

Outcome of Conservative vs Surgical Management of Clavicle

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ABSTRACT

Background: Clavicle fractures are common orthopedic injuries, particularly in young, active individuals. Management of midshaft clavicle fractures remains controversial, with options including conservative treatment and surgical fixation. While conservative care avoids surgical risks, displaced fractures may result in nonunion, malunion, and delayed functional recovery. Surgical fixation aims to restore anatomy, permit early mobilization, and improve functional outcomes. Evidence comparing both approaches in local populations remains limited.

Objective: To compare the functional and radiological outcomes of conservative versus surgical management of clavicle fractures in adult patients.

Methods: A prospective comparative observational study was conducted at Department of Orthopaedic Surgery, BBSTH/ DHQ Hospital Abbottabad from Sep 2022 to August 2023. Adult patients (18-60 years) with acute midshaft clavicle fractures were enrolled and allocated to conservative or surgical treatment groups. Conservative management involved arm sling immobilization and physiotherapy, while surgical patients underwent open reduction and internal fixation with precontoured plates. Functional outcomes were assessed using the Constant-Murley shoulder score at three and six months. Radiological outcomes included time to union, union rate, and incidence of nonunion. Complications were documented. Statistical analysis included t-tests and chi-square tests, with $p < 0.05$ considered significant.

Results: A total of 120 patients were analyzed (62 conservative, 58 surgical). Surgical management resulted in significantly faster fracture union (11.2 ± 2.1 vs. 15.6 ± 3.4 weeks, $p < 0.001$), higher union rates (96.6% vs. 83.9%, $p = 0.02$), and superior Constant-Murley scores at six months (88.4 ± 6.2 vs. 78.1 ± 8.5 , $p < 0.001$). Complications were fewer in the surgical group, although both approaches were generally safe.

Conclusion: Surgical fixation of midshaft clavicle fractures provides faster union, higher union rates, and better early functional outcomes compared to conservative management, particularly in displaced fractures.

Keywords: Clavicle fracture; Surgical fixation; Conservative treatment; Functional outcome

INTRODUCTION

One of the most frequently experienced skeletal injuries, which is presented in orthopedic practice, is clavicle fractures, which comprise about 25-50 percent of all fractures with up to 44 percent of all injuries involving the shoulder girdle¹. These are often associated with young and active people after road traffic collisions, falls and sport related injuries and cause huge morbidity, and temporary or permanent functional disability². A clavicle is an important attribute of shoulder biomechanics as it helps to keep the scapula in position and significantly improves movement of the upper limb, which is why proper fracture management is essential³.

Most clavicle fractures most especially the midshaft ones were traditionally treated without surgery either with arm sling or figure-of-eight bandages and early literature show good results [3]. Conservative treatment has found wide acceptance since it is non-invasive, it is cheap and eliminates the chances of surgery that comes with risks. Nonetheless, there has been more up-to-date evidence that allows raising concerns about increased rates of non-union, malunion and chronic shoulder dysfunction when managed non-operatively in displaced fractures⁴.

Surgical techniques and devices used in fixation of the clavicles have improved which is why there is a change towards operative management of the selected clavicle fractures. The goals of surgical fixation include restoration of anatomy, rigid fixation and allowance of early shoulder mobility, which would result in better functional outcome⁵. In various studies the plate fixation of the displaced midshaft clavicle fractures has been shown to (a) reduce the non-union rates and (b) restore daily activity earlier than conservative management.

Although these are possible benefits, surgery as a treatment of clavicle fracture has its risks. The literature has reported complications like surgical site infection, irritation of the hardware, implant failure, neurovascular injury and secondary procedures⁶. The mentioned aspects require the careful selection of patients, especially in healthcare systems where surgical facilities and postoperative care might be insufficient⁷.

The choice on conservative or surgical treatment is still debatable and depends on a variety of factors such as displacement, comminution, shortening, age of the patient, functional demand, and aesthetic considerations of the patient⁶. Even though various randomized controlled trials and meta-analyses have compared the two modality of treatment, inconsistent findings and discrepancy in the outcome measures have hindered the development of a general guideline to treatment⁸.

In developing nations like Pakistan, one of the orthopedic presentations is clavicle fracture, mainly because of the high mortality rates of road traffic accidents and falls². Nevertheless, there are few locally obtained data of functional and radiological results of conservative and surgical treatment. The disparities in patient demographic, late presentation, socioeconomic factors, and post-treatment follow-up could affect the final results of treatment, so region-specific evidence is essential^{4,8}.

A comparison between the outcomes of conservative and surgical treatment in a local tertiary care unit may aid in further development of the treatment regimen, better use of the available resources, and patient education on predicted recovery and complications^{5,7}. This type of comparative data are vital in order to inform evidence-based practice and management strategies in accordance with the demands of the local population⁸.

Objective: To compare the functional and radiological results of conservative and surgical treatment of clavicle fractures in adult patients who present to a tertiary care hospital.

METHODOLOGY

Study Design and Setting: The paper was a prospective comparative observational study, which was undertaken at the Department of Orthopaedic Surgery, BBSTH/ DHQ Hospital Abbottabad from Sep 2022 to August 2023. The hospital is a large referral center of urban and rural people of Khyber Pakhtunkhwa and a large number of trauma cases is referred. The research was conducted throughout twelve months, January 2024 to December 2024 after the Institutional Review Board and Hospital Ethical Committee gave its consent.

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Population of Study and method of sampling: The eligibility assessment of adult patients was conducted in the emergency department or orthopedic outpatient clinic with a diagnosis of clavicle fracture. The enrolment of patients who met the study inclusion criteria was carried out through a non-probability consecutive sampling method during the study period. All the participants were provided with informed consent before being enrolled. The patients were divided into two groups according to the choice of treatment modality predetermined by the orthopedic consultant present in the clinic as per the common clinical indications as well as patient preference.

Inclusion and Exclusion Criteria: The subjects included in the study were patients aged 18-60 years of both sexes with a confirmed acute fracture of the clavicles radiologically that occurred within two weeks after the injury. Dislocated and undislocated fractures of the midshaft of the clavicle were taken into account. Patients who had open fractures, pathological fractures, fractures and neurovascular injury, floating shoulder, polytrauma and needing intensive care management, had previous shoulder pathology, or were medically unable to undergo surgery were excluded. Patients that refused to give their consent or lost to follow-up were not included in the final analysis.

Treatment Protocols: The conservative management group was treated by putting the patient on an arm sling to immobilize as well as using analgesics and instructions on gradual shoulder mobilization. The immobilization was normally continued between three to four weeks after which physiotherapy under supervision is continued in terms of range of motion and strengthening exercises. The surgical management group involved patients who were subjected to open reduction and internal fixation with precontoured locking plates under the general anesthesia. The consultant orthopedic surgeons carried out all surgical procedures in accordance with the standard operative procedures. The postoperative management involved analgesia, wound management, antibiotic prophylaxis, and early commencement of passive and active shoulder exercises by the patient.

Data Collection and Results Measures: The baseline demographic data such as age, gender, mechanism of injury, side of fracture and fracture displacement were estimated during the enrolment. The radiographic evaluation was done with standard anteroposterior clavicle radiographs at initial presentation and at subsequent follow-ups. The Constant Murley Shoulder score was used to determine the functional outcomes of the shoulder and measures pain, daily activities, range of movement, and strength. The radiological outcomes were the time to fracture union, which was the presence of bridging callus on x-rays and absence of tenderness at fracture site. Problems like non-union, malunion, infection, implant related, and stiffness of the shoulder were reported.

Follow-Up Protocol: All patients were also tracked at a specific time of two weeks, six weeks, three months and six months after their treatment. Clinical check-up and radiographic checking were carried out by every follow-up visit in order to evaluate the fracture healing and functional recovery. The functional scores were measured at six and three months. The patients who did not meet the schedule follow-up visits were called to comply with ensuring that they would not lose to follow-up.

Statistical Analysis: Statistical Package of Social Sciences (SPSS) version 26 was used in entering and analysing data. Such quantitative variables as age, time to union, and functional scores were presented in the form of mean and standard deviation, whereas such qualitative variables as gender, fracture side, and complications were depicted in the form of frequencies and percentages. The chi-square test was implemented in comparing the categorical variables whereas the independent sample t-test was carried out to assess the comparison of the continuous variables between the surgical and the conservative group. The p-value of less than 0.05 was regarded as statistically significant.

Ethical Considerations: The study was developed with the support of the Institutional Review Board of the hospital that

provided ethical approval before the study started. All the participants were provided with informed written consent after being informed about the goals of the study, procedures, possible advantages, and risks of the study. The study observed patient confidentiality and the data were utilized to conduct the research as per the research ethics.

RESULTS

One hundred and twenty patients who had their clavicles fractured were used in the final analysis. Among them, 62 patients (51.7%), received conservative treatment and 58 patients (48.3%), were treated with surgical fixation. The average age of the study population was 34.6 ± 9.8 years and there was no statistically significant difference between the two groups ($p=0.42$). The male patients dominated in both categories indicating the high prevalence of trauma-related injuries among the young adults. Table 1 indicated that the baseline demographic characteristics and a profile of injuries were similar in the two groups.

The most prevalent mechanism of injury was road traffic accidents then falls. Right-sided fractures of the clavicles were a bit more in both groups as compared to left-sided fractures. There were also displaced fractures in the surgical group that were much more prevalent than the conservative group ($p < 0.001$), which means that the cases were properly chosen to be operated (Table 1).

Radiological outcomes showed a statistically significant difference between the mean time to fracture union in the surgical and the conservative group where surgical group had a shorter mean time of 11.2 ± 2.1 weeks and the conservative group had a longer mean of 15.6 ± 3.4 weeks. The success rate of union was high in 96.6 percent of patients who were surgically treated and 83.9 percent who were conservatively treated. Table 2 shows that nonunion rates were more in the conservative group (12.9%), than the surgical group (3.4%).

There was a superior outcome in the surgical group measured by the constant Murley shoulder score in functional outcomes at three months and six months follow-up. At six months, the Constant Murley mean score was 88.4 ± 6.2 in the surgical group and 78.1 ± 8.5 in the conservative group and this was significantly different ($p < 0.001$). Both groups had shown improvement in functional scores over time; but recovery had been quicker and more complete in surgically treated patients (Table 3). These differences in functional outcomes are graphically illustrated with the help of the graph of figure 1.

The two groups were different in terms of complication rates. There was more Malunion and shoulder stiffness in the conservative group and implementation related irritation and superficial surgical site infection in the surgical group. The total complication rates were also more in the conservative group (29.0) than in the surgical group (17.2), but the difference was not statistically significant ($p = 0.11$). Table 4 gives the detailed distribution of complications.

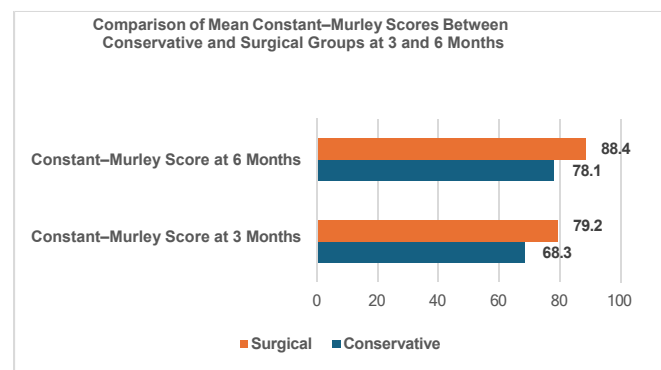


Figure 1: Comparison of Mean Constant-Murley Scores Between Conservative and Surgical Groups at 3 and 6 Months

Table 1: Baseline Demographic and Clinical Characteristics of Patients

Variable	Conservative (n=62)	Surgical (n=58)	Test Statistic	p-value
Mean age (years)	35.1 ± 10.2	34.0 ± 9.4	t = 0.81	0.42
Male gender	46 (74.2%)	44 (75.9%)	$\chi^2 = 0.04$	0.84
Road traffic accident	38 (61.3%)	40 (69.0%)	$\chi^2 = 0.78$	0.38
Right-sided fracture	34 (54.8%)	33 (56.9%)	$\chi^2 = 0.05$	0.82
Displaced fracture	29 (46.8%)	49 (84.5%)	$\chi^2 = 18.6$	<0.001

Statistical test: Independent sample t-test for continuous variables and Chi-square test for categorical variables

Table 2: Radiological Outcomes

Outcome	Conservative (n=62)	Surgical (n=58)	Test Statistic	p-value
Mean time to union (weeks)	15.6 ± 3.4	11.2 ± 2.1	t = 8.54	<0.001
Union achieved	52 (83.9%)	56 (96.6%)	$\chi^2 = 5.12$	0.02
Non-union	8 (12.9%)	2 (3.4%)	$\chi^2 = 3.56$	0.05

Statistical test: Independent sample t-test and Chi-square test

Table 3: Functional Outcomes (Constant-Murley Score)

Follow-up Time	Conservative	Surgical	Test Statistic	p-value
3 months	68.3 ± 9.1	79.2 ± 7.4	t = 7.01	<0.001
6 months	78.1 ± 8.5	88.4 ± 6.2	t = 7.54	<0.001

Statistical test: Independent sample t-test

Table 4: Complications in Both Treatment Groups

Complication	Conservative (n=62)	Surgical (n=58)	χ^2 value	p-value
Malunion	10 (16.1%)	2 (3.4%)	5.02	0.02
Shoulder stiffness	6 (9.7%)	3 (5.2%)	0.86	0.35
Surgical site infection	0	3 (5.2%)	3.28	0.07
Implant irritation	0	4 (6.9%)	4.44	0.03
Total complications	18 (29.0%)	10 (17.2%)	2.56	0.11

Statistical test: Chi-square test

DISCUSSION

This paper shows that surgical therapy in clavicle fracture is linked to greater radiological healing, rate of union and functional results than conservative therapy. The findings are consistent with an increasing amount of current evidence indicating that operative fixation, especially of displaced midshaft clavicle fractures, offers more predictable healing, and better shoulder functions than non-operative treatment^{9,10}.

The average fracture union time was found to be much lower in surgical group compared to the conservative one in this study. Identical shortenings of period, to joining with plate fixation, have been found in the new comparative research and pooled research, which explain this aid through anatomical diminution, fixed fixation and early movement through surgery^{11,12}. Early union not only leads to faster recovery to normal practice but it also minimizes the period of pain and immobilization that is also a consideration to young and economically viable patients.

The overall union rate and nonunion rate that was higher among surgically handled patients in the current study is akin to the results in recent meta-analyses that found the nonunion rate after operative fixation to be 2 to 5 percent as opposed to 10 to 15 percent after conservative treatment in displaced fractures^{10,13}. Nonion in conservatively treated clavicle fractures has been closely linked to fracture displacement, shortening, as well as comminution, which had a higher incidence in the patients who have been selected to undergo surgery in the current study but they were successfully managed using fixation¹⁴.

The surgical group performed much better in both the three- and six-month follow-ups using the Constant Murley score as a functional measure. Other recent trials have also documented better early and intermediate functional scores of operative managements, especially during the initial six months of injury^{9,15}. The higher functional recovery rates after the operation can be

also associated with the recovery of clavicular length, the enhancement of shoulder biomechanics, and realization of early rehabilitation. Though there is a hypothesis that longer-term functional differences can be reduced with time, early functional advantage is still clinically significant particularly among patients who have high functional demands¹⁶.

Patterns of complications in the current research are similar to those described by current literature. Malunion and shoulder stiffness were found to be higher with conservative treatment which has been proven to adversely affect the strength of the shoulder, its endurance, and cosmetic satisfaction^{12,17}. It has been associated with shortening of the scapulothoracic joints, which has been associated with scapulothoracic altered scapulothoracic mechanics and persistent pain, which could be attributed to the lower functional scores witnessed in the conservative group¹⁸.

On the other hand, surgical management was linked with implant irritation and superficial surgical site infections. These problems were continuously reported in recent literature, and one of the most prevalent causes of the secondary surgeries after clavicle repair is the prominence of the implant^{11,19}. Most problems associated with implants are however not severe and can be controlled and the effects they cause on the end result of final functional performance is usually not so severe compared to the effects of non-union or symptomatic malunion²⁰.

The general complication rates were higher numerically in the conservative group yet the difference was not statistically significant. The fact that surgery presents a risk of procedures but the conservative treatment presents a risk of healing-related complications that could pose more long-term functional implications validates this observation^{13,16}. The results of this study highlight the significance of personalized treatment choices using the features of the fractures, the expectations of the patient, and the functional needs.

Limitations: This research has a number of limitations. The non-random nature of the treatment groups could have affected the selection bias in terms of patients who had more displaced fractures were more likely to be subjected to surgery. The six-month follow-up was not considered a sufficiently long follow-up period to address both long-term functional outcome and late complications (implant failure or refracture following implant removal). Moreover, one functional scoring system might be not representative of all patient-reported outcome and satisfaction. Bigger studies with protracted follow-up and patient-reported outcome measures would give a more detailed understanding of the comparison of conservative and surgical treatment of clavicle fractures.

CONCLUSION

Surgery treatment of clavicle fracture had shown faster radiological union, higher rate of union and better early functional outcome as opposed to conservative treatment especially in displaced midshaft fracture. Although conservative management is still a viable solution in minimally displaced fractures, it has been related to increased incidences of nonunion, malunion, and delayed functional recovery in this study. Even with the complication of procedures (implant irritation and surface infection) in the first six months, the outcome of the fixation was more predictable and better shoulder performance in operative fixation. It is necessary to carefully select patients depending on the nature of their fractures, the requirements of functional tasks, and expectations to achieve the best possible outcome and then make personalized decisions about treatment.

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