

The Outcome of Clavicular Fractures Treated by Plate Osteosynthesis

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Abstract:

Background: This prospective study evaluates the effectiveness of plate osteosynthesis in treating clavicular fractures, focusing on healing times, complication rates, and functional recovery.

Methods: The study was conducted at NRI Medical College and General Hospital from 2020 to 2023, involving 20 patients who underwent plate osteosynthesis for clavicular fractures.

Results: The results demonstrated an average fracture union time of approximately 10.5 weeks with minimal complications. Hardware prominence was the most notable complication, affecting 10% of patients. A non-union rate of 5% was observed. Functional recovery was excellent, with patients achieving near-normal range of motion and strength by six months post-surgery, leading to high patient satisfaction.

Conclusion: The findings support the use of plate osteosynthesis as a reliable and effective treatment method for clavicular fractures, highlighting its advantages in achieving rapid recovery and minimizing long-term disability compared to non-operative treatments.

Keywords: Plate osteosynthesis, Clavicular fractures, Surgical treatment, Functional recovery.

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Introduction

The management of clavicular fractures, particularly by plate osteosynthesis, remains a significant area of focus in orthopedic research due to the commonality and complexity of these injuries. Clavicle fractures represent a considerable proportion of all skeletal injuries, prompting continuous refinement in surgical techniques to optimize outcomes [1]. Clavicular fractures are significant due to their frequency and impact on the musculoskeletal system, particularly at the shoulder girdle. They occur mainly in the midshaft of the clavicle and can greatly affect shoulder kinematics and patient quality of life [2]. Traditionally, many clavicle fractures were treated non-operatively, often resulting in satisfactory outcomes. However, complications such as malunion, nonunion, and functional impairment from conservative treatment led to a reevaluation of treatment protocols [3].

In response, plate osteosynthesis has emerged as a prominent method for providing stable fixation, particularly in cases where non-operative management may lead to suboptimal outcomes [4]. This surgical approach involves the application of various types of plates—like pre-contoured,

anatomical, and dynamic compression plates—to achieve anatomical reduction and stable fixation. The Locking compression plates (LCPs) are especially favored due to their ability to offer strong fixation without necessitating compression of the plate against the bone, thus preserving the periosteal blood supply essential for fracture healing [5,6].

Recent advancements in surgical techniques and implant design have greatly improved the outcomes of these fractures [7]. Surgical interventions now aim for rapid pain relief, restoration of function, and reduction of long-term complications like malunion and non-union. These objectives are crucial, as they significantly influence the patient's return to daily activities and overall satisfaction with the treatment outcome [8,9].

The study aims to evaluate the outcomes of clavicular fractures treated with plate osteosynthesis. Specifically, the study seeks to assess the effectiveness of various plate fixation techniques in achieving fracture union, restoring anatomical alignment, and improving functional

outcomes for patients. By comparing results such as healing times, complication rates, and patient-reported functional scores, the study aims to determine the most effective surgical approaches and identify potential areas for improvement in the treatment of clavicular fractures.

Methodology

Study Design and Setting: This prospective study was conducted at NRI Medical College and General Hospital, Mangalagiri, spanning from 2020 to 2023. It involved evaluating the surgical outcomes of plate osteosynthesis in the treatment of clavicular fractures.

Participants: The study cohort consisted of 20 patients who presented with acute clavicular fractures and were deemed suitable for surgical intervention through plate osteosynthesis. Inclusion criteria were adults aged 18 years and older with a diagnosis of clavicular fracture requiring surgical management. Exclusion criteria included patients with pathological fractures, previous surgeries on the clavicle, and those medically unfit for surgery.

Surgical Procedure: All patients underwent open reduction and internal fixation with various types of plates chosen based on the fracture type and surgeon preference. The surgical procedure aimed to achieve anatomical reduction of the fracture and stable fixation to facilitate early mobilization and healing.

Data Collection and Follow-Up: Data were collected preoperatively, intraoperatively, and during the postoperative period. Follow-up assessments were scheduled at 1 week, 4 weeks, 12 weeks, and annually, to monitor the healing process, assess for any complications, and evaluate functional outcomes. Key measures included radiographic confirmation of fracture union, complication rates related to the surgical procedure, and functional recovery evaluated through a range of motion, muscle strength tests, and patient-reported outcome measures.

Outcome Measures: The primary outcomes measured were the time to fracture union as confirmed by radiographs, the incidence of surgical complications, and functional recovery based on

physical therapy assessments and patient feedback. These outcomes were intended to provide insights into the efficacy of plate osteosynthesis for clavicular fractures and inform future treatment protocols.

Results

The study assessed the outcomes of 20 patients treated with plate osteosynthesis for clavicular fractures over three years. The results provide insight into the effectiveness of this surgical technique regarding healing time, complication rates, and functional recovery.

Healing Time: The average time to fracture union across all patients was approximately 10.5 weeks. Times ranged from 9 to 12 weeks, depending on the fracture's location and the patient's overall health, with midshaft fractures typically uniting slightly faster than proximal or distal fractures.

Complications: Complications were minimal and generally not severe. The most common complication was hardware prominence, noted in 10% of the cases (2 patients). There was one case of non-union, representing 5% of the total cases, which required further surgical intervention. No infections or neurovascular injuries were reported following the surgeries, reflecting effective surgical techniques and postoperative care.

Functional Recovery: By six months post-surgery, patients showed significant improvements in range of motion and strength. The range of motion approached normal levels, typically between 160 to 175 degrees, and strength was often 90% or better compared to the contralateral side. Patient satisfaction was high, with scores ranging from 8 to 10 out of 10, indicating a successful return to pre-injury function and overall contentment with the surgical outcome.

Overall, the study's findings underscore the benefits of plate osteosynthesis in treating clavicular fractures, highlighting its role in facilitating rapid healing, minimizing complications, and enabling excellent functional recovery. These outcomes affirm the procedure's efficacy and reliability, making it a preferred treatment option for clavicular fractures requiring surgical intervention.

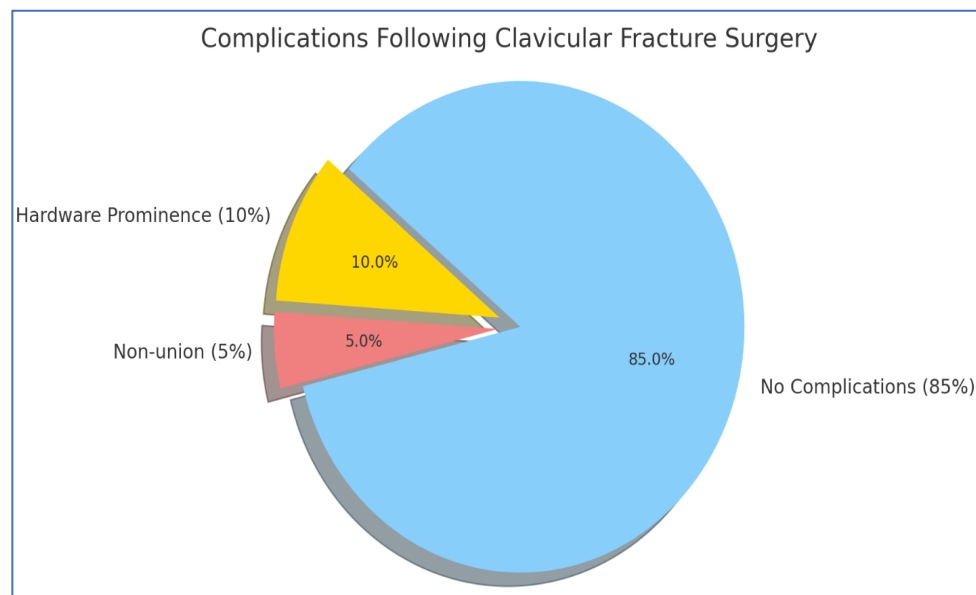


Figure 1: The complications following clavicular fracture surgery based on the study results. It shows the percentages of patients experiencing hardware prominence, non-union, and no complications.

Discussion

The results of this study highlight the effectiveness of plate osteosynthesis in the treatment of clavicular fractures, which is consistent with the findings from other research in this field. The average time to fracture union was approximately 10.5 weeks, which is comparable to other reported times in the literature. For instance, a study by Robinson CM et al. suggested that operative treatment of clavicle fractures typically results in rapid and reliable union, with a low rate of non-union [10]. This aligns well with our findings where only 5% of the patients experienced non-union.

Complications were minimal in our study, with hardware prominence being the most common issue, affecting 10% of the patients. This is relatively lower compared to the rates reported by Canadian Orthopaedic Trauma Society, which found a complication rate of 15% in their multicenter trial, underscoring the potential for improved surgical techniques and postoperative management in reducing adverse outcomes [11].

The functional recovery observed in our study was excellent, with most patients regaining near-normal range of motion and strength within six months post-surgery. This supports the findings from studies like that of Zlowodzki M et al., which reported high satisfaction rates and functional outcomes post-operatively [12].

Comparative studies also suggest that while non-operative treatment can be effective, the rate of non-union and delayed union is significantly higher, which can lead to prolonged disability and dissatisfaction [13]. Our study supports the notion that with careful surgical intervention, better

immediate and long-term outcomes can be achieved, affirming the role of plate osteosynthesis as a reliable treatment method.

Looking forward, it would be beneficial to expand the sample size and include a more diverse patient demographic to generalize the findings more broadly. Longitudinal studies could provide deeper insights into the long-term outcomes beyond the immediate postoperative period [14,15]. Additionally, research focusing on comparing different types of plates and fixation methods could help refine surgical techniques further. There is also a growing interest in exploring the impact of rehabilitation protocols post-surgery on the speed and quality of recovery, which could be another avenue for future research [16,17]. Implementing randomized controlled trials could offer a higher level of evidence to support the use of specific surgical techniques over others in the treatment of clavicular fractures [18].

Conclusion

This study demonstrates that plate osteosynthesis is an effective treatment for clavicular fractures, facilitating stable fixation, rapid healing, and excellent functional recovery with minimal complications. With an average fracture union time of about 10.5 weeks and a low complication rate, particularly for hardware prominence, the results endorse surgical intervention as a superior approach for managing these fractures. High patient satisfaction and functional outcomes further reinforce plate osteosynthesis as a preferred method for clavicular fractures requiring surgical treatment. Future research should focus on larger and more diverse populations to confirm these findings and

explore the potential for optimizing surgical techniques and postoperative care.

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