



Original Article

## Functional Outcome of Intramedullary Interlocking Nail in Fractures of Shaft of Humerus: A Prospective Interventional Study

Vinay B. Patil<sup>1</sup>, Ravindra Rairam<sup>2</sup>, Eshwar M. Masgal<sup>3</sup>, Sehajpal Singh Riar<sup>4</sup>

<sup>1</sup>Professor, Department of Orthopaedics, Mahadevappa Rampure Medical College, Kalaburagi (Gulbarga) – 585101, Karnataka, India.

<sup>2</sup>Assistant Professor, Department of Orthopaedics, Mahadevappa Rampure Medical College, Kalaburagi (Gulbarga) – 585101, Karnataka, India.

<sup>3</sup>Assistant Professor, Department of Orthopaedics, Mahadevappa Rampure Medical College, Kalaburagi (Gulbarga) – 585101, Karnataka, India.

<sup>4</sup>PGY-3 (Resident), Department of Orthopaedics, Mahadevappa Rampure Medical College, Kalaburagi (Gulbarga) – 585101, Karnataka, India.

 OPEN ACCESS

### Corresponding Author:

**Sehajpal Singh Riar**

PGY-3 (Resident), Department of Orthopaedics, Mahadevappa Rampure Medical College, Kalaburagi (Gulbarga) – 585101, Karnataka, India.

Received: 17-01-2026

Accepted: 02-03-2026

Available online: 31-05-2026

Copyright © International Journal of Medical and Pharmaceutical Research

### ABSTRACT

**Background:** Humeral shaft fractures constitute a significant proportion of long bone injuries and are associated with functional impairment if not managed appropriately. Intramedullary interlocking nailing offers a minimally invasive technique with biological fixation and early mobilization.

**Objective:** To evaluate functional outcome, radiological union, and postoperative complications of intramedullary interlocking nailing in humeral shaft fractures.

**Methodology:** A prospective interventional study was conducted over 18 months including 35 patients with humeral shaft fractures treated with intramedullary interlocking nail fixation. Functional outcome was assessed using Neer's Shoulder Score and radiological union was evaluated using serial radiographs. Statistical analysis was performed using SPSS.

**Results:** Most patients were males (68.57%) with peak incidence in 31–45 years (31.43%). Radiological union occurred predominantly within 12–16 weeks (45.71%). Functional outcome was satisfactory in 77.14% and excellent in 20.00%. Complications were minimal with delayed union (11.43%) and shoulder stiffness (8.57%).

**Conclusion:** Intramedullary interlocking nailing provides stable fixation with excellent functional recovery and acceptable complication rates.

**Keywords:** Humeral shaft fracture; Intramedullary interlocking nail; Functional outcome; Neer score; Radiological union.

### INTRODUCTION

Fractures of the shaft of the humerus account for approximately 3–5% of all fractures and represent an important cause of morbidity affecting upper limb function<sup>1</sup>. These injuries commonly occur due to high-energy trauma in younger individuals and low-energy falls in elderly populations<sup>2</sup>. Proper restoration of alignment, rotation, and length is essential to ensure optimal functional recovery<sup>3</sup>. While conservative management remains an option, surgical fixation is increasingly preferred due to faster rehabilitation and reduced complications<sup>4</sup>. Plate osteosynthesis provides rigid fixation but requires extensive soft tissue dissection and carries risks such as infection and radial nerve injury<sup>5</sup>. Intramedullary interlocking nailing offers a minimally invasive alternative with preservation of fracture biology and early mobilization<sup>6</sup>. McCormack et al (7) demonstrated comparable outcomes between plating and nailing<sup>7</sup>, while Chapman et al (8) highlighted concerns regarding shoulder function<sup>8</sup>. Recent advances in nail design have reduced these complications and improved outcomes<sup>9</sup>. Studies by Hameed et al. and Furuhashi et al. have shown favorable functional outcomes with intramedullary nailing<sup>10,11</sup>, although variability persists in reported results. Therefore, further prospective evaluation is necessary to assess functional and radiological outcomes in selected fracture patterns.

**AIM**

To evaluate functional outcome, radiological union, and postoperative complications of intramedullary interlocking nailing in humeral shaft fractures.

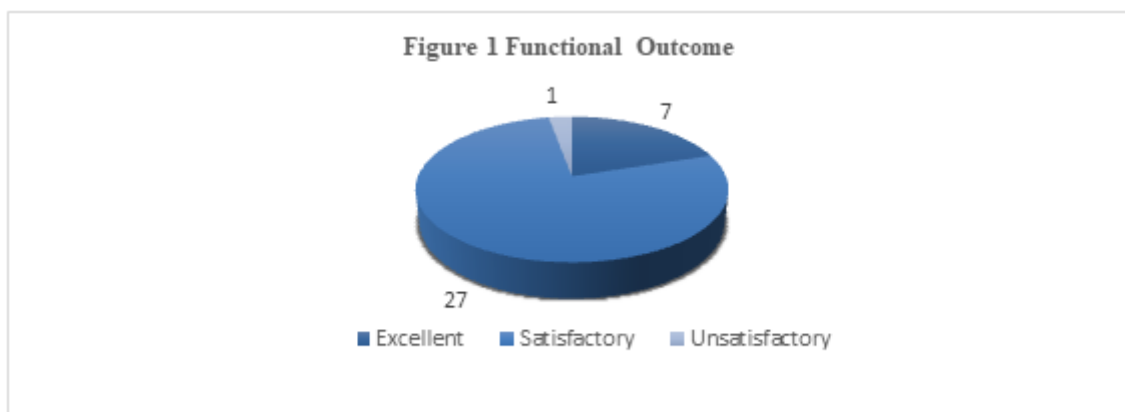
**METHODOLOGY**

This prospective interventional study was conducted over 18 months including 35 patients with humeral shaft fractures treated with intramedullary interlocking nail fixation. Patients above 18 years with AO type 12A1, 12A2, 12A3, 12B1, and 12B2 fractures were included, while pathological fractures, open fractures, and neurovascular injuries were excluded. All patients underwent clinical and radiological evaluation followed by surgical fixation under C-arm guidance. Postoperative rehabilitation included early mobilization and structured follow-up at regular intervals. Functional outcomes were assessed using Neer’s Shoulder Score and radiological union was evaluated using serial radiographs. Statistical analysis was performed using SPSS with  $p < 0.05$  considered  $p < 0.05$  was considered statistically significant .

**RESULTS**

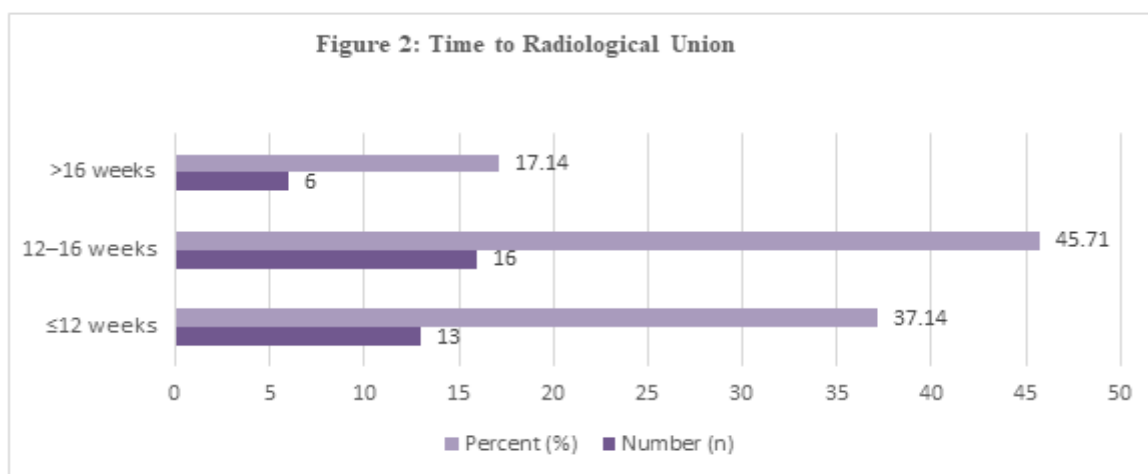
**Table 1: Functional Outcome (Neer Score Distribution)**

Outcome	Number (n)	Percent (%)
Excellent	7	20.00
Satisfactory	27	77.14
Unsatisfactory	1	2.86



**Table 2: Time to Radiological Union**

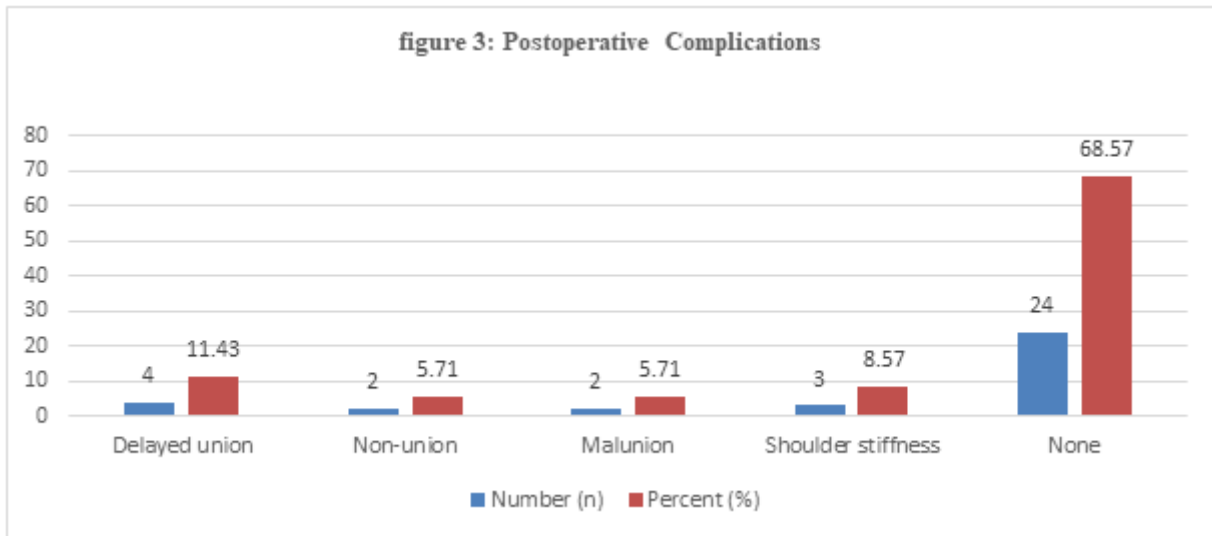
Time	Number (n)	Percent (%)
≤12 weeks	13	37.14
12–16 weeks	16	45.71
>16 weeks	6	17.14



**Table 3: Postoperative Complications**

Complication	Number (n)	Percent (%)
Delayed union	4	11.43

Non-union	2	5.71
Malunion	2	5.71
Shoulder stiffness	3	8.57
None	24	68.57



## RESULTS

The study included 35 patients with humeral shaft fractures treated using intramedullary interlocking nailing. Functional outcome assessed by Neer's score showed satisfactory results in 27 patients (77.14%) and excellent results in 7 patients (20.00%), while only 1 patient (2.86%) had an unsatisfactory outcome. Radiological union was achieved in the majority of cases within 12–16 weeks in 16 patients (45.71%), followed by  $\leq 12$  weeks in 13 patients (37.14%), and  $> 16$  weeks in 6 patients (17.14%). Postoperative complications were minimal, with delayed union observed in 4 patients (11.43%), shoulder stiffness in 3 patients (8.57%), and non-union and malunion each in 2 patients (5.71%). A majority of patients (68.57%) had no complications.

## DISCUSSION

The present study demonstrates that intramedullary interlocking nailing provides favorable functional and radiological outcomes in humeral shaft fractures. Court-Brown et al. described the epidemiological significance of humeral fractures, consistent with the demographic distribution observed in this study<sup>4</sup>. Ekholm et al. emphasized the importance of operative stabilization for improved outcomes<sup>3</sup>. McCormack et al. reported comparable union rates between plating and nailing<sup>7</sup>, aligning with the satisfactory union rates observed. Chapman et al. noted shoulder-related complications following nailing<sup>8</sup>, whereas improvements in surgical techniques have reduced such issues, reflected in the low incidence of stiffness in this study. Lin reported satisfactory outcomes with interlocking nails<sup>6</sup>, which is comparable to the high percentage of satisfactory results observed. Hameed et al. demonstrated good functional recovery with intramedullary nailing<sup>10</sup>, similar to the progressive improvement in Neer scores noted here. Furuhashi et al. identified factors influencing shoulder outcomes<sup>11</sup>, reinforcing the importance of early mobilization. Angachekar et al. and Alrashedan et al. showed comparable outcomes between plating and nailing with advantages of minimally invasive techniques<sup>12,13</sup>. Lakhani reported high union rates with interlocking nails<sup>14</sup>, which is consistent with the radiological outcomes observed. Bal et al. highlighted acceptable complication rates with nailing<sup>15</sup>, aligning with the low complication rates in this study. Overall, the findings of the present study are consistent with McCormack et al. and Hameed et al., supporting intramedullary interlocking nailing as an effective treatment modality.”

## CONCLUSION

Intramedullary interlocking nailing is a reliable and effective modality for the management of humeral shaft fractures, providing excellent functional outcomes, timely radiological union, and minimal complication rates. Its minimally invasive nature, preservation of fracture biology, and facilitation of early mobilization make it a preferred surgical option, particularly in selected fracture patterns, thereby improving overall patient recovery and quality of life.

## REFERENCES

1. Court-Brown CM, Caesar B. Injury. 2006;37:691–7.
2. Court-Brown CM, Heckman JD. Rockwood and Green's Fractures in Adults. 2015.
3. Ekholm R, et al. J Bone Joint Surg Br. 2006;88:1469–73.
4. Hoppenfeld S. Surgical Exposures in Orthopaedics. 2009.

5. Bell MJ, et al. *J Bone Joint Surg Br.* 1985;67:293–6.
6. Lin J. *J Trauma.* 1998;44:859–64.
7. McCormack RG, et al. *J Bone Joint Surg Br.* 2000;82:336–9.
8. Chapman JR, et al. *J Orthop Trauma.* 2000;14:162–6.
9. HU H, et al. *J Clin Emerg.* 2015.
10. Hameed MH, et al. *Int J Med Public Health.* 2025.
11. Furuhashi R, et al. *BMC Musculoskelet Disord.* 2024.
12. Angachekar D, et al. *Cureus.* 2024.
13. Alrashedan BS, et al. *Cureus.* 2024.
14. Lakhani A. *Bioinformation.* 2022.
15. Bal GS, et al. *Int J Res Med Sci.* 2022.