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Original Research Article

Retro-prospective Comparative Study of Functional Outcomes of Closed Humeral Shaft Fractures Treated Using Nailing or Plating

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Abstract:

Background: Humeral shaft fractures account for approximately 3% of all fractures and are seen both in young individuals following high-velocity trauma and elderly patients with osteoporotic bone. Although non-operative treatment has traditionally been advocated, surgical management is increasingly preferred. Two commonly used methods, intramedullary interlocking (IMIL) nailing and dynamic compression plating, remain subjects of debate.

Methods: This retro-prospective study included 36 adult patients with closed humeral shaft fractures treated with either plating (n=20) or IMIL nailing (n=16) between November 2021 and November 2024 in a tertiary care Hospital. Patients were assessed for time to union, functional outcomes using Quick DASH score, shoulder range of motion, and complications. Follow-up was conducted for a minimum of 6 months.

Results: The plating group showed a mean Quick DASH score of 11.36, while the nailing group showed 12.8 (p=0.71, not significant). Most fractures united within 12 weeks in both groups. Shoulder stiffness was more frequent in the nailing group (25%) compared with plating (10%). No infections were reported. Overall, both techniques demonstrated similar union rates and functional outcomes.

Conclusion: Dynamic compression plating and IMIL nailing offer comparable results in terms of union and function. Nailing may be associated with higher rates of shoulder stiffness, although this was not statistically significant. Larger randomized studies with longer follow-up are warranted to establish superiority.

Introduction

Humeral shaft fractures form a relatively small portion of skeletal injuries, making up around 3% of all fractures, but they are important because of the functional disability they create. These fractures are seen in two distinct patient groups. In younger men, they usually follow high-energy accidents such as road traffic trauma or sports injuries, while in elderly women they often occur after simple falls on osteoporotic bone. Non-operative care, particularly the functional brace described by Sarmiento, has long been considered the standard approach and has shown good

union rates in many series. However, conservative management has drawbacks including prolonged immobilization, delayed return to activity, malalignment, and stiffness of the adjacent joints. With increasing patient demands for faster recovery and earlier mobilization, surgical management has become more widely favored.

Among the surgical methods, two techniques are most commonly practiced: plating and intramedullary interlocking (IMIL) nailing. Plating offers stable fixation and permits direct visualization and anatomical reduction of the fracture, which is particularly beneficial for complex patterns. However, it requires a larger surgical exposure, which may jeopardize soft tissue integrity and carries risks such as infection and injury to the radial nerve. IMIL nailing, on the other hand, is a less invasive procedure that preserves the biological environment of the fracture and provides load-sharing fixation. It is particularly useful for comminuted fractures, but its limitations include possible shoulder pain and stiffness due to entry through the rotator cuff and technical difficulties during distal locking. Each technique has its own advantages and shortcomings, leading to continued discussion over which is more suitable in different clinical situations.

The literature comparing these two approaches presents mixed findings. Some studies report better functional outcomes with plating, while others highlight the benefits of nailing in terms of preserving fracture biology and minimizing soft tissue damage. Overall, most reports suggest that both techniques achieve similar union rates, though their complication profiles differ. Because of these variations, the choice between plating and nailing often depends on the treating surgeon's experience, the type of fracture, and patient-related factors. To add clarity to this debate, the present study was conducted at a tertiary care hospital to compare outcomes of IMIL nailing and plating in closed humeral shaft fractures. Functional results, time to union, and complication rates were analyzed with the aim of contributing further evidence to guide treatment decisions.

Materials and Methods

Study design: Retro-prospective hospital-based comparative study.

Setting: Deenanath Mangeshkar Hospital and Research Centre, Pune, Orthopaedics Department.

Duration: November 2021 – November 2024.

Sample size: 36 patients (20 plating, 16 nailing).

Inclusion criteria:

- Adults >18 years with closed humeral shaft fractures.

Exclusion criteria:

- Pathological fractures, polytrauma patients, open fractures, non-union cases, fractures involving shoulder or elbow joint.

Procedures:

- **Plating:** Internal fixation with a dynamic compression plate and open reduction.
- **Nailing:** Antegrade intramedullary interlocking nailing via proximal humeral entry.
- Standard post-operative rehabilitation protocol was followed in both groups.

Assessments:

- Radiological union.
- Functional outcome: Quick DASH score.
- Shoulder range of motion.
- Complications.

Statistical analysis: Continuous variables expressed as mean ± SD, categorical variables as percentages. Significance set at $p<0.05$.

Results

Demographics:

- Age range: 18–70 years.
- 17 females (47.2%) and 19 males (52.8%).

Union:

- Majority of fractures united by 12 weeks in both groups.
- No significant difference between plating and nailing.

Functional outcomes:

- Quick DASH score:
  - Plating group: 11.36
  - Nailing group: 12.8
  - p = 0.71 (not significant).

Complications:

- Shoulder stiffness: 25% in nailing vs 10% in plating.
- No infections in either group.

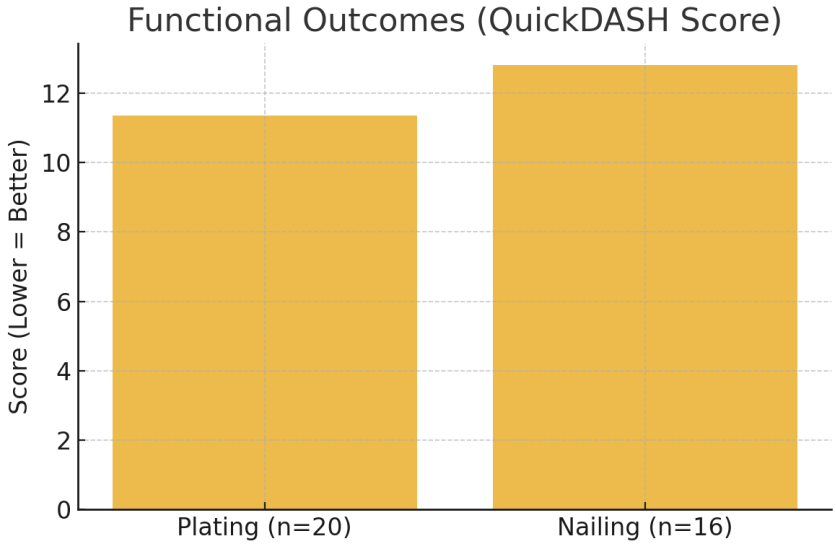

Fig. 1: Functional Outcomes (Quick DASH Score)

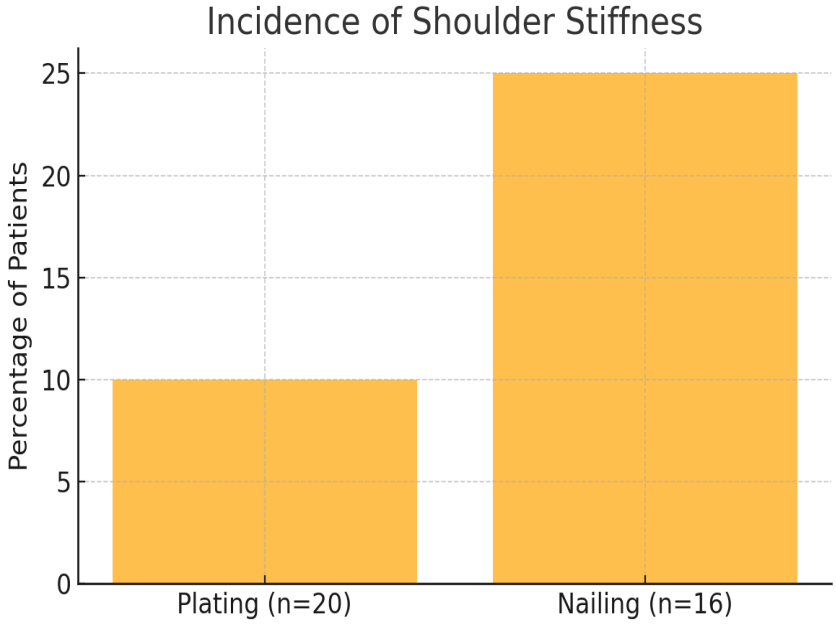

Fig. 2: Incidence of Shoulder Stiffness

Table 1. Functional outcomes (Quick DASH scores)

Group	Mean Score	p-value
Plating	11.36	0.67
Nailing	12.8	0.71

Discussion

Fractures of the humeral shaft, although relatively uncommon, carry important clinical implications because of the functional limitations they impose on the upper limb. Historically, these injuries were managed non-operatively, most notably with the functional brace technique described by Sarmiento, which allowed satisfactory rates of bone healing in many cases. Over time, however, limitations of conservative treatment such as prolonged immobilization, malalignment, delayed return to activity, and joint stiffness have become increasingly recognized. With greater demands for early mobility and predictable outcomes, surgical fixation has gained acceptance as the preferred approach in a large proportion of patients. Among surgical methods, dynamic compression plating and IMIL nailing are the most frequently employed, each offering unique benefits and drawbacks.

The present study compared these two techniques in 36 patients with closed humeral shaft fractures, focusing on union time, functional recovery, and complications. Our results indicate that both plating and nailing produced comparable union rates, with most fractures consolidating within 12 weeks. Functional evaluation using the Quick DASH score also demonstrated no statistically significant difference between the two groups: the nailing group 12.8 and the plating group averaged 11.36, with a p-value of 0.71. These findings suggest that, in terms of fracture healing and overall functional performance, either technique may be considered reliable. Similar conclusions have been reported in earlier studies, many of which highlight equivalent union times between the two approaches.

One point of difference in our study was the incidence of shoulder stiffness. This complication was more frequent in the nailing group, affecting one quarter of patients compared to 10% in the plating group. The higher rate of stiffness with IMIL nailing has been consistently described in previous literature and is thought to arise from antegrade entry through the rotator cuff, which may compromise shoulder mechanics. While structured physiotherapy can alleviate symptoms in many patients, this complication remains a notable disadvantage of the technique, especially for individuals who rely heavily on shoulder function for work or sport. Plating avoids this problem but is associated with its own risks, including infection and radial nerve palsy, though such complications were not encountered in our series.

When our findings are placed in the context of other published studies, the overall pattern becomes clearer. Meta-analyses and randomized trials generally confirm that both plating and nailing achieve high rates of union, but each has distinct complication profiles. Plating carries risks related to surgical exposure, including infection and nerve injury, whereas nailing more often produces shoulder-related complaints. In our cohort, the absence of infection and nerve palsy may be due to the limited number of cases, careful surgical execution, and relatively short follow-up. It is worth noting, however, that shoulder stiffness in the nailing group was evident even within the six-month follow-up period, supporting the concern raised by other authors.

Biomechanical considerations provide further explanation for these results. Plating offers stable fixation with direct visualization of the fracture, allowing precise anatomical reduction. This is

particularly beneficial for simple or transverse fracture patterns. On the other hand, the procedure requires more extensive dissection, which may affect soft tissues and blood supply. IMIL nailing, by contrast, is less invasive and biologically friendly, offering load-sharing fixation and reduced disruption of fracture hematoma. It is often preferred for comminuted or segmental fractures, but its disadvantages include technical challenges with distal locking and the potential compromise of shoulder function. These differences suggest that the choice between plating and nailing should be individualized, taking into account patient characteristics, fracture configuration, and surgeon expertise rather than assuming universal superiority of one method.

This study does have limitations that must be recognized. The sample size was small, limiting statistical power and the ability to identify subtle differences. The follow-up duration was restricted to six months, which may not adequately capture late complications such as implant failure, nonunion, or degenerative changes in the shoulder. In addition, the retro-prospective nature of the study means there may have been variability in surgical technique, implant choice, and rehabilitation, all of which could influence outcomes. Future work should therefore focus on large multicenter RCT with longer follow-up and standardized protocols. Incorporating patient-reported outcome measures, return-to-work data, and cost-effectiveness assessments would also provide a more complete picture of treatment success.

In summary, this study supports the view that both plating and IMIL nailing are efficient in treating fractures of the closed humeral shaft. Union rates and overall functional recovery were comparable, though nailing was associated with a higher risk of shoulder stiffness. While our findings align with existing evidence, they also highlight the need for larger, high-quality studies to determine whether one technique can be recommended over the other. Until such data are available, the choice of fixation should be guided by the fracture pattern, patient demands, and surgeon judgment, with an emphasis on meticulous surgical technique and structured rehabilitation to optimize outcomes.

Conclusion

Both dynamic compression plating and IMIL nailing provide satisfactory outcomes in closed humeral shaft fractures. Union rates and functional recovery are comparable, though nailing may be associated with a higher risk of shoulder stiffness. Given the limitations of our small sample size and short follow-up, further large-scale randomized studies with longer observation are required to guide definitive treatment recommendations.

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