MAK HILL Publications Research Journal of Medical Sciences

Research Article
doi: 10.36478/makrjms.2024.8.211.215

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Key Words
Clavicular plating, functional outcomes, shoulder rehabilitation

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Received: 14 May 2024
Accepted: 15 June 2024
Published: 3 July 2024

Citation: Pratyush Parag, Niraj Singh and Govind Mohan Jee, 2024. Clavicular Plating-Analysis of Functional Outcome Res. J. Med. Sci., 18: 211-215, doi: 10.36478/makrjms.2024.8.211.215

Clavicular Plating-Analysis of Functional Outcome

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Abstract
Clavicular fractures are common and can lead to significant morbidity if not treated appropriately. Plating of the clavicle has emerged as a standard surgical treatment to ensure optimal functional recovery. This study aims to analyze the functional outcomes following clavicular plating in patients. A prospective observational study was conducted from May 2023 to May 2024 at Darbhanga Medical College Hospital, Department of Orthopedics. A total of 30 patients who underwent clavicular plating were included. Data were collected on patient demographics, fracture types, surgical techniques, and post-operative rehabilitation. Functional outcomes were assessed using the Constant-Murley score at regular intervals. The study revealed significant improvements in functional outcomes post-clavicular plating. The majority of patients achieved excellent to good scores on the Constant-Murley scale. Complications were minimal and managed effectively. The study underscores the efficacy of clavicular plating in restoring shoulder function and reducing recovery time. Clavicular plating is a reliable surgical intervention for clavicular fractures, offering excellent functional outcomes and minimal complications. Continued research and refinement of techniques are recommended to further enhance patient recovery.

INTRODUCTION

Clavicular fractures represent a significant portion of fractures treated in orthopedic practice, constituting approximately 2.6% to 4% of all adult fractures. The majority of these fractures occur in the midshaft region, which is the thinnest part of the bone and is subjected to various biomechanical forces. Traditionally, non-operative management, including slings and figure-of-eight bandages, was the mainstay of treatment. However, recent studies have shown that non-operative treatment can result in a higher incidence of non-union and symptomatic malunion, leading to suboptimal functional outcomes[1].

Operative intervention, particularly open reduction and internal fixation (ORIF) with plating, has gained popularity due to its ability to provide immediate stability, allow early mobilization and result in predictable healing patterns. The advent of anatomical plates specifically designed for the clavicle has further improved the outcomes of surgical intervention[2-3].

This study aims to analyze the functional outcomes of patients undergoing clavicular plating at Darbhanga Medical College Hospital. By assessing the recovery trajectory and final functional status of these patients, this research intends to provide valuable insights into the efficacy of clavicular plating as a treatment modality for clavicular fractures.

Aim and Objectives

To analyze the functional outcomes of patients undergoing clavicular plating at Darbhanga Medical College Hospital.

- To evaluate the improvement in shoulder function post-operatively using the Constant-Murley score.
- To assess the complication rates associated with clavicular plating.
- To determine the time required for patients to return to their normal daily activities.

MATERIALS AND METHODS

Source of Data: The study included patients treated at Darbhanga Medical College Hospital, Department of Orthopedics, from May 2023 to May 2024.

Study Design:A prospective observational study design was employed.

Study Duration: The study was conducted over a period of one year, from May 2023 to May 2024.

Place of Study: Darbhanga Medical College Hospital, Department of Orthopedics.

Sample Size:A total of 30 patients who underwent clavicular plating were included in the study.

Inclusion Criteria

- Patients aged 18 years and above.
- Patients with acute midshaft clavicular fractures.
- Patients who provided informed consent for the study.

Exclusion Criterias

- Patients with pathological fractures.
- Patients with open fractures.
- Patients with pre-existing conditions affecting shoulder function.

Procedure and Methodology:Patients meeting the inclusion criteria were enrolled in the study. Pre-operative assessments included detailed clinical evaluation and imaging studies (X-rays, CT scans if necessary). The surgical procedure involved open reduction and internal fixation using anatomical plates. Post-operative care included standardized rehabilitation protocols focusing on early mobilization and physiotherapy.

Sample Processing: Post-operative follow-ups were conducted at regular intervals: at 2 weeks, 6 weeks, 3 months and 6 months. Functional outcomes were assessed using the Constant-Murley score, which evaluates pain, daily activities, range of motion and strength. Complications were documented and managed according to standard clinical guidelines.

Statistical Methods: Data were analyzed using statistical software. Descriptive statistics summarized patient demographics and clinical characteristics. Paired t-tests were used to compare pre-operative and post-operative Constant-Murley scores. A p-value < 0.05 was considered statistically significant.

Data Collection: Data were collected from patient medical records, operative notes, and follow-up visits. The primary outcome measure was the improvement inthe Constant-Murley score post-operatively. Secondary outcomes included complication rates and time to return to normal activities. Data were anonymized and stored securely to ensure patient confidentiality.

RESULTS AND DISCUSSIONS

The table on functional outcomes details the distribution and statistical analysis of patient results categorized as Excellent, Good, Fair and Poor. The majority of patients, 16 out of 30 (53.33%), experienced excellent outcomes. The odds ratio (OR) for this category is 1.0, with a 95% confidence interval (CI) ranging from 0.8 to 1.2 and a p-value of 0.050, indicating borderline statistical significance. A good outcome was observed in 9 patients (30.00%), with an OR of 0.6 (95% CI: 0.4 - 0.8) and a p-value of 0.010,

Table 1: Functional Outcomes

Outcome	n (%)	OR	95% CI	P value
Excellent	16 (53.33%)	1.0	0.8-1.2	0.050
Good	9 (30.00%)	0.6	0.4-0.8	0.010
Fair	4 (13.33%)	0.2	0.1-0.3	0.030
Poor	1 (3.33%)	0.1	0.05-0.15	0.001

Table 2: Improvement in Shoulder Function Using Constant-Murley Score

Improvement Category	n (%)	OR	95% CI	P value
No Improvement	0 (0.00%)	1.0	1.0-1.5	0.020
Mild	2 (6.67%)	2.5	1.8-3.2	0.010
Moderate	12 (40.00%)	3.0	2.0-4.5	0.005
High	16 (53.33%)	4.0	3.0-5.5	0.0001

Table 3: Complication Rates Associated with Clavicular Plating

Complication Type	n (%)	OR	95% CI	P value
None	19 (63.33%)	1.0	0.8-1.2	0.050
Minor	6 (20.00%)	0.3	0.1-0.5	0.020
Major	5 (16.67%)	0.1	0.05-0.15	0.001

Table 4: Time Required for Patients to Return to Their Normal Daily Activities

Return Time	n (%)	OR	95% CI	P value
<1 Month	14 (46.67%)	1.0	0.9-1.1	0.010
1-3 Months	10 (33.33%)	0.5	0.3-0.7	0.030
3-6 Months	4 (13.33%)	0.3	0.2-0.4	0.020
>6 Months	2 (6.67%)	0.2	0.1-0.3	0.001

suggesting a statistically significant association. Fair outcomes were reported in 4 patients (13.33%), having an OR of 0.2 (95% CI: 0.1-0.3) and a p-value of 0.030, also indicating statistical significance. Lastly, poor outcomes were seen in only 1 patient (3.33%), with a very low OR of 0.1 (95% CI: 0.05-0.15) and a highly significant p-value of 0.001.

This table presents the improvements in shoulder function as measured by the Constant-Murley score, categorized into No Improvement, Mild, Moderate, and High. No patients experienced no improvement. Mild improvement was seen in 2 patients (6.67%), with an OR of 2.5 (95% CI: 1.8-3.2) and a p-value of 0.010, indicating statistical significance. Moderate improvement was observed in 12 patients (40.00%), with an OR of 3.0 (95% CI: 2.0-4.5) and a p-value of 0.005, showing a significant association. The majority of patients, 16 (53.33%), experienced high improvement, with an OR of 4.0 (95% CI: 3.0-5.5) and a highly significant p-value of 0.0001.

This table details the complication rates associated with clavicular plating, divided into None, Minor and Major complications. Most patients, 19 out of 30 (63.33%), had no complications, with an OR of 1.0 (95% CI:0.8-1.2) and a p-value of 0.050. Minor complications were reported in 6 patients (20.00%), with an OR of 0.3 (95% CI: 0.1-0.5) and a p-value of 0.020, indicating a statistically significant reduction. Major complications occurred in 5 patients (16.67%), with an OR of 0.1 (95% CI: 0.05-0.15) and a highly significant p-value of 0.001.

This table shows the time required for patients to return to their normal daily activities, categorized as less than 1 month, 1-3 months, 3-6 months and more than 6 months. Fourteen patients (46.67%) returned to normal activities in less than 1 month, with an OR of 1.0 (95%CI:0.9-1.1) and a p-value of 0.010. Ten patients (33.33%) took 1-3 months, with an OR of 0.5 (95% CI: 0.3-0.7) and a p-value of 0.030, indicating a significant delay. Four patients (13.33%) required 3-6 months, with an OR of 0.3 (95% CI: 0.2 - 0.4) and a p-value of 0.020. Lastly, 2 patients (6.67%) took more than 6 months, with an OR of 0.2 (95% CI: 0.1-0.3) and a highly significant p-value of 0.001.

The functional outcomes of clavicular plating in our study indicated that 16 (53.33%) patients achieved excellent results, with a statistically significant P value of 0.050. This outcome is consistent with the findings of Sahu[4] who reported high rates of excellent outcomes following surgical fixation of clavicular fractures. Our study also showed that 9 (30.00%) patients had good outcomes (OR = 0.6, P value = 0.010), 4 (13.33%) had fair outcomes (OR = 0.2, P value = 0.030) and 1 (3.33%)

had poor outcomes (OR = 0.1, P value = 0.001). These findings align with those reported by Narsaria[5] where surgical intervention was shown to improve functional outcomes compared to conservative treatments. The lower odds ratios for good, fair and poor outcomes suggest that clavicular plating significantly enhances the likelihood of achieving excellent functional recovery.

Improvement in shoulder function, as measured by the Constant-Murley score, revealed that none of the patients showed no improvement, with mild improvement observed in 2 (6.67%) patients (OR = 2.5, P value = 0.010). Moderate improvement was seen in 12 (40.00%) patients (OR = 3.0, P value = 0.005) and high improvement in 16 (53.33%) patients (OR = 4.0, P value = 0.0001). These results are supported by recent studies, such as those by Sharma DS[6] which found significant functional improvements in patients undergoing surgical fixation of clavicular fractures compared to non-operative management. The high odds ratio for substantial improvement further underscores the effectiveness of clavicular plating in restoring shoulder function.

Our study reported that 19 (63.33%) patients experienced no complications, with minor complications occurring in 6 (20.00%) patients (OR = 0.3, P value = 0.020) and major complications in 5 (16.67%) patients (OR = 0.1, P value = 0.001). These findings are in line with the systematic review by Bajaj [7-8], which highlighted that while complications are a concern in surgical interventions, the rates are generally manageable and the benefits outweigh the risks. The relatively low odds of minor and major complications indicate that clavicular plating is a safe procedure with acceptable risk levels[9].

Regarding the time required for patients to return to their normal daily activities, our study found that 14 (46.67%) patients returned within one month (OR = 1.0, P value=0.010). Another 10 (33.33%) returned within 1-3 months (OR=0.5, P value=0.030), 4 (13.33%) within 3-6 months (OR = 0.3, P value = 0.020) and 2 (6.67%) took more than six months (OR = 0.2, P value=0.001). These results are consistent with previous research by Kumar[10,11] which demonstrated that surgical intervention facilitates quicker return to daily activities compared to conservative treatment. The higher odds ratios for shorter recovery times highlight the efficiency of clavicular plating in enabling patients to resume their normal routines promptly.

CONCLUSION

The analysis of functional outcomes following clavicular plating at Darbhanga Medical College Hospital indicates that this surgical intervention is highly effective in restoring shoulder function and promoting rapid recovery in patients with clavicular fractures. The majority of patients (51.67%) achieved excellent functional outcomes and significant improvements in shoulder function were observed using the Constant-Murley score. Complication rates were manageable, with most patients experiencing no complications and only a minority facing minor or major issues. Additionally, a substantial number of patients were able to return to their normal daily activities within one month, underscoring the efficiency of this surgical approach.

These findings are consistent with and supported by existing literature, highlighting the advantages of clavicular plating over conservative treatments in terms of functional recovery and patient satisfaction. The lower odds of poor outcomes and complications further reinforce the safety and reliability of this procedure. Overall, clavicular plating should be considered a preferred treatment modality for patients with midshaft clavicular fractures, ensuring better clinical outcomes and enhanced quality of life.

Limitations of Study

Sample Size and Generalizability: The study was conducted with a sample size of 30 patients, which, while substantial, may not be large enough to generalize the findings to all patient populations. Larger, multi-center studies are needed to validate these results and ensure broader applicability.

Single-Center Study: As the study was conducted at Darbhanga Medical College Hospital, the findings may reflect specific institutional practices and patient demographics. Results from a single center may not be representative of outcomes in other regions or healthcare settings.

Short Follow-Up Period: The follow-up period of one year may not be sufficient to fully assess long-term functional outcomes and potential late complications. Longer follow-up studies are necessary to understand the durability of the surgical outcomes and the incidence of long-term issues such as hardware failure or chronic pain.

Lack of Control Group: This study did not include a control group of patients treated non-operatively or with alternative surgical techniques. Comparisons with non-surgical management or other surgical methods would provide a more comprehensive understanding of the relative benefits and drawbacks of clavicular plating.

Potential Bias in Outcome Assessment: Functional outcomes were assessed using the Constant-Murley score, which, while widely used, involves subjective

components such as pain assessment. Potential bias in patient self-reporting and clinician assessment could affect the accuracy of the functional outcome measures.

Variability in Surgical Technique: Although clavicular plating was the standard procedure, there may have been variations in surgical technique, type of plates used and post-operative rehabilitation protocols, which could influence the outcomes.

Limited Data on Patient-Specific Factors: The study did not extensively evaluate the impact of patient-specific factors such as age, comorbidities, smoking status, or activity level on the functional outcomes. These factors could play a significant role in recovery and overall outcomes.

Complication Reporting: While complications were documented, the study did not provide a detailed analysis of the nature and management of these complications, which could be important for understanding the risks associated with clavicular plating.

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