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Research Article

Long-Term Functional Outcomes and Complications of Non-Surgical Management for Clavicular Middle Third Fractures

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Abstract

Background: Clavicle fractures are relatively common, and most often occur in the middle third. Fractures that are not displaced or are displaced with no other indication for surgical intervention are treated supportively. Displaced fractures that have been managed non-surgically have had acceptable outcomes. The goal of this study is to evaluate pain scores, the resumption of daily activities, rates of acceptable healing, non-union, malunion, and the need for additional surgical intervention.
Methods: This observational study was conducted on 432 patients with midclavicular fractures who were referred to a high-level trauma center. All patients were treated non-surgically and followed for six months. The primary outcomes were patients' function or disability, assessed using the Disabilities of the Arm, Shoulder, and Hand (DASH) and University of California, Los Angeles (UCLA) scores. The secondary outcomes included the rate of pain relief, measured by the Verbal Numeric Scale (VNS) score, as well as complications such as malunion, nonunion, and the need for secondary surgical intervention.
Results: A total of 432 patients were enrolled. The rates of malunion and nonunion were 63.4% and 2.3%, respectively. Patients with malunion exhibited a higher pain score ($P < 0.001$). The average UCLA score among patients was 32.53, which corresponds to good and excellent grades; it was significantly lower for those with malunion ($P < 0.001$). The mean DASH score was 5.92, and there was no significant difference between the two groups regarding malunion and normal union ($P > 0.05$).
Conclusion: Our study demonstrated a low non-union rate, good functionality, and a high rate of satisfaction among patients with middle third clavicle fractures who were treated non-surgically.

Keywords: Clavicle; Fractures; Conservative Treatment; Union

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Background

Clavicle fractures are relatively common, and most of them occur in the middle third (1). They can be managed surgically or non-surgically (2). Fractures that are not displaced or are displaced without other indications for surgical intervention are treated supportively; displaced fractures that have been managed non-surgically have had acceptable outcomes (3). Various non-surgical treatments have been described, but often, a simple sling or figure-of-8 bandage is used (2). Most physicians recommend supportive and non-surgical care for 6 weeks, and they rarely need open reduction (4-6). Open reduction and internal fixation (ORIF) is indicated for those with open fractures accompanied by neurovascular complications, distal third fractures accompanied by a torn coracoacromial ligament in adults, soft tissue engagement between fractured parts, floating shoulder, severe displacement accompanied by humerus, rib, or other clavicle fractures, failure of non-surgical management, and non-union (5, 7).

Serious complications are not common following the fractures of the middle third of the clavicle; the most common one is mal-union, which can lead to angulation, shortening, or cosmetic issues. Malunion may rarely cause malfunction or neurologic defect, especially in the case of shortening more than 2 centimeters (8). Non-union is defined as no evidence of union after 4-6 months; predisposing factors include more displacement of fractured parts, severe trauma, comminuted fracture, shortening, surgical intervention, advanced age, and inadequate immobilization (9, 10).

Given the number of midclavicular fracture cases that emergency physicians encounter and manage –often as the first line of care and frequently as the final decision-maker in emergency departments, particularly in trauma centers –this study was designed to examine the long-term (6 months) outcomes of these cases, which have been managed non-surgically by emergency physicians. The aim is to estimate pain scores, return to daily activities, rates of acceptable union, non-union, mal-union, and the need for secondary surgical intervention.

Methods

In this prospective observational study, all patients aged 18-65 years who were referred to an academic emergency department (Shohadaye Haftom Tir Hospital, Tehran, Iran) with midclavicular fractures and treated non-surgically from August 23rd, 2020, through August 22nd, 2021, were included.

The Ethics Committee of Iran University of Medical Sciences, Tehran, approved the analysis of patients with clavicular middle third fractures under letter No. IR.IUMS.FMD.REC.1398.057. Therefore, this research adhered to the standards laid down in the Declaration of Helsinki.

These patients were followed up for 6 months through clinic visits, telephone calls, and hospital files; data were entered in pre-prepared checklists. Those with bilateral fractures, outside the 18-65 age range, or those who underwent primary surgery were excluded.

Patients' primary outcomes were assessed by their functional status or disabilities, using the University of California, Los Angeles (UCLA) and Disabilities of the Arm, Shoulder, and Hand (DASH) scores, respectively. Secondary outcomes included the rate of pain relief, measured by the Verbal Numeric Scale (VNS) score, as well as complications such as mal-union, non-union, and the need for secondary surgical intervention, evaluated through radiological assessments.

The UCLA Shoulder Score is a joint evaluation, incorporating sections completed by both the physician and the patient. Its categories consist of "active forward flexion" (maximum of 5 points and completed by the physician), "strength of forward flexion" (maximum of 5 points and completed by the physician), "pain" (maximum of 10 points and completed by the patient), "satisfaction" (maximum of 5 points and completed by the patient), and "function" (maximum of 10 points and completed by the patient). Scores range from 0 to 35, with a score of 0 indicating poor shoulder function and 35 indicating excellent shoulder function.

The DASH is a 30-item self-report questionnaire that uses 5-point Likert scales for response options. Scores range from 0 (no disability) to 100 (most severe disability) and are designed to be useful for patients with any musculoskeletal disorder of the upper limb. This questionnaire inquires about symptoms such as pain, ability to perform certain activities, and sleep quality based on conditions in the past week. If patients did not have the chance to perform an activity during that time, they should provide their best estimate of which response would be most accurate. It does not matter which hand or arm they use to carry out the activity; they should answer based on their ability, regardless of how they perform the task. VNS is an 11-point scale from 0 (no pain) to 10 (insufferable pain).

Data analysis was performed using SPSS software (version 22, IBM Corporation, Armonk, NY, USA). Numerical variables were reported as mean and standard deviation (SD), while qualitative variables were summarized by frequency and percentage of frequency. The Student's t-test or Mann-Whitney U test was used to analyze the quantitative data. A significance level of P-value less than 0.05 was considered significant.

Results

A total of 478 patients who met the inclusion criteria were enrolled; all were treated with arm slings, and 46 cases were excluded afterward. Of those, 40 were lost to follow-up, two had concomitant arm and shoulder injuries, and four experienced similar trauma again during the following month.

A total of 432 patients with midclavicular fractures were followed for a minimum of 6 months; 376 (87%) were men, and 56 (13%) were women. Their average age was 32.44 years, with an SD of 13.18 years; the youngest and oldest patients were 18 and 60 years old, respectively. The demographic characteristics of the patients are presented in table 1.

Table 1. Demographic characteristics of patients

	Value
Sex	
Men	376 (87.00)
Women	56 (13.00)
Age (year)	32.40 ± 13.38
Side of fracture	
Right	244 (56.48)
Left	188 (43.52)
Mechanism of injury	
Motor vehicle collision	240 (63.80)
Auto-pedestrian collision	72 (19.10)
Falling down	48 (12.80)
Simple fall	16 (4.30)
Concomitant injuries	
Face	22 (5.60)
Chest wall	26 (6.10)
Lungs	10 (2.30)
Extremities	14 (3.20)

Data are presented as mean ± standard deviation (SD) or number and percent

Primary and secondary outcomes have been indicated in tables 2 and 3. Only 35.3% (n = 148) of cases had a normal union, while the rate of non-union was 2.3% (n = 10) and mal-union rate was 63.4% (n = 274).

Table 2. Rate of pain, function, and disabilities in the patients

	Minimum	Maximum	Mean ± SD
VNS score	0	5	0.64 ± 1.26
DASH score	0	70	5.92 ± 16.18
UCLA score	13	35	32.53 ± 4.49

VNS: Verbal numeric scale; DASH: Disabilities of the Arm, Shoulder, and Hand; UCLA: University of California, Los Angeles (shoulder score); SD: Standard deviation

The rates of pain, function, and disabilities are shown in tables 2 and 3. While 132 patients (16.7%) experienced pain after 6 months, 300 (83.3%) reported no pain at that time. The VNS scores were higher in patients with mal-union ($P < 0.001$), and only two patients with normal union had pain after 6 months. The rates of morbidity and shoulder function were evaluated using the UCLA and DASH scales. Pain, function, active shoulder performance, strength, and patient satisfaction were assessed at UCLA, where a score of 27 or above is considered good to excellent. The mean UCLA score among our patients was 32.53, with only 36 patients (8.33%) scoring below 27, all of whom belonged to the mal-union group ($P < 0.001$). The mean DASH score was 5.92, and there was no significant difference between the mal-union and normal union groups ($P > 0.05$). Furthermore, there was no relationship between pain levels, UCLA scores, DASH scores, and the shortening of the fractured clavicle (more or less than 2 centimeters). None of the 10 patients with non-union required secondary corrective surgery due to sufficient pain control and good function, except for one patient, in whom serial radiographs showed progressive displacement.

Discussion

Our study proved the results of previous studies in terms of etiology of clavicle fracture, direct trauma due to traffic collisions as the most common cause.

The most common concomitant injuries were the same as what was reported in previous studies, including rib fracture, scapula fracture, pneumothorax, and hemothorax.

Because some patients refused to refer to the clinic and to reduce the errors, we used a VNS instead of a Visual Analog Scale (VAS) to rate pain scores; it has been shown to have the same value. We recorded fewer mean scores compared to those reported previously (0.64 versus 0.9-1.8) (11).

Table 3. Rate of pain, function, and disabilities related to the union in the patients

	Normal union	Mal-union	P-value	Shortening > 2 cm	Shortening < 2 cm	P-value
VNS score	0.08	0.96	0.001	1.20	0.55	0.079
DASH score	6.47	5.80	0.168	4.27	6.18	0.062
UCLA score	33.92	31.70	0.001	32.20	32.58	0.312

VNS: Verbal numeric scale; DASH: Disabilities of the Arm, Shoulder, and Hand; UCLA: University of California, Los Angeles (shoulder score)

Pain outcomes in our cohort (mean VNS: 0.64) were superior to earlier reports, potentially due to the use of VNS over VAS. While malunion correlated with higher pain scores, only 16.7% of patients reported residual pain, mirroring high satisfaction rates in studies where 79% of adolescents reported perfect patient-reported outcomes after nonoperative care (12).

We obtained a mean DASH score less than the previous studies (5.92 versus 11.10-13.55) (13, 14). We could not find any difference in DASH scores between the two groups with a shortening of more or less than 2 centimeters, which has already been seen in higher scores in those with a shortening of more than 2 centimeters (14); those results might have been due to other factors, such as age, sex, and mechanism of injury. We could report a high mean UCLA score (32.53), which is considered excellent according to previous studies (above 27).

Notably, a prospective study identified angulation (> 22.8°) and shortening (> 16.8 mm) as critical thresholds for predicting suboptimal functional outcomes (constant score < 85) (15). Our results, however, suggest that even with malunion, patients achieved excellent UCLA scores (mean: 32.53) and minimal disability (mean DASH: 5.92), underscoring the resilience of shoulder function despite radiographic imperfections. This discrepancy may reflect differences in patient populations or adaptive mechanisms, as seen in adolescent cohorts where remodeling significantly reduced initial shortening (12).

This study's observational design and single-center cohort may introduce selection bias, particularly in a high-energy trauma setting where surgeons might favor surgery for complex cases. Loss to follow-up (9.6%) and reliance on self-report metrics instead of clinician-assessed tools may affect generalizability. Additionally, while our results align with long-term adolescent outcomes, the lack of pediatric data limits extrapolation to younger populations. Future studies should integrate predictive models to stratify patients for surgical versus non-surgical pathways based on displacement thresholds and comorbidities.

Conclusion

Our study showed a low non-union rate, good function, and high satisfaction rate in patients with fractures of the middle third of the clavicle who were managed non-surgically.

Conflict of Interest

The authors declare no conflict of interest in this study.

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