (IMN) technique, a deltoid splitting incision was performed, allowing for exposure of the supraspinatus tendon. The point of entry was determined, and a medullary canal finder was inserted. Under the guidance of an image intensifier, fracture reduction and guide wire insertion were carried out. After reaming, a humeral interlocking nail with distal threads was utilized. The distal threads were engaged into the distal bone, and a proximal locking screw was inserted.

Following the surgery, patients were encouraged to perform shoulder exercises within their tolerance. Clinical and radiological follow-ups were conducted at 1.5, 3, 6, and 12 months to assess union. The ASES Shoulder Score was used for clinical evaluation, while serial radiographs were utilized to assess immediate postoperative reduction and union.

Fracture union was defined as the presence of bridging callus, visible on at least three cortices, as observed through radiographic examination.

Follow up:

The patients were followed up for an average period of 11 months (ranging from 7-18 months). Each case was reviewed clinically and radiologically during follow up period.

1st visit: 2 weeks after surgery, stitch removal was done shoulder and elbow mobilization was advised.

2nd visit: 6 weeks following surgery during this visit both shoulder movement 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 12 and 24 week then once in every 3 months.

Statistical Analysis:

The collected data will be organized in the forms of tables. The continuous variables will be analyzed in terms of means and interpreted by student independent "t" test. In respect of categorical variables will be expressed in terms of percentages and they will be interpreted by χ^2 (Chi- square) test. The above statistical procedures will be performed with the help of the statistical package namely IBM SPSS statistics-20. The P values less than or equal to 0.05 ($P \leq 0.05$) will be statistically significant.



Figure -2 Intramedullary nailing preop, postoperative x-ray follow-up at 2, 4, 8 month



Figure – 3 - Intramedullary Nailing shoulder ROM 5 month- follow up.

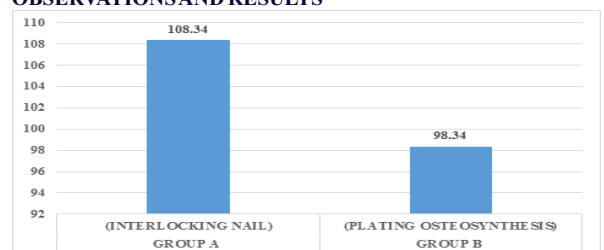


Figure -4 Preop x- ray Midshaft humerus fracture & Postop x- ray - immediate post op MIPO plate, Post op x ray -2,4 ,8 month follow up,



Figure -5 Shoulder ROM movement-5 month follow up MIPO PLATE.

OBSERVATIONS AND RESULTS



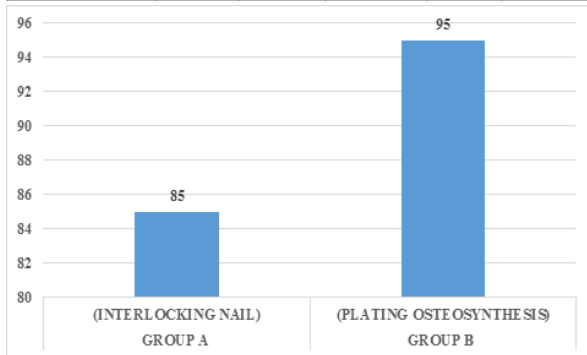
Graph 6: Mean Blood Loss During Procedure

Table 1 : Mean Blood Loss During Procedure

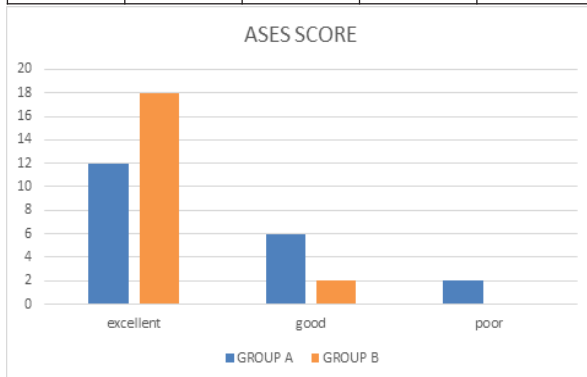
Mean Blood loss (in ml)	Group A (Interlocking Nail)		Group B (Plating Osteosynthesis)		p-value
	Mean	SD	Mean	SD	
Mean±SD	108.34	182.57	98.34	222.11	0.87 (NS)

Table 2 : Mean Duration Of Procedure

Mean duration of procedure (in minutes)	Group A (interlocking Nail)		Group B (plating Osteosynthesis)		p-value
	Mean	SD	Mean	SD	
Mean±SD	85.00	100.995	95.00	100.995	0.75 (NS)

**Graph 8:** Mean Duration Of Procedure**Table 3: ASES Score**

ASES Score	Group A (Interlocking Nail)		Group B (Plating Osteosynthesis)	
	N	%	N	%
Excellent	12	60.00%	18	90.00%
Good	6	30.00%	02	10.00%
Poor	02	10.00%	0	00%
Total	20	100%	20	100%

**Graph 13:** ASES Score

DISCUSSION

The aims of patient care for midshaft humerus fractures involve timely and safe surgical intervention to facilitate quick mobilization and prevent medical complications. Currently, both intramedullary nails and minimally invasive plating osteosynthesis are commonly employed for managing midshaft humerus fractures.

This study was carried out in the Orthopaedics department of M.L.B. Medical College, Jhansi, from MAY 2022 to MAY 2024. It included patients aged 18-60 years who presented with midshaft humerus fractures. The study spanned 12 months and involved a total of 40 patients, with 20 cases in each group.

This observational prospective and comparative study involved 40 patients aged 18-60 years who were admitted to M.L.B. Medical College, Jhansi, with midshaft humerus fractures. Out of these, 20 patients underwent antegrade humerus interlocking nail surgery, while the other 20 patients underwent minimally invasive plating osteosynthesis through an anterior approach.

We compared the outcomes of patients with midshaft humerus fractures treated with antegrade humerus interlocking nail surgery and

minimally invasive plating osteosynthesis through an anterior approach. The majority of patients in both groups were between 18-30 years old (Group A: 12 [60%]; Group B: 15 [75%]). Our study observed a male predominance (Group A: 14 [70%]; Group B: 18 [90%]).

In terms of blood loss, the majority of patients in Group A experienced a blood loss of 101-150 ml (9 [45%]), while in Group B, it was 51-100 ml (9 [45%]), with no patients experiencing blood loss exceeding 250 ml. The mean blood loss in Group A and Group B was 108.34±182.57 and 98.34±222.11, respectively, with a p-value of 0.87 (not significant).⁽³¹⁻³²⁾

SUMMARY

- In our study, Group A (interlocking nail) was performed on 20 patients, of whom 12 were aged between 18 and 30 years, 6 were aged between 31 and 45 years, and 2 were aged between 46 and 60 years.
- In Group B (plating osteosynthesis), 20 patients underwent the procedure, with 15 falling within the 18-30 age group, 2 within the 31-45 age group, and 3 belonging to the 46-60 age group.
- The majority of patients in both groups were male.
- The majority of patients in our study had suffered from a road traffic accident (RTA) in both groups.
- The majority of patients in our study had a right-sided fracture.
- The mean duration of the procedure was 85±100.9 minutes in Group A and 95±100.9 minutes in Group B, with a p-value of 0.75, indicating no statistically significant difference.
- The mean number of antibiotic doses in Group A was 6.23±11.95, and in Group B it was 6.76±11.95, with a p-value of 0.75, which is not statistically significant.
- In our study, the mean duration of hospital stay was 4.6±7.18 days in Group A and 4.8±9.91 days in Group B, with a p-value of 0.94, indicating no statistically significant difference.
- In Group A, the humerus interlocking nail group, the ASES score was excellent in 12 patients, good in 6 patients, and poor in 2 patients. In Group B, MIPO plating group, the ASES score was excellent in 18 patients, good in 2 patients, and poor in 0 patient.

CONCLUSION

Based on our study, we have discovered that there is a lack of comparability in terms of procedure duration, antibiotic dosage requirement, hospital stay, and blood loss between the interlocking nail and minimal invasive plate osteosynthesis methods.

Furthermore, the ASES scores were excellent in 18 patients, good in 2 patients of MIPO plating group whereas 12 patients had excellent scores, 6 patients had good, and 2 patients had poor ASES scores in humerus interlocking nail group. Signifying MIPO plating group had superior shoulder movement compared to humerus interlocking nail group.

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