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ORIGINAL RESEARCH

Comparison of Effectiveness of Conservative versus Surgical Management for Displaced Mid-Shaft Clavicle Fractures in a Tertiary Care Hospital in Eastern India

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ABSTRACT

Background: Fractures of the clavicle, particularly mid-shaft fractures, are prevalent injuries often resulting from high-energy impacts. The management of these fractures is crucial in a tertiary care setting in Eastern India due to their high incidence and impact on functional outcomes. Traditional treatment options include conservative and surgical approaches, each with its advantages and disadvantages, leading to ongoing debates regarding their effectiveness.

Objective: To evaluate and compare the effectiveness of conservative versus surgical management for displaced mid-shaft clavicle fractures.

Methods: A comparative observational study was conducted involving 100 patients diagnosed with displaced mid-shaft clavicle fractures. Patients were divided into two groups: Group A received non-operative management, while Group B underwent surgical intervention using a locking compression plate (LCP). Inclusion and exclusion criteria were established, and data were collected on demographic details, clinical assessments, and radiological examinations. Outcome measures included union time, non-union rates, functional scores (UCLA and DASH), and complications.

Result: The study found that surgical treatment resulted in significantly faster union times compared to conservative management (60% of surgical patients united in 2-3 months vs. 28% of conservative patients, $p = 0.045$). However, non-union rates were similar between groups (12% in conservative vs. 4% in surgical, $p = 0.61$). Functional outcomes, as measured by UCLA scores, showed no significant differences at any time point, while DASH scores indicated better functional results for conservative treatment at later stages ($p < 0.0001$).

Conclusion: Surgical treatment for clavicle fractures leads to faster union times but does not significantly improve functional outcomes compared to conservative treatment. Conservative management may provide better long-term functionality, suggesting that treatment choice should consider patient priorities regarding recovery speed versus functional improvement.

Keywords: Clavicle fractures, Conservative management, Surgical management, DASH score, UCLA score

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INTRODUCTION

Fractures of the clavicle, particularly those occurring in the mid-shaft region, are common injuries encountered in clinical practice.[1] These fractures often result from high-energy impacts, such as those sustained in road traffic accidents or sports injuries.[2] In the context of a tertiary care hospital in Eastern India, managing such fractures efficiently is paramount given the high incidence and the impact on patients' functional outcomes.[3] Traditionally, both conservative and surgical approaches have been employed to treat displaced mid-shaft clavicle fractures, each with its proponents and detractors. However, there remains an ongoing debate regarding which method offers superior outcomes in terms of healing time, functional recovery, and complication rates.[4]

Conservative management typically involves non-surgical interventions such as the use of slings or figure-of-eight bandages to immobilize the fracture and allow natural healing. This approach is often favoured due to its non-invasive nature and lower initial costs. Despite its benefits, conservative treatment may be associated

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with longer recovery times, potential for malunion, and persistent discomfort, which can hinder the patient's ability to resume normal activities promptly.[5]

Conversely, surgical management involves the use of internal fixation techniques to realign and stabilize the fracture fragments. This method aims to ensure anatomical restoration and early mobilization, potentially leading to quicker recovery and better functional outcomes. However, surgical intervention carries risks inherent to any invasive procedure, such as infection, hardware complications, and the need for subsequent surgeries. The decision to opt for surgical versus conservative treatment hinges on multiple factors, including the patient's age, activity level, and specific fracture characteristics.[6]

The rationale for conducting this study stems from the need to provide evidence-based guidance on the most effective management strategy for displaced mid-shaft clavicle fractures in the specific context of a tertiary care hospital in Eastern India. Given the region's unique demographic, socio-economic, and healthcare delivery landscape, it is essential to ascertain whether the benefits of surgical intervention outweigh the risks and costs compared to conservative approaches. This study aims to fill the gap in existing literature by providing a comprehensive analysis of patient outcomes, thereby informing clinical practice and optimizing patient care.

By comparing the effectiveness of conservative and surgical management, this research seeks to offer valuable insights into the best practices for treating displaced mid-shaft clavicle fractures. The findings will not only enhance the understanding of treatment outcomes but also aid in developing standardized protocols that can be implemented in similar healthcare settings. Ultimately, the goal is to improve patient outcomes, reduce the burden of disability, and ensure that healthcare resources are utilized efficiently to deliver the best possible care.

The objective of this study is to evaluate and compare the effectiveness of conservative versus surgical management for displaced mid-shaft clavicle fractures in patients treated at a tertiary care hospital in Eastern India. This research aims to determine which approach offers superior outcomes in terms of healing time, functional recovery, and complication rates, thereby providing evidence-based guidance for clinical practice and improving patient care in the regional healthcare context.

MATERIALS AND METHODS

This research employs a comparative observational design conducted at Department of Orthopedics, SKMCH, Muzaffarpur. The study has received approval from the institutional ethics committee, ensuring compliance with ethical standards and the guidelines of the Declaration of Helsinki. A total of 100 patients diagnosed with displaced mid-shaft clavicle fractures were included in the study and were subsequently assigned to two groups based on their management approach—Group A underwent non-operative management, while Group B received operative management using an LCP.

Inclusion Criteria

- Patients aged between 18 to 60 years.
- Documented mid-shaft clavicle fractures with a displacement of over 1.5 cm.
- Fractures occurring due to trauma such as falls or road traffic accidents.
- Patients providing informed consent for participation in the study.

Exclusion Criteria

- Associated neurovascular injuries.
- Open fractures or those requiring immediate surgery.
- Pathological fractures due to conditions such as osteoporosis or malignancy.
- Patients with a history of previous shoulder surgeries.

Sample Size Calculation

Sample size necessary for achieving statistically significant results was determined using power analysis. Calculating a power of 80% and a significance level (alpha) of 0.05, the study necessitated a minimum sample size of 25 patients for each group. Therefore, a total sample size of 50 patients was ascertained and appropriately recruited.

DATA COLLECTION

Data collection was systematically carried out using a pre-defined proforma capturing demographic details, mechanism of injury, clinical assessments, and radiological examinations. Potential confounding variables such as age, gender, and associated injuries were noted. Clinical assessments were performed at baseline, 6-weeks, 3-months, 6-months and 12-months post-intervention.

Management Protocol

In Group A, non-operative management was instituted, which entailed the application of a figure-of-eight brace. Patients were educated regarding the importance of adhering to the rehabilitation protocol, emphasizing gradual mobilization and pain management strategies. Follow-up appointments were scheduled at specified intervals to monitor for signs of union and functional improvements.

In Group B, operative management involved surgical intervention via the application of a locking compression plate. Surgery consisted of an open reduction and internal fixation (ORIF) technique, where the fracture site was accessed through a standard anterior approach. Proper attention was paid to soft tissue preservation and anatomical restoration of the fracture alignment. Post-operatively, a standardized rehabilitation program was initiated focusing on pain control, range of motion, and muscle strengthening exercises.

Outcome Measures

The principal outcome measures of this study were evaluated through clinical and radiological methods. Functional outcomes were assessed using the Fast DASH questionnaire and UCLA,[7, 8] which evaluates shoulder function based on pain, daily activities, range of motion, and strength. Radiological union was defined as bridging callus formation evident on X-ray.

Additionally, complications associated with each treatment modality were meticulously recorded, including infection, non-union, malunion, or hardware-related issues. Patient satisfaction was gauged by a qualitative questionnaire at the end of the study period, assessing quality of life post-fracture management.

Statistical Analysis

Data were subjected to statistical analysis using appropriate software (Graph Pad Version 8.4.3), with significance set at $p < 0.05$. Categorical variables such as gender, cause or side of fracture, union time, and union rate were presented as frequency and percentage, while continuous variables such as age and UCLA score were described as means and standard deviations. Comparisons between groups for outcome measures were made utilizing t-tests for continuous data and chi-square tests for categorical data. A *p-value* of less than 0.05 was taken as a threshold of statistical significance.

RESULT

In comparing baseline demographic and clinical characteristics between Group A (conservative) and Group B (surgical), the data shows no statistically significant differences in age distribution, gender, cause of fracture, or side of fracture. Both groups have similar age distributions, with most patients in the 31–50 age range. Gender ratios are comparable, with males being more prevalent in both groups. Causes of fractures are mainly attributed to road traffic accidents, followed by falls on outstretched hands and sports injuries. The side of the fracture (right or left) is also evenly distributed between both groups. Overall, these variables are well-matched between the groups, suggesting they are comparable for further analysis regarding the outcomes of conservative versus surgical treatments. (Table 1)

Table 1: Comparison of baseline demographic and clinical characteristics between group A (conservative) vs group B (surgical).

Variables	Group A (%, n=25)	Group B (%, n=25)	*p-value*
Age			
18–30	7 (28.00)	5 (20.00)	0.61*
31–40	8 (32.00)	11 (44.00)	
41–50	9 (36.00)	9 (36.00)	
>50	1 (4.00)	0 (0.00)	
Gender			
Male	15 (60.00)	18 (72.00)	0.55**
Female	10 (40.00)	7 (28.00)	
Cause of Fracture			
Road Traffic Accident	13 (52.00)	14 (56.00)	0.91*
Fall on out-stretched hand	8 (32.00)	8 (32.00)	
Sports Injury	4 (16.00)	3 (12.00)	
Side of Fracture			
Right	8 (32.00)	8 (32.00)	>0.99**
Left	17 (68.00)	17 (68.00)	

*Chi-Square Test; **Fisher's Exact Test

Table 2 presents a comparison of union time and non-union rates between Group A (conservative) and Group B (surgical) treatments. The data indicates a significant difference in the union time, with Group B showing a faster union time (2–3 months) in 60% of cases compared to 28% in Group A ($p = 0.045$). Conversely, a higher percentage of patients in Group A experienced union times greater than 3-months (72% vs 40%). Regarding non-union rates, the difference between the groups was not statistically significant, with 12% in Group A and 4% in Group B ($p = 0.61$). This suggests that while surgical treatment may lead to faster union times, the overall non-union rates remain similar between the two groups.

Table 3 compares UCLA scores between Group A (conservative) and Group B (surgical) in clavicle fractures over different time periods. At 3-months, the mean UCLA scores were 21.55 ± 4.32 for Group A and 20.12 ± 4.50 for Group B, with a p-value of 0.257393, indicating no significant difference. At 6-months, the scores were 27.10 ± 4.61 for Group A and 25.99 ± 4.13 for Group B, with a *p-value* of 0.374359. Similarly, at 9 months, the scores were 30.92 ± 4.77 for Group A and 30.12 ± 4.20 for Group B, with a p-value of 0.532090. Finally, at 12-months, the scores were 34.50 ± 2.30 for Group A and 33.00 ± 3.70 for Group B, with a *p-value* of 0.091596. These results suggest that there were no significant differences in UCLA scores between the two groups at any of the measured time points.

Table 2: Comparison of union time and non-union rate between group A (conservative) vs group B (surgical).

Variables	Group A (%, n=25)	Group B (%, n=25)	*P-Value* (Fisher's Exact Test)
Time for union			
2-3 months	7 (28.00)	15 (60.00)	0.045
Great-er than 3-months	18 (72.00)	10 (40.00)	
Non-union			
Yes	3 (12.00)	1 (4.00)	0.61
No	22 (88.00)	24 (96.00)	

Table 3: Comparison of UCLA Score between Group A (Conservative) vs Group B (Surgical).

Variables	UCLA score in mean ± SD		P-Value (Unpaired t-test)
	Group A (%, n=25)	Group B (%, n=25)	
3-months	21.55 ± 4.32	20.12 ± 4.50	0.257393
6-months	27.10 ± 4.61	25.99 ± 4.13	0.374359
9-months	30.92 ± 4.77	30.12 ± 4.20	0.532090
12-months	34.50 ± 2.30	33.00 ± 3.70	0.091596

Table 4 examines the DASH scores between Group A (conservative) and Group B (surgical) treatments over various time points. At 3-months, Group A had a mean DASH score of 34.80 ± 5.40, while Group B had a score of 37.70 ± 6.40, with a p-value of 0.089768, indicating no significant difference. However, at 6 months, Group A showed a significantly lower DASH score of 20.95 ± 4.30 compared

Table 4: Comparison of DASH score between group A (conservative) vs group B (surgical).

Variables	DASH score in mean ± SD		*p-value* (Unpaired t test)
	Group A (%, n = 25)	Group B (%, n = 25)	
3-months	34.80 ± 5.40	37.70 ± 6.40	0.089768
6-months	20.95 ± 4.30	25.10 ± 5.20	0.003467
9-months	4.50 ± 0.95	9.00 ± 1.20	<0.0001
12-months	0.80 ± 0.15	1.40 ± 0.35	<0.0001

to Group B's 25.10 ± 5.20 (p = 0.003467). The trend continued at 9 months, with Group A having a score of 4.50 ± 0.95 and Group B at 9.00 ± 1.20 (p<0.0001), and at 12-months, where Group A's score was 0.80 ± 0.15 versus Group B's 1.40 ± 0.35 (p<0.0001). These results suggest that conservative treatment leads to better functional outcomes over time, as reflected by lower DASH scores in Group A at the later stages.

DISCUSSION

Traditionally, nonoperative management was standard for "acute clavicle fractures." For an extended period, conservative therapy had been the predominant treatment method; however, new studies indicate that "non-union rates" are higher. Moreover, individuals undergoing conservative management face an increased risk of clinical symptoms such as pain, weakness, and rapid exhaustion associated with "clavicle fracture non-union and malunion."[9]

The management of misaligned mid-shaft clavicle fractures remains contentious.[10] The surgeon's key objectives are enhanced patient satisfaction, prompt union, favorable functional outcomes, and optimal reduction with minimal complications. Upon examining the literature, "both conservative and surgical interventions" have been proposed. This investigation on mid-shaft clavicular fractures reveals that individuals who had "surgical reduction with LCP" experienced a significantly shorter time frame for fracture union compared to those who had got conservative care. Patients undergoing conservative care exhibited relatively superior functional results. The non-surgical group exhibited greater levels of satisfaction than the surgery group.

The non-operative approach has been the established standard of therapy for all "types of mid-shaft clavicular fractures." A higher incidence of "non-union and malunion" was noted in "clavicle fractures with displacements" above 2 cm, particularly in instances with comminution. Furthermore, due to patient dissatisfaction and reduced abduction strength, they exhibited worse functional scores.[11]

Recent research reveals that mid-shaft clavicle fractures treated surgically heal more rapidly than those managed with conservative care.[12] Despite the increasing prevalence of clavicle fracture surgery, emerging complications necessitate surgical intervention. Frequent adverse consequences encompass implant discomfort, aesthetic dissatisfaction, and paresthesia at the incision site resulting from supraclavicular nerve damage incurred during "plating and scarring."[13,14] An suitable patient must be selected for surgery to mitigate complications and reduce the patient's burden, while also preventing unnecessary surgical procedures and optimizing outcomes. Surgical surgery is warranted in an active individual for improved "immediate functional outcomes" and a swifter resumption of activities.[6]

Treating "displaced mid-shaft clavicular fractures" with LCP, rather than sling immobilization, decreased the occurrence of malunion and non-union. Implant-associated complications are rather prevalent (9–64%), although the low incidence of "non-union and malunion" post-surgical interventions. These studies indicate that the most common subsequent surgery was for the removal of the implant.[15-17]

Ban *et al*. conducted a thorough assessment of clavicle fractures and found that surgically treated fractures yielded superior functional outcomes. The conservative group exhibited a higher complication rate (47%) compared to the surgically treated group (30%). Conversely, 60% of patients who underwent surgery encountered complications, but merely 20% of those who got conservative treatment did.[16]

The Cochrane Collaboration suggested therapeutic alternatives for "mid-shaft clavicular fractures." Each alternative was assessed individually for every patient, with meticulous attention to the distinct benefits and risks of each intervention, alongside the patient's preferences.[18]

Conservative therapy avoids unnecessary "soft tissue and periosteal stripping;" although radiological fusion is prolonged, clinical functionality is restored more rapidly than in surgical instances. Malunion occurred in 98 percent of patients managed conservatively; nevertheless, there were no neurological symptoms or sensations of pressure. Furthermore, the originally substantial hump was not cosmetically noticeable as it progressively diminished due to remodeling. Patients must be apprised of the anticipated results and the requirement for revision surgery, especially about implant removal, anytime a surgical approach is contemplated for treatment. Patients must be apprised about "non-union rates" and the difficulties inherent with cautious management.[19]

The data indicate that there is no significant operational distinction among the two groups, even though the surgical group exhibited a shorter union time. Considering that conservative treatment yields similar functional outcomes to surgical intervention, enhances patient satisfaction, and circumvents unnecessary treatments, particularly in economically disadvantaged countries where cost is a significant factor, it may be favored over surgical options. With proper bracing and stringent immobilization, fractures exhibiting displacements above 2 cm will heal appropriately. The primary limitations of our study were its restricted sample size and brief follow-up duration.

CONCLUSION

Based on the findings, it can be concluded that surgical treatment for clavicle fractures leads to a significantly faster union time compared to conservative treatment. However, the non-union rates are similar between the two groups. In terms of functional outcomes, the UCLA scores did not differ significantly at any time point, indicating comparable outcomes. Yet, conservative treatment showed better functional results as reflected by consistently lower DASH scores at later stages. Therefore, while surgery accelerates the healing process, conservative treatment may result in better long-term functional outcomes. These insights can inform the choice of treatment based on the patient's priority, whether it is faster recovery or improved functionality over time.

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