

Comparative Outcomes of Plating Versus Interlocking Nailing in Humeral Shaft Fractures

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Abstract

Background: Fractures of the humeral shaft are relatively common and can be managed either by plate osteosynthesis or interlocking nailing. The optimal fixation method remains debated, as each technique offers unique advantages and potential complications. **Objectives:** To compare plating versus interlocking nailing in the surgical management of diaphyseal fractures of the humerus, focusing on union rates, functional outcomes, and complications. **Materials and Methods:** This prospective comparative study included 20 patients with humeral shaft fractures treated at a tertiary care hospital between October 2020 and September 2022. Patients were randomized into two groups: plating (n=10) and interlocking nail fixation (n=10). Baseline demographics, mechanism of injury, fracture type (AO classification), and side involved were recorded. Patients were followed clinically and radiologically until union. Functional outcome was assessed using the Disabilities of the Arm, Shoulder, and Hand (DASH) score at nine months. **Results:** The mean age of patients was 36.7 years, with a male predominance (70%). Road traffic accidents were the leading cause of injury (65%). According to AO classification, simple and wedge fractures predominated. All patients achieved fracture union, with mean union time being shorter in the plating group (16.8 ± 2.1 weeks) compared to interlocking nailing (18.2 ± 2.6 weeks). Postoperative complications were minimal; one case of transient radial nerve palsy occurred in the plating group, while shoulder stiffness was slightly more frequent after interlocking nailing. Functional outcomes were superior with plating, with 70% achieving excellent DASH scores versus 50% in the nailing group. **Conclusion:** Both plating and interlocking nailing are effective for humeral shaft fractures; however, plating demonstrated earlier union and better functional outcomes with fewer complications.

Keywords: Humeral shaft fracture, plating, interlocking nail, union, DASH score, functional outcome.

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INTRODUCTION

Fractures of the humeral shaft account for nearly 3% of all skeletal injuries and approximately one-fifth of humeral fractures.^[1] While conservative modalities such as functional bracing and hanging arm casts have historically shown acceptable union rates, they are frequently associated with complications including malunion, prolonged immobilization, and joint stiffness.^[2] With advances in surgical techniques, operative intervention has become increasingly preferred, particularly in polytrauma cases, open fractures, comminuted or segmental injuries, and when early mobilization is necessary.^[3]

Among the operative methods, plate osteosynthesis and interlocking intramedullary nailing are the most widely employed. Plating offers stable fixation and high union rates but requires extensive exposure and careful radial nerve handling.^[4] Interlocking nails, in contrast, are less invasive, preserve fracture biology, and act as load-sharing devices, though they carry risks of shoulder pain, stiffness, and technical challenges with distal locking.^[5]

The choice between the two techniques remains debated, as literature presents variable findings regarding union rates, functional recovery, and complication profiles. Some studies favor plating for superior shoulder function and predictable outcomes, whereas others demonstrate that intramedullary nailing provides comparable results with

reduced surgical morbidity.^[6]

In this context, the present study was undertaken to prospectively compare plating and interlocking nailing in humeral shaft fractures with respect to union rates, postoperative complications, and functional outcomes, using the Disabilities of Arm, Shoulder, and Hand (DASH) score as the principal assessment tool.

MATERIALS AND METHODS

Study Design and Setting: This was a prospective comparative study conducted in the Department of Orthopaedics, Mamata Medical College and General Hospital, Khammam, Telangana, between October 2020 and September 2022.

Study Population: A total of 20 adult patients with diaphyseal

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fractures of the humerus requiring operative management were enrolled. Patients were randomized into two groups:

Group A: Plate osteosynthesis with dynamic compression plate (DCP) (n=10)

Group B: Interlocking intramedullary nailing (ILN) (n=10).

Inclusion Criteria:

Patients aged ≥18 years

Diaphyseal fractures of the humerus indicated for surgical fixation

Exclusion Criteria:

Fractures of proximal or distal humerus

Pathological fractures

Patients with pre-existing shoulder or elbow disorders

Cases managed by other fixation methods

Patients lost to follow-up before achieving union

Preoperative Evaluation: All patients underwent thorough clinical examination, including assessment of neurovascular status. Standard radiographs of the humerus (anteroposterior and lateral views) were obtained, and fractures were classified using the AO/OTA system.

Surgical Technique:

Plating: Open reduction and internal fixation with 4.5 mm narrow DCP using either anterolateral or posterior approach, depending on fracture location.

Nailing: Antegrade intramedullary interlocking nail insertion with proximal and distal locking under fluoroscopic guidance.

Postoperative Protocol: All patients received parenteral antibiotics for 3 days, followed by suture removal at 10–12

days. Early mobilization was initiated as tolerated. Patients were reviewed every two weeks until radiological union.

Outcome Measures:

Primary outcome: Time to radiological union (defined as trabecular continuity across ≥3 cortices).

Secondary outcomes: Postoperative complications and functional outcome assessed at 9 months using the Disabilities of the Arm, Shoulder, and Hand (DASH) score. DASH scores were graded as Excellent (0–20), Good (21–40), Fair (41–60), and Poor (>60).

Statistical Analysis: Data were analyzed using descriptive statistics and Student’s *t*-test for continuous variables. A *p*-value <0.05 was considered statistically significant.

Ethical Considerations: The study was approved by the Institutional Ethics Committee of Mamata Medical College, Khammam. Informed consent was obtained from all participants, ensuring confidentiality, autonomy, and adherence to ethical guidelines.

RESULTS

A total of 20 patients with diaphyseal fractures of the humerus were included, of whom 10 underwent plating and 10 were treated with interlocking nailing. The mean age of participants was 36.7 years, with no significant difference between groups. Males predominated (70%), and right-sided involvement was more frequent (65%). Road traffic accidents accounted for the majority of injuries (65%), followed by falls and other causes (35%) [Table 1].

Table 1: Baseline Characteristics of Study Population

Variable	Plating (n=10)	Interlocking Nail (n=10)	Total (n=20)
Mean Age (years)	37.3 ± 11.2	36.1 ± 11.3	36.7 ± 11.1
Male (%)	7 (70%)	7 (70%)	14 (70%)
Female (%)	3 (30%)	3 (30%)	6 (30%)
Side Involved (Right/Left)	6 / 4	7 / 3	13 / 7
Mode of Injury – RTA	7	6	13
Mode of Injury – Fall/Other	3	4	7

The fractures were categorized according to the AO classification. Simple fractures (A1–A3) constituted nearly half the cases, wedge-type fractures (B1–B3) were also

common, while complex fractures (C1–C3) were more frequent in the interlocking nail group (30%) compared with the plating group (10%) [Table 2, Figure 1].

Table 2: Distribution by Level of Fracture (AO Classification)

Fracture Type	Plating (n=10)	Interlocking Nail (n=10)	Total (n=20)
Simple (A1–A3)	5	4	9
Wedge (B1–B3)	4	3	7
Complex (C1–C3)	1	3	4

Postoperative complications were few and largely comparable between the two treatment modalities. One patient in each group developed a superficial surgical site infection that responded to appropriate management. Transient radial nerve palsy was observed in one patient in the plating group, which

completely recovered within follow-up. Shoulder stiffness was slightly more common after interlocking nailing (20%) than plating (10%). No cases of non-union were observed in either group [Table 3].

Healing outcomes were favorable in both groups, with 100%

union achieved. The mean union time was shorter in the plating group (16.8 ± 2.1 weeks) compared to the interlocking nail group (18.2 ± 2.6 weeks), though the difference was not statistically significant. One delayed union occurred in each group [Table 4].

Functional assessment at nine months using the Disabilities of Arm, Shoulder and Hand (DASH) score revealed better

outcomes in the plating group. An excellent result (score 0–20) was achieved in 70% of plating patients compared to 50% of interlocking nail patients. Good outcomes were comparable (20% vs. 30%), while fair results were slightly higher in the interlocking nail group (20% vs. 10%). No patient had a poor outcome in either group [Table 5, Figure 2].

Table 3: Postoperative Complications

Complication	Plating (n=10)	Interlocking Nail (n=10)
Superficial Infection	1	1
Radial Nerve Palsy	1 (recovered)	0
Shoulder Stiffness	1	2
Non-union	0	0

Table 4: Healing Outcomes

Parameter	Plating (n=10)	Interlocking Nail (n=10)	p-value
Mean Union Time (weeks)	16.8 ± 2.1	18.2 ± 2.6	NS
Delayed Union	1	1	–
Rate of Union (%)	100	100	–

Table 5: Functional Outcome (DASH Score at 9 Months)

Outcome Grade	Plating (n=10)	Interlocking Nail (n=10)
Excellent (0–20)	7	5
Good (21–40)	2	3
Fair (41–60)	1	2
Poor (>60)	0	0

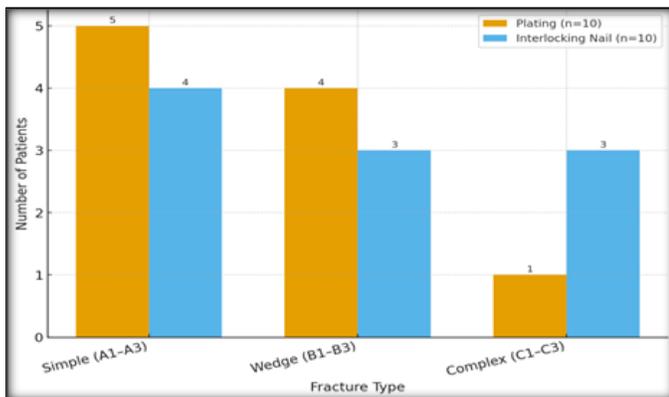


Figure 1: Distribution by Level of Fracture (AO Classification)

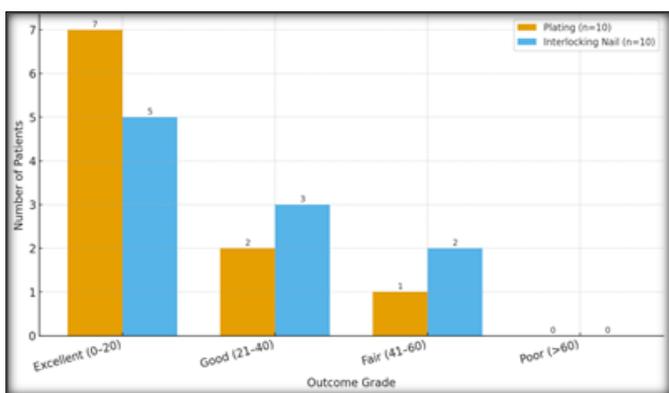


Figure 2: Functional Outcome at 9 Months (DASH Grades)

DISCUSSION

The present study compared plating and interlocking intramedullary nailing for humeral shaft fractures, focusing on union, complications, and functional outcomes. Both techniques achieved a 100% union rate, though plating resulted in a slightly shorter mean union time and superior functional scores.

Our findings are supported by Angachekar et al., who demonstrated comparable union rates between dynamic compression plating and intramedullary nailing, though plating was associated with better early functional recovery.^[7] Similarly, Fan et al. observed that plating offered more favorable shoulder function, while interlocking nailing was associated with higher incidences of postoperative shoulder pain and stiffness.^[8] Ge et al. extended these observations in elderly patients, reporting that intramedullary nailing was less effective than plating in maintaining functional independence, though both outperformed conservative treatment.^[9]

Kumar et al. also highlighted that while both methods yield satisfactory union, plating tends to provide more predictable outcomes in terms of union time and function.^[10] Bisaccia et al. compared plate fixation, nailing, and external fixation, noting that plating offered the best balance of stability, union rate, and complication profile, whereas external fixation was reserved for complex trauma.^[11] More recently, Tosun et al. found that plating, especially double plating in complex fractures, achieved better stability and functional results compared to interlocking nailing, underscoring the versatility of plating techniques.^[12]

In our series, complications were minor and similar to those reported in earlier studies. Radial nerve palsy was transient and limited to the plating group, while shoulder stiffness was more common with nailing, consistent with the risk associated with antegrade entry.^[8,12]

Limitations: The study is limited by its small sample size and single-center design. Larger multicenter trials with longer follow-up are required to validate these results.

CONCLUSION

This prospective comparative study demonstrated that both plating and interlocking intramedullary nailing are effective methods for the management of diaphyseal humeral fractures, achieving 100% union with minimal complications. Plating showed a trend toward earlier union, fewer functional limitations, and superior DASH scores, with 70% of patients attaining excellent outcomes compared to 50% in the interlocking nail group. Although nailing offered the advantages of a less invasive approach and preserved fracture biology, shoulder stiffness was more common. Overall, plate osteosynthesis remains the more reliable option for humeral shaft fractures, while interlocking nails may be considered in specific patient subsets requiring minimally invasive fixation.

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Conflicts of interest

There are no conflicts of interest.

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