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COMPARISON OF SURGICAL VERSUS NON-SURGICAL MANAGEMENT OF MID-SHAFT CLAVICULAR FRACTURES

Original Research

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ABSTRACT

Background: Mid-shaft clavicle fractures represent a common orthopedic injury, comprising approximately 80–85% of all clavicle fractures and 2–5% of adult fractures. These injuries are frequently encountered in both trauma and sports-related settings. Although non-surgical management has long been the standard due to its simplicity and traditionally favorable outcomes, recent literature suggests that surgical fixation may offer improved functional recovery in displaced cases. However, consensus remains lacking regarding the most effective treatment modality for optimal shoulder function.

Objective: To compare the functional outcomes of surgical management versus non-surgical management of mid-shaft clavicle fractures using the Constant-Murley Shoulder Score at three months.

Methods: This randomized controlled trial was conducted at the Department of Orthopedic Surgery, Benazir Bhutto Hospital, Rawalpindi, from April 15 to October 16, 2023. A total of 60 patients aged 18–80 years with displaced mid-shaft clavicle fractures were enrolled and randomized into two equal groups. Group A received non-surgical management with a figure-of-eight bandage and arm sling, while Group B underwent surgical fixation using plate osteosynthesis. Patients were followed up at three months, and functional outcomes were assessed using the Constant-Murley Shoulder Score. Data were analyzed using SPSS version 22, with a p-value ≤ 0.05 considered statistically significant.

Results: The mean time since injury was 3.67 ± 1.78 hours in the non-surgical group and 3.50 ± 1.55 hours in the surgical group ($p = 0.701$). At the third-month follow-up, the mean Constant score was significantly higher in the surgical group (77.23 ± 4.79) compared to the non-surgical group (68.97 ± 5.14), with a p-value < 0.001.

Conclusion: Surgical management of displaced mid-shaft clavicle fractures resulted in significantly better functional outcomes than non-surgical treatment when assessed at three months post-intervention.

Keywords: Bone Plates, Clavicle Fractures, Constant Score, Fracture Fixation, Midshaft Clavicle, Orthopedic Surgery, Shoulder Function.

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INTRODUCTION

Clavicle fractures are among the most common injuries involving the shoulder girdle, representing approximately 2.6% of all fractures (1). The incidence is notably higher in men during their second and third decades of life, followed by a decline with age. In females, the distribution follows a bimodal pattern, with peaks observed in both younger and older age groups. Of all clavicular fractures, those occurring in the middle third of the bone are the most prevalent, comprising nearly 80–85% of cases (1,2). Traditionally, mid-shaft clavicle fractures have been managed non-operatively, owing to their historically low rates of nonunion and favorable healing outcomes with simple immobilization (3,4). This conservative approach became the standard of care, supported by evidence from earlier studies demonstrating satisfactory clinical results. However, more recent literature has raised concerns regarding the efficacy of non-surgical management in cases of displaced fractures. A growing body of research suggests that conservative treatment may lead to higher rates of nonunion, functional impairment, and cosmetic deformities such as clavicular shortening and visible bony prominence at the base of the neck, largely due to callus formation and malalignment (4–7). These shortcomings have led to an increased interest in surgical options such as open reduction with plate fixation (ORPF) and intramedullary nailing (IMN), both of which aim to restore anatomical alignment and clavicular length more reliably (7,8). Surgical intervention has been associated with improved union rates, faster recovery, and better functional outcomes in selected patients (9,10).

Despite the advantages, operative management is not without complications, including infection, implant-related discomfort, hypertrophic scarring, and, in some cases, the need for hardware removal (11,12). Furthermore, there remains a lack of consensus in the orthopedic community regarding the definitive treatment strategy for displaced mid-shaft clavicular fractures. The literature is limited in direct comparative studies evaluating the long-term functional outcomes of surgical versus non-surgical modalities, particularly in varied demographic and clinical contexts. This ongoing uncertainty highlights the necessity for high-quality evidence to guide clinicians in selecting the most effective and appropriate intervention. Therefore, the objective of the present study is to assess and compare the functional outcomes of surgical and non-surgical management of mid-shaft clavicle fractures, aiming to provide an evidence-based recommendation for the optimal treatment strategy.

METHODS

This randomized controlled trial was conducted in the Department of Orthopedic Surgery at Benazir Bhutto Hospital, Rawalpindi, over a six-month period from April 15, 2023, to October 16, 2023. The study aimed to evaluate and compare the functional outcomes of surgical versus non-surgical management in patients presenting with displaced mid-shaft clavicle fractures. These fractures were confirmed through anteroposterior (AP) and oblique shoulder radiographs, specifically identifying involvement of the middle one-third of the clavicular shaft. The sample size was calculated using the WHO sample size calculator for comparison of mean differences, with a 5% level of significance and 90% power. Based on previously published mean Constant-Murley Scores—75.77 ± 5.96 for non-surgical and 83.63 ± 4.82 for surgical management groups (9)—a total of 60 patients (30 in each group) were included. Patients aged 18 to 80 years, of either gender, who presented with displaced mid-shaft clavicle fractures were eligible for inclusion. Exclusion criteria comprised patients with associated injuries such as shoulder joint dislocations, fractures involving other parts of the body, or those with systemic or pathological bone disorders. Following approval from the Institutional Review Board and Ethical Committee of the hospital, informed written consent was obtained from all participants. Patients meeting the eligibility criteria were selected through non-probability consecutive sampling. Randomization was carried out using a computer-generated random number table in Microsoft Excel. Participants were allocated into two groups: Group A received non-surgical treatment using a figure-of-eight bandage and arm sling, while Group B underwent surgical intervention using plate osteosynthesis.

The primary outcome measure was functional performance assessed via the Constant-Murley Shoulder Score, a validated composite score ranging from 0 to 100 points. This tool assesses four domains: pain (15 points), activities of daily living (20 points), strength (25 points), and range of motion (40 points), including forward elevation, external rotation, abduction, and internal rotation. Higher scores correspond to better shoulder function. Functional assessments were carried out at the three-month postoperative or post-treatment follow-up. Baseline demographic and injury-related variables including age, gender, laterality, cause of trauma, and duration since injury

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were recorded using a structured proforma. Potential confounding variables such as age and gender were controlled both through sample restriction and statistical adjustment during analysis. Data were entered and analyzed using IBM SPSS version 22. An independent samples t-test was applied to compare the mean Constant-Murley Scores and time since injury between the two groups, with a p-value of ≤0.05 considered statistically significant.

RESULTS

A total of 60 patients with displaced mid-shaft clavicle fractures were included in the study, with 30 patients each in the non-surgical and surgical treatment groups. The mean age of participants was 51.27 ± 17.63 years, with an age range of 20 to 80 years. Of the total participants, 25 (41.7%) were male and 35 (58.3%) were female. Left-sided fractures were more frequent, observed in 34 (56.7%) patients, compared to 26 (43.3%) with right-sided fractures. The most common cause of fracture was road traffic accidents, accounting for 23 (38.3%) cases, followed by machine-related injuries in 21 (35.0%), falls from height in 11 (18.3%), and sports-related injuries in 5 (8.3%). The mean time since injury at presentation was 3.58 ± 1.66 hours. When comparing both groups, the mean time since injury was slightly higher in the non-surgical group (3.67 ± 1.78 hours) compared to the surgical group (3.50 ± 1.55 hours), with no statistically significant difference ($p = 0.701$). However, a statistically significant difference was found in functional outcome scores at the third month of follow-up. The mean Constant-Murley Score in the non-surgical group was 68.97 ± 5.14, whereas the surgical group had a significantly higher mean score of 77.23 ± 4.79 ($p < 0.001$).

Stratified analysis showed that in patients aged ≤50 years, the mean Constant score was 68.61 ± 5.95 in the non-surgical group and 77.53 ± 5.21 in the surgical group ($p < 0.001$). In patients older than 50 years, the respective scores were 69.23 ± 4.60 and 76.93 ± 4.51 ($p < 0.001$). Among male participants, the Constant score was 68.08 ± 5.06 in the non-surgical group and 76.33 ± 4.75 in the surgical group ($p < 0.001$). In females, these scores were 69.65 ± 5.25 and 77.83 ± 4.86, respectively ($p < 0.001$). When analyzed by mechanism of injury, patients with road traffic accidents had significantly higher Constant scores in the surgical group (80.28 ± 3.40) compared to the non-surgical group (70.22 ± 4.63) ($p < 0.001$). Although the scores for machine-related injuries and falls from height were higher in the surgical group (73.50 ± 4.72 and 76.87 ± 3.87, respectively) compared to the non-surgical group (67.59 ± 5.52 and 71.33 ± 3.05), the differences did not reach statistical significance ($p = 0.064$ and $p = 0.06$, respectively). Stratified analysis of time since injury showed no statistically significant difference between groups across all age categories, genders, and causes of trauma, with p-values well above 0.05 in each comparison.

Table 1: Descriptive statistics of demographic and fracture related variables

Characteristics		Frequency (%)
Age (Years)		51.27 ± 17.63 (20-80)
Gender	Male	25 (41.7%)
	Female	35 (58.3%)
Involved side	Left	34 (56.7%)
	Right	26 (43.3%)
Time since injury (Hours)		3.58 ± 1.66 (1.0-6.0)
Cause of fracture	Machine-related injury	21 (35.0%)
	Road traffic injury	23 (38.3%)
	Fall from height	11 (18.3%)
	Sports injury	5 (8.3%)

Table 2: Comparison of time since injury and constant score between study groups

	Study Groups		p-value
	Non-Surgical	Surgical	
n	30	30	
Time since injury (Hours)	3.67 ± 1.78	3.50 ± 1.55	0.701 NS
Constant score	68.97 ± 5.14	77.23 ± 4.79	<0.001

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Table 3: Comparison of time since injury between study groups stratified by effect modifiers

Time since injury (Hours)		Study Groups		p-value
		Non-Surgical	Surgical	
Age (Years)	≤ 50	4.23 ± 2.13	4.20 ± 1.32	0.964 NS
	>50	3.23 ± 1.39	2.80 ± 1.47	0.397 NS
Gender	Male	3.85 ± 1.67	3.50 ± 1.68	0.611 NS
	Female	3.53 ± 1.91	3.50 ± 1.50	0.960 NS
Cause of Fracture	Machine related injury	3.41 ± 1.77	2.75 ± 0.96	0.484 NS
	Road traffic Injury	4.11 ± 1.96	3.78 ± 1.25	0.631 NS
	Fall from height	4.33 ± 1.53	4.12 ± 1.88	0.06 NS

Table 4: Comparison of constant score between study groups stratified for effect modifiers

Constant Score		Study Groups		p-value
		Non-surgical	Surgical	
Age (Years)	≤ 50	68.61 ± 5.95	77.53 ± 5.21	<0.001*
	>50	69.23 ± 4.60	76.93 ± 4.51	<0.001*
Gender	Male	68.08 ± 5.06	76.33 ± 4.75	<0.001*
	Female	69.65 ± 5.25	77.83 ± 4.86	<0.001*
Cause of Fracture	Machine related injury	67.59 ± 5.52	73.50 ± 4.72	0.064 NS
	Road traffic Injury	70.22 ± 4.63	80.28 ± 3.40	<0.001*
	Fall from height	71.33 ± 3.05	76.87 ± 3.87	0.06 NS

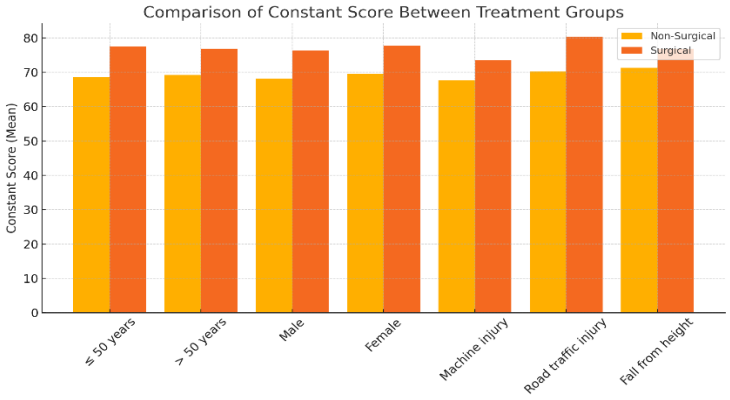

Figure 1 Comparison of Constant Score Between Treatment Group

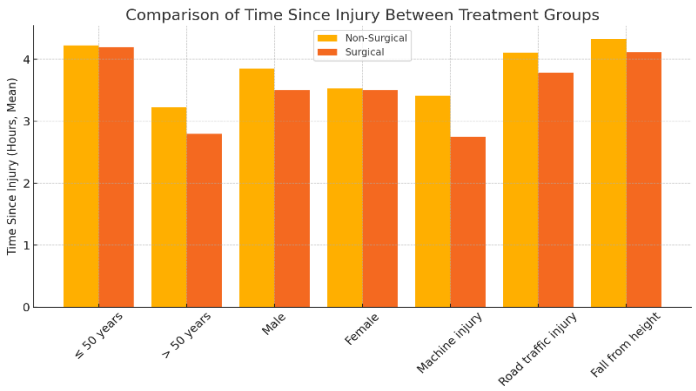

Figure 2 Comparison of Time Since Injury Between Treatment Group

DISCUSSION

The present study demonstrated a statistically significant difference in functional outcomes between surgical and non-surgical management of displaced mid-shaft clavicle fractures, with higher Constant-Murley Scores observed in the surgical group at three months post-intervention. This finding is consistent with prior evidence suggesting that surgical fixation, particularly using plate osteosynthesis, can yield superior early functional recovery in appropriately selected patients. The improved outcomes may be attributed to anatomical restoration of clavicular alignment and length, early mobilization, and minimized residual deformity associated with operative treatment. Clavicle fractures are relatively common, accounting for 2–5% of all adult fractures, and are particularly prone to displacement due to the bone's unique S-shaped contour and subcutaneous position (13-15). Historically, non-operative treatment was preferred due to the bone's excellent natural healing capacity and low rates of nonunion. However, recent shifts in clinical practice have favored surgical approaches, particularly in cases involving displacement, comminution, or high functional demands. Several studies have reported significantly higher Constant scores following surgical fixation compared to non-surgical immobilization, supporting the

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findings of the current study (16-18). Although conservative treatment still holds value in minimally displaced fractures, operative intervention appears to offer tangible benefits in early functional restoration, especially in younger and active individuals.

Despite these benefits, the debate between operative and non-operative management remains nuanced. While surgical management reduces the incidence of nonunion and malunion, long-term functional advantages over conservative treatment remain modest in many cases (19,20). Some literature has shown marginal improvements in validated scoring systems such as Constant-Murley and DASH, suggesting clinically relevant but not necessarily transformative benefits (21,22). It is also important to recognize that surgery carries inherent risks, including infection, hardware-related complications, and the possibility of revision procedures. Therefore, careful patient selection remains critical. The present study contributes valuable data from a local clinical setting, reinforcing global trends. A key strength of this investigation was its randomized controlled design and standardized outcome measurement using the Constant-Murley Score. Additionally, stratified analyses enhanced the robustness of findings across various demographic and injury-related subgroups. However, certain limitations merit consideration. The follow-up period was limited to three months, precluding assessment of long-term functional outcomes, complications, or delayed unions. Moreover, the relatively small sample size and single-center setting may limit the generalizability of results. The study also did not report on the incidence of nonunion, malunion, or adverse events, which are critical parameters in evaluating treatment efficacy. Future studies with larger, multi-center cohorts and extended follow-up periods are needed to provide a more comprehensive understanding of functional, radiological, and quality-of-life outcomes associated with both treatment modalities. Inclusion of patient-reported outcome measures and cost-effectiveness analyses would further enhance clinical decision-making. Overall, the findings of this study support the growing consensus that surgical fixation can be advantageous in managing displaced mid-shaft clavicular fractures, particularly in patients for whom early return to function is a priority.

CONCLUSION

This study concluded that surgical management of displaced mid-shaft clavicle fractures led to superior functional outcomes compared to non-surgical treatment, as assessed by the Constant-Murley Shoulder Score. The findings underscore the clinical value of operative intervention in achieving better shoulder function during the early recovery period. These results support the growing preference for surgical fixation in appropriately selected patients, particularly where early return to daily activities and optimal shoulder performance are desired.

AUTHOR CONTRIBUTION

Author	Contribution
Saif Ullah*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Obaid Ur Rahman	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published

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