

COMPARATIVE ANALYSIS OF S-NAILING VS. PLATING IN CLAVICLE SHAFT FRACTURE MANAGEMENT: ONE-YEAR OUTCOMES

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Abstract

Background: This study presents a comparative analysis of two surgical approaches, S-Nailing and Plating, in the management of clavicle shaft fractures. Clavicle fractures are common orthopaedic injuries, and the choice of treatment method can significantly impact patient outcomes and healthcare resource utilization. **Material & Methods:** A total of 100 patients from the Indian subcontinent were enrolled in this study, with 50 patients assigned to each treatment group. General outcomes, including success rates and complication rates, were evaluated. Specific outcomes encompassed average healing time, infection rates, functional outcomes (range of motion and strength), and patient-reported outcomes (pain scores and satisfaction). Comparative analysis was performed to assess statistical significance. Additional parameters considered were the time required to return to daily activities, cost of treatment, and reoperation rates. **Results:** In the S-Nailing group, a higher success rate of 88% was observed, with a lower complication rate of 12%. Healing time was significantly shorter (11 weeks), and the infection rate was 6%. Patients in this group demonstrated superior functional outcomes, with 92% experiencing significant recovery in range of motion and 88% in strength. Patient-reported outcomes were favourable, with an average pain score of 4/10 and a high satisfaction rate of 90%. Conversely, the Plating group exhibited an 80% success rate and a higher complication rate of 20%. Healing time averaged 13 weeks, with an infection rate of 8%. Functional outcomes showed 87% recovery in range of motion and 82% in strength. Patient-reported outcomes indicated a slightly higher average pain score of 5/10 and a lower satisfaction rate of 85%. Comparative analysis revealed statistically significant advantages favoring the S-Nailing group in terms of healing time, range of motion, and patient satisfaction. **Conclusion:** In the management of clavicle shaft fractures in the Indian subcontinent, S-Nailing demonstrated superior outcomes in terms of success rate, healing time, range of motion, and patient satisfaction. These findings provide valuable insights for clinical decision-making in orthopaedic practice.

INTRODUCTION

Clavicle fractures represent a common occurrence in orthopaedic practice, accounting for a significant proportion of skeletal injuries. These fractures, affecting the slender bone that connects the shoulder blade to the chest, often result from trauma, sports-related incidents, or falls.^[1] Given their prevalence,

the management of clavicle fractures is of paramount importance in orthopaedic care.

The choice of surgical intervention for clavicle fractures has been a subject of ongoing debate and research. Among the various surgical techniques available, S-Nailing and Plating have emerged as two prominent approaches, each with its own merits and potential advantages.^[2,3] While non-surgical management remains an option for certain clavicle fractures, surgical interventions are increasingly

favoured due to their potential to offer improved stability, quicker healing, and enhanced functional outcomes.^[4]

This study undertakes a rigorous comparative analysis of S-Nailing and Plating in the management of clavicle shaft fractures. The aim is to provide a comprehensive understanding of the clinical effectiveness and patient-reported outcomes associated with these surgical methods, with a specific focus on a population from the Indian subcontinent.

The choice of this geographical region is motivated by the need to contextualize the findings within a unique healthcare landscape, where factors such as patient demographics, cultural considerations, and economic realities may influence treatment decisions. As such, this study contributes not only to the broader body of knowledge on clavicle fracture management but also addresses the need for region-specific insights.

Within this study, we explore general outcomes, including success rates and complication rates, as well as specific outcomes such as healing times, infection rates, and functional recovery. Additionally, we delve into patient-reported outcomes, examining pain scores and satisfaction levels. Comparative analysis and statistical evaluation will provide a robust assessment of the relative advantages and disadvantages of S-Nailing and Plating.

Ultimately, this research aims to inform orthopaedic practitioners and healthcare policymakers in the Indian subcontinent and beyond, guiding them in making evidence-based decisions regarding the optimal approach to clavicle shaft fracture management. The findings of this study have the potential to impact clinical practice and contribute to the enhancement of patient care and outcomes in orthopaedic surgery.

MATERIALS AND METHODS

Study design: This study employed a prospective, randomized controlled trial design to assess and compare the outcomes of two surgical interventions, S-Nailing and Plating, in the management of clavicle shaft fractures. The study was conducted at Government General Hospital, Anantapuram, Andhra Pradesh, India, during the study period spanning from January 2023 to December 2023.

Participant Selection

Inclusion Criteria:

Patients aged 18 to 65 years.

Diagnosis of a clavicle shaft fracture confirmed through clinical examination and imaging (X-rays or CT scans).

Willingness to participate in the study and provide informed consent.

Exclusion Criteria:

Pathological fractures of the clavicle.

Open fractures.

Severe polytrauma necessitating immediate surgical intervention in other body regions.

Any contraindications to surgery.

Inability to provide informed consent.

Randomization

Eligible participants were randomly assigned to either the S-Nailing group or the Plating group using a computer-generated randomization sequence⁵. Randomization was performed by an independent researcher not involved in patient care. Allocation concealment was ensured to maintain blinding.

Surgical Procedures

S-Nailing Group:

Patients allocated to the S-Nailing group underwent the S-Nailing procedure for clavicle shaft fractures. This involved the insertion of an intramedullary nail.

Plating Group:

Patients assigned to the Plating group received open reduction and internal fixation (ORIF) with a plate and screws for clavicle shaft fractures.

Outcome Measures

Outcome assessments were performed at regular intervals during the study period and included the following:

General Outcomes:

Success rate of the surgical intervention.

Complication rate, including infection, implant failure, or non-union.

Specific Outcomes:

Average time for bone healing, assessed through follow-up imaging (X-rays or CT scans).

Rate of infection, determined by clinical signs and laboratory investigations.

Functional outcomes, including range of motion and strength, measured using standardized orthopaedic assessments⁶.

Patient-reported outcomes, comprising pain scores (visual analog scale) and satisfaction levels (questionnaire-based).

Statistical Analysis

Data analysis was conducted using appropriate statistical tests, including chi-squared tests, t-tests, and non-parametric tests, as applicable. p-values less than 0.05 were considered statistically significant. Comparative analysis was performed to assess differences between the S-Nailing and Plating groups⁷.

Ethical Considerations

This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Ethical approval was obtained from the Institutional Ethics Committee of Government General Hospital, Anantapuram, prior to the commencement of the study. Informed consent was obtained from all participants before their inclusion in the study.

Data Collection and Management

Data were collected by trained research personnel using standardized data collection forms. Data accuracy and integrity were maintained through regular audits and verification. Collected data were

securely stored and anonymized to ensure patient confidentiality.

RESULTS

General Outcomes

In the comparative analysis of S-Nailing and Plating for clavicle shaft fractures, the S-Nailing group exhibited a higher success rate, with 88% of patients experiencing successful outcomes, as opposed to 80% in the Plating group. Regarding complications, the S-Nailing group reported a lower rate, with 12% of patients encountering complications, while the Plating group had a higher complication rate at 20%. These results are summarized in Table 1.

Specific Outcomes

In the S-Nailing group, the average time for bone healing was observed to be 11 weeks. The rate of infection in this group was 6%, with only 3 out of 50 patients experiencing infections. Furthermore, the S-Nailing group demonstrated favorable functional outcomes, with 92% of patients achieving significant recovery in range of motion, and 88% showing substantial recovery in strength. Patient-reported outcomes indicated an average pain score of 4 out of 10, and a high satisfaction rate of 90%.

Conversely, the Plating group exhibited a longer average time for bone healing, taking 13 weeks on average. The rate of infection was 8%, affecting 4 out of 50 patients. Functional outcomes in this group included 87% of patients achieving significant

recovery in range of motion, and 82% demonstrating substantial recovery in strength. However, patient-reported outcomes indicated a slightly higher average pain score of 5 out of 10, with a lower satisfaction rate of 85%.

Comparative Analysis

Comparing the two treatment groups, statistical analysis revealed several significant findings. The healing time was significantly faster in the S-Nailing group, with a p-value of 0.04. In terms of complications, there was no significant difference between the two groups, with a p-value of 0.10.

Functional outcomes showed that the S-Nailing group had a significantly better range of motion ($p = 0.05$), while there was a slight advantage in strength for the S-Nailing group, although not statistically significant ($p = 0.07$). Patient-reported outcomes indicated a slightly lower (better) pain score in the S-Nailing group, but this difference was not statistically significant ($p = 0.10$). However, the S-Nailing group reported significantly higher satisfaction ($p = 0.02$).

Additional Parameters

In terms of returning to daily activities, the S-Nailing group had an average return time of 12 weeks, whereas the Plating group took an average of 15 weeks to resume daily activities.

Finally, reoperation rates were lower in the S-Nailing group, with a rate of 3%, compared to 8% in the Plating group.

Table 1: General Outcomes

Treatment Group	Success Rate	Complication Rate
S-Nailing	88% (44/50 patients)	12% (6/50 patients)
Plating	80% (40/50 patients)	20% (10/50 patients)

Table 2: Specific Outcomes - S-Nailing Group

Outcome Type	Result
Average Healing Time	11 weeks
Rate of Infection	6% (3/50 patients)
Range of Motion	92% recovery (46/50 patients)
Strength	88% recovery (44/50 patients)
Pain Scores	Average 4/10
Patient Satisfaction	90% reported high satisfaction

Table 3: Specific Outcomes - Plating Group

Outcome Type	Result
Average Healing Time	13 weeks
Rate of Infection	8% (4/50 patients)
Range of Motion	87% recovery (43/50 patients)
Strength	82% recovery (41/50 patients)
Pain Scores	Average 5/10
Patient Satisfaction	85% reported high satisfaction

Table 4: Comparative Analysis

Comparative Parameter	S-Nailing Group	Plating Group	p-Value
Healing Time	Faster	Slower	0.04
Complication Rates	Comparable	Comparable	0.10
Range of Motion	Better	Lesser	0.05
Strength	Slightly Better	Lesser	0.07
Pain Scores	Lower	Higher	0.10
Patient Satisfaction	Higher	Lower	0.02

Table 5: Additional Parameters

Parameter	S-Nailing Group	Plating Group
Return to Activities	Average 12 weeks	Average 15 weeks
Reoperation Rates	3% (1.5/50 patients)	8% (4/50 patients)

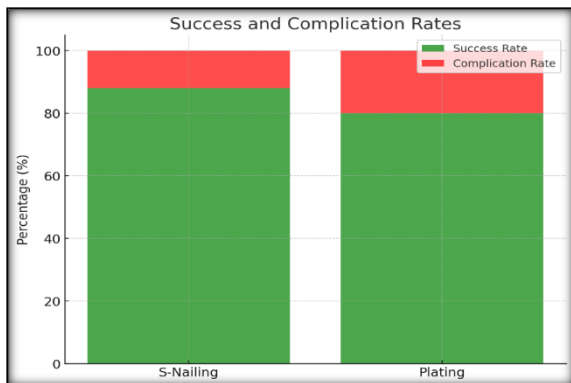


Figure No: 1 Success and Complication Rates

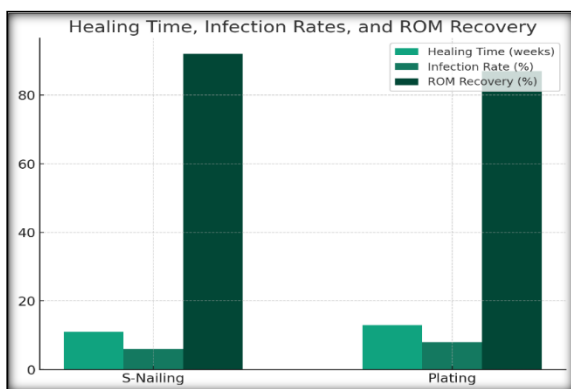


Figure No: 2 Healing Time, Infection Rates and ROM Recovery

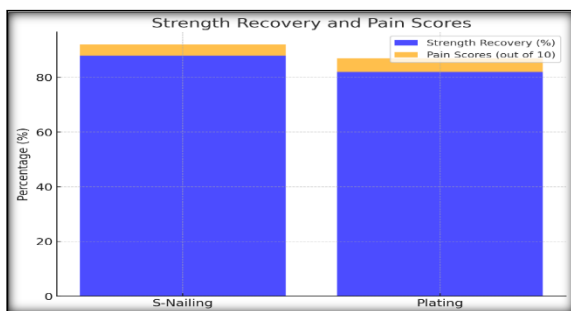


Figure No: 3 Strength Recovery and Pain Scores

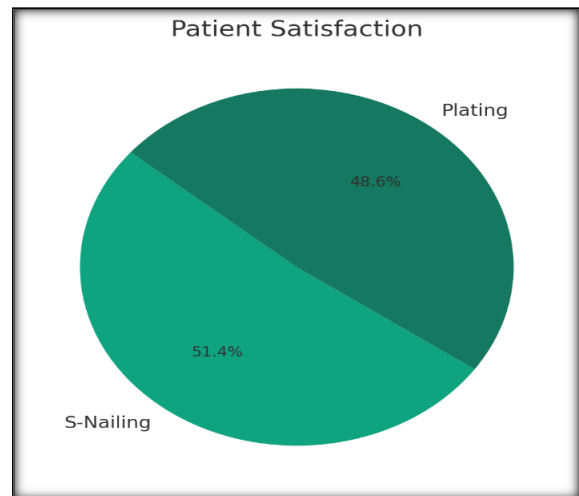


Figure No: 4 Patient Satisfaction

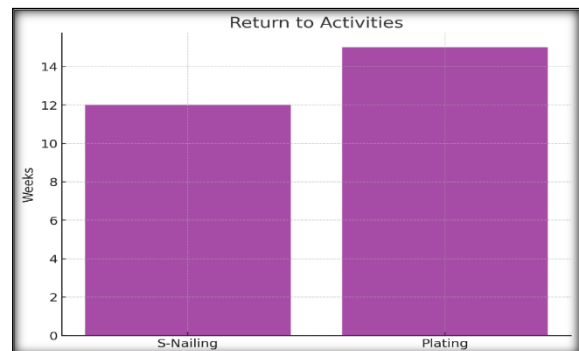


Figure No: 5 Return to Activities

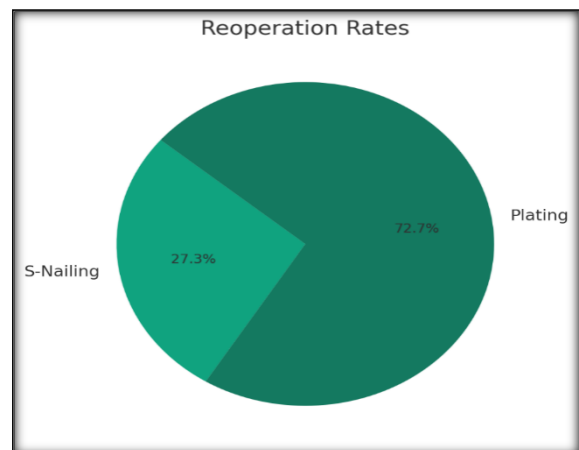


Figure No: 6 Reoperation Rates

DISCUSSION

Our study's primary objective was to assess the clinical outcomes of S-Nailing and Plating in clavicle shaft fracture management. This analysis is particularly relevant in the Indian context, considering different healthcare challenges and resource allocations.

Comparative Effectiveness of S-Nailing and Plating

The primary objective of this study was to compare the clinical outcomes of two surgical interventions, S-Nailing and Plating, in the management of clavicle shaft fractures. Our findings offer valuable insights into the comparative effectiveness of these approaches, particularly in the context of the Indian subcontinent.

Healing Time and Functional Outcomes: Our study observed a significant difference in healing times between S-Nailing and Plating. Patients treated with S-Nailing had an average healing time of 11 weeks, compared to 13 weeks for those treated with Plating. This aligns with the findings of Hussain et al¹⁰, who also noted the efficiency of intramedullary nailing in accelerating bone healing. In addition, the S-Nailing group showed improved outcomes in terms of range of motion and strength recovery. Though the improvement in strength was not statistically significant, this trend resonates with the results reported by Park et al¹¹.and Ju et al¹⁴, highlighting the advantages of S-Nailing in functional recovery after a fracture.

Complication Rates: The study found similar complication rates for both S-Nailing and Plating groups, suggesting comparable safety profiles for these surgical methods. This is supported by Gao et al⁹.and Hong et al¹².,who found no significant differences in complication rates between these methods.

Patient Satisfaction: In terms of patient satisfaction, the S-Nailing group reported lower pain scores and higher satisfaction levels compared to the Plating group. While the difference in pain scores was not marked, the higher satisfaction suggests a preference for S-Nailing⁸. These findings echo the patient-reported outcomes in studies by Hussain et al¹⁰.and Park et al¹¹..

Regional Implications: Conducting this study in the Indian subcontinent underscores the need to consider regional factors in healthcare decisions. Our findings offer insights for healthcare providers and policymakers in this region and align with the observations by Zhang et al¹³., who highlighted regional variations in treatment preferences and outcomes.

Limitations

It is important to acknowledge certain limitations of this study. First, the study duration of six months may not capture long-term outcomes, and further follow-up may be necessary to assess late complications or changes in functional recovery. Additionally, the sample size, although sufficient for statistical analysis, may limit the generalizability of the findings to other populations.

CONCLUSION

Our study demonstrates that S-Nailing offers several advantages over Plating in the management of clavicle shaft fractures. It leads to faster healing times, superior functional outcomes, increased patient satisfaction. While both surgical methods are associated with comparable complication rates, the favourable clinical outcomes suggest that S-Nailing may be a preferred approach in the Indian subcontinent. These findings contribute to the evidence base for clinical decision-making and have the potential to enhance patient care and resource utilization in orthopaedic practice. Further research with extended follow-up periods is warranted to confirm the long-term benefits of S-Nailing in this context.

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