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Comparison of Interlocking Nail and Compression Plating in Treatment of Humerus Shaft Fractures

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ABSTRACT

Background: *Humeral shaft fractures are common orthopaedic injuries. Though both intramedullary nailing (IMN) and compression plating are used widely, their comparative functional outcomes remain debated. This study compares these two fixation methods.*

Methods: *A retrospective analysis of 40 patients with humeral shaft fractures was conducted. Twenty patients were treated with compression plating and 20 with IMN. Outcome measures included operative time, radial nerve palsy, complications, and Rodriguez Merchan functional grade. Statistical analysis was performed using SPSS v21.*

Results: *Plating resulted in significantly more 'Excellent' outcomes and a higher complication-free rate than IMN. IMN had shorter operative time. Radial nerve palsy occurred more frequently with plating, while rotator cuff injuries were unique to IMN. Functional outcomes favored the plating group.*

Conclusion: *Compression plating provides superior functional outcomes compared to IMN for humeral shaft fractures, with fewer specific complications and improved recovery profiles.*

Key words: *intramedullary nailing (IMN) ,locking compression plate (LCP),Dynamic compression plate (DCP),Non union, Radial nerve palsy,Rotator cuff injury .*

INTRODUCTION:

Humeral shaft fractures represent approximately 3% of all long bone fractures and 14% of all humerus fractures [1,2]. These injuries are typically the result of high-energy trauma such as road traffic accidents in younger individuals or low-energy falls in the elderly, often presenting a bimodal age distribution [3]. They can cause significant functional impairment, with the primary goals of treatment being early union, preservation of range of motion (ROM), and return to pre-injury activity levels.

Traditionally, humeral shaft fractures were managed conservatively using functional bracing or hanging casts, especially in minimally displaced or non-comminuted fractures. These nonoperative methods have demonstrated high union rates in selected cases [4]. However, complications such as malunion, nonunion, and prolonged immobilization have encouraged surgeons to prefer operative management in selected patients [5].

Indications for surgical fixation include polytrauma, open fractures, bilateral injuries, segmental fractures, and failure of conservative treatment [6]. Among the operative options, intramedullary nailing (IMN) and compression plating (via dynamic compression plate [DCP] or locking compression plate [LCP]) are widely accepted techniques.

IMN, a load-sharing device, is often preferred for its minimally invasive approach, preservation of soft tissue integrity, and shorter operative time [7]. However, drawbacks such as shoulder dysfunction due to entry point violation of the rotator cuff and difficulty in controlling rotational alignment are notable concerns [8]. In contrast, plating allows for direct visualization and anatomical reduction of the fracture fragments, offering superior control of rotational stability and alignment [9]. However, plating may involve extensive soft tissue dissection and carries a risk of iatrogenic radial nerve injury [10].

Given the differences in biomechanics, healing potential, and complication profiles between these two methods, there is no consensus in the literature about the superiority of one method over the other. Thus, the objective of this study is to retrospectively compare the functional and radiological outcomes

of compression plating and IMN in humeral shaft fractures,The union will be defined as absence of pain at the fracture site and evidence of bridging callus in the antero posterior and lateral radiographic views of the humerus. based on data from a tertiary care center.

MATERIALS AND METHODS

Study Design:
Retrospective comparative study
Period: April 2021 to March 2024
Location: Department of Orthopaedics, R.L. Jalappa Hospital, Kolar,Karnataka.
Sample size: Total Patients: 40 (20 Plate, 20 IMN)
Inclusion Criteria: Unilateral and bilateral closed displaced proximal- and middle-third of humeral shaft fractures, Age of patient more than 18 years,Unacceptable reduction after conservative treatment,Humerus shaft fracture treated with IMN, compression plating (DCP,LCP),Noncompliant patient for conservative treatment.
Exclusion Criteria: Pathological fracture, Preoperative radial nerve injury, History of previous humerus fractures,Fractures older than 3 weeks, Distal-third humerus shaft fractures, Patients treated with nonsurgical methods, those lost to follow-up were excluded from the study
Data Collection:
Data was collected retrospectively from medical records and radiographs after obtaining the necessary IEC approval, in a tertiary care hospital-RLJH Hospital, Kolar, Karnataka. The union will be defined as the absence of pain at the fracture site and evidence of bridging callus in the anteroposterior and lateral radiographic views of the humerus. Outcome grade based on Rodriguez Merchan criteria, Operative time, nerve palsy, complications at 1-year follow up.Statistical analysis via SPSS v21; $p<0.05$ considered significant

RESULTS

In our study, the total number of participants were 40. Table 1 presents the Comparison of Age Between Plating and Intramedullary nailing group . The mean age of participants in plate group was 43.5 years and mean age of participants in Intramedullary nailing group was 44.1 years.

Table 1. Comparison of Age Between Plating and IMN Groups

Group	Mean Age (Years)
Plate	43.5
IMN	44.1

In our study, the total number of participants were 40. Table 2 presents the Comparison of operative time Between Plating and Intramedullary nailing group . The mean operative time of participants in plate group was 75.9 Minutes which is lesser compared to the mean operative time of participants in Intramedullary nailing group which was 60.2 minutes.

Table 2. Comparison of Operative Time

Group	Operative Time (min)
Plate	75.9
IMN	60.2

In our study, the total number of participants were 40. Table 3 presents the Comparison of Radial nerve injury Between Plating and Intramedullary nailing group . The incidence of Radial nerve palsy was observed in four subjects in plating group and one in Intramedullary nailing group. This results interpretate that higher incidence of Radial nerve palsy in plating group.

Table 3. Incidence of Radial Nerve Palsy

Group	Radial Nerve Palsy (Y)	Total Patients	% Affected	Test Statistic	p value
Plate	4	20	20%	$\chi^2 = 0.91$	p=0.339
IMN	1	20	5%		
Test: Chi-square test was used , and significance was set at a p-value of <0.05					
Interpretation: Higher incidence in the plating group.					

In the present study, mild complications were observed in four (20%) subjects in the plating group and five (25%) subjects in the Intramedullary nailing group. Non union was observed in two patients (10%) in plating group and in one patient (5%) in nailing group. Infection was observed in two patients (10%) in both plating and nailing group. Rotatory cuff injury was observed in two patients (10%). (Table 4).

Table 4. Postoperative Complications

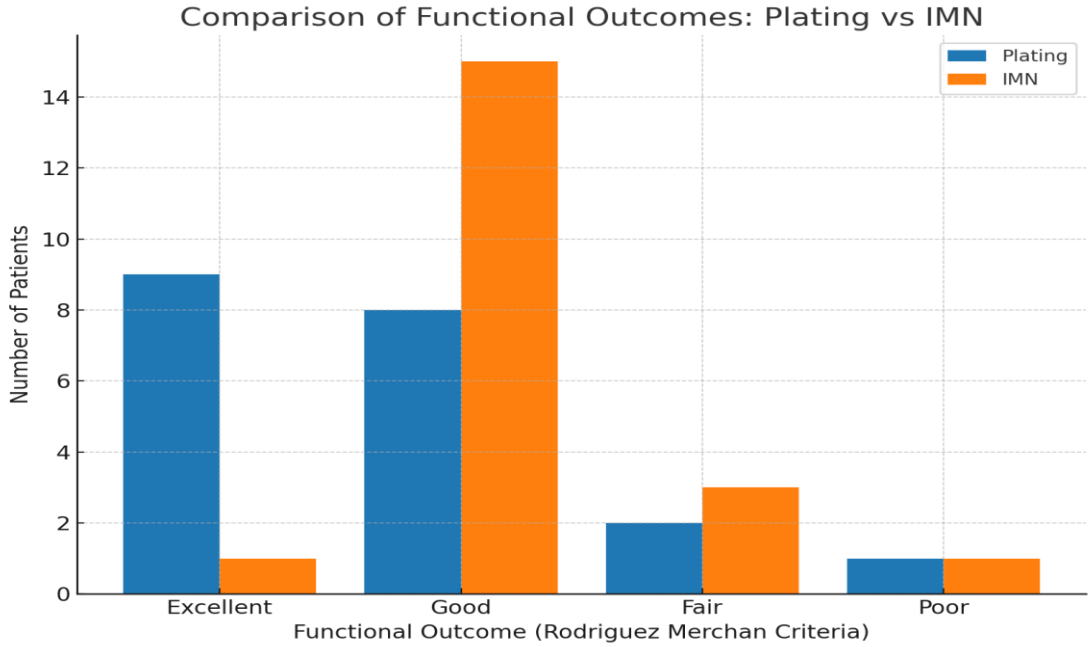
Complication	Plate (n=20)	IMN (n=20)	Test Statistic	p Value
Nonunion	2	1	$\chi^2 = 0.00$	p=1.000
Infection	2	2		
Rotator Cuff Injury	0	2		
Total Complications	4	5		
Test: Descriptive comparison was used , and significance was set at a p-value of <0.05				
Interpretation: Rotator cuff injuries occurred only in IMN; total complications were comparable.				

In the present study, Functional Outcomes was measured using (Rodriguez Merchan Criteria). Excellent outcomes was observed more in plating group (45%) compared to IMN group (5%) . Eight patients (40%) in plating group had good functional outcomes whereas fifteen patients (75%) had good functional outcomes in IMN group. Fair functional outcomes were observed in two patients (10%) in plating group and one patient (5%) in IMN group. Poor functional out comes were observed in one patient (5%) in both plating and IMN group. These results suggests that patients undergoing plate fixation had excellent functional outcomes compared to IMN group. (Table 5) (Figure 1).

Table 5. Functional Outcome Grades (Rodriguez Merchan Criteria)

Outcome Grade	Plate (n=20)	IMN (n=20)	Test Statistic	p value
Excellent	9	1	$\chi^2 = 8.73$	p=0.033
Good	8	15		
Fair	2	3		
Poor	1	1		
Test: Chi-square test was used , and significance was set at a p-value of <0.05				
Interpretation: Significantly more 'Excellent' outcomes in the plating group.				

Figure 1. Comparison of Functional Outcomes between Plating and IMN group



DISCUSSION

The findings of our study indicate that compression plating offers superior functional outcomes compared to intramedullary nailing (IMN) in the treatment of humeral shaft fractures. This is evidenced by a significantly higher proportion of 'Excellent' Rodriguez Merchan outcome grades in the plating group and superior mean shoulder ROM.

The superior functional outcomes with plating may be attributed to multiple biomechanical and anatomical advantages. Compression plating allows for direct fracture visualization, precise anatomical reduction, and stable fixation, which facilitates early rehabilitation and shoulder mobility [11]. Furthermore, the avoidance of rotator cuff violation—a common issue with IMN—contributes to better postoperative shoulder function, as highlighted in previous studies by Livani et al. and Kim et al. [12,13].

Our data also revealed a shorter operative time in the IMN group. This finding aligns with previous studies reporting that IMN, due to its closed technique and smaller incisions, can be performed more quickly [14]. However, the trade-off seems to be a higher incidence of shoulder-related complications such as rotator cuff injury, which was seen only in the IMN group in our cohort.

Interestingly, the plating group showed a slightly higher incidence of radial nerve palsy. This complication is well-documented in the literature and is often associated with the extensive exposure required during open reduction and internal fixation [15]. However, none of the cases in our study resulted in permanent deficits, and all resolved with conservative management, suggesting that meticulous surgical technique and careful dissection remain crucial.

The nonunion rates and infection rates were similar between the two groups, supporting findings from randomized controlled trials that suggest both techniques are biomechanically sound in achieving fracture healing [16,17]. However, only IMN was associated with rotator cuff-related complications, supporting prior biomechanical and MRI studies that indicate the supraspinatus tendon is vulnerable during proximal entry for nailing [18].

In a systematic review and meta-analysis by Amer et al. [4], plating was associated with better functional scores and fewer shoulder complications, while IMN showed marginal advantages in terms of operative time and blood loss. Our study findings are consistent with these observations, further reinforcing the notion that choice of fixation should be guided by patient-specific factors including the functional demands, fracture morphology, and surgeon expertise.

Another consideration is implant-related irritation or hardware prominence. While not explicitly measured in our cohort, these are common long-term issues that may warrant hardware removal—more frequently required in IMN cases due to impingement or proximal locking screw prominence [20].

Given the widespread availability of both techniques and their respective advantages, a nuanced, individualized approach remains key. However, our data suggest that in settings where functional recovery and range of motion are prioritized, plating may offer a more favorable outcome profile.

Limitations

Despite these encouraging outcomes, the study had few limitations. The retrospective design and relatively small sample size may limit the generalizability of the findings. Furthermore, just one center was used for the study, which could have introduced selection bias. To evaluate long-term problems and functional outcomes, longer follow-up is required. Future research with larger sample sizes and longer follow-up durations is warranted to better delineate the indications for each treatment modality.

CONCLUSION

Both compression plating and intramedullary nailing are effective for humeral shaft fractures, but the choice should be tailored to patient profile, fracture pattern, and surgeon expertise. In the management of humeral shaft fractures, compression plating demonstrates superior functional outcomes, fewer rotator cuff injuries, and more patients achieving "Excellent" functional grades compared to intramedullary nailing. The slightly higher radial nerve injury rate with plating highlights the importance of meticulous dissection. Despite the minimally invasive nature of IMN, plating remains the preferred technique in many clinical scenarios, particularly when functional recovery is prioritized. Future randomized controlled studies with larger sample sizes and longer follow-up will be essential to confirm these findings and provide stronger recommendations.

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