

Research Article / Araştırma Makalesi

Demographic and clinical characteristics of patients with isolated sternal fractures: a retrospective study

İzole sternal fraktürlü hastaların demografik ve klinik özellikleri: retrospektif bir çalışma

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ABSTRACT

Objective: Isolated sternal fractures represent a rare yet clinically significant subgroup of chest trauma. This study aimed to evaluate the demographic and clinical characteristics, trauma mechanisms, fracture localizations, and treatment outcomes of patients with isolated sternal fractures.

Materials and Methods: A retrospective analysis was conducted on 151 patients diagnosed with isolated sternal fractures and treated between January 2013 and November 2023. Patients were assessed based on age, gender, mechanism of injury, fracture localization, treatment method, and clinical course. Fractures were classified into three anatomical regions, and trauma mechanisms were categorized into five groups. Data were analyzed using SPSS version 23.0.

Results: Of the patients, 71.5% were male, and the mean age was 51.5±18.3 years. The most common cause of trauma was motor vehicle accidents (74.2%). The most frequently affected fracture site was the corpus sterni (48.3%). All patients were managed conservatively, and no mortality or significant cardiac complications were observed. The mean length of hospital stay was 3.24±1.15 days.

Conclusion: These findings suggest that isolated sternal fractures typically follow a stable clinical course and can be effectively managed with conservative treatment.

Keywords: Sternal fracture, chest trauma, isolated injury, conservative management

ÖZET

Amaç: İzole sternum kırıkları, göğüs travmalarının nadir fakat önemli bir alt grubunu oluşturur. Bu çalışma, izole sternum kırığı olan hastalarda demografik ve klinik özellikleri, travma mekanizmalarını, kırık lokalizasyonlarını ve tedavi sonuçlarını değerlendirmeyi amaçlamaktadır.

Materyal ve Metot: Ocak 2013- Kasım 2023 tarihleri arasında izole sternum kırığı tanısıyla takip edilen 151 hastanın verileri retrospektif olarak incelendi. Hastalar; yaş, cinsiyet, travma nedeni, kırık lokalizasyonu, tedavi şekli ve klinik seyir açısından değerlendirildi. Kırıklar üç anatomik bölgeye göre, travma mekanizmaları ise beş gruba ayrılarak sınıflandırıldı. Veriler SPSS 23.0 programı ile analiz edildi.

Bulgular: Hastaların %71,5'i erkekti ve yaş ortalaması 51,5±18,3 yıldı. En sık travma nedeni motorlu taşıt kazalarıydı (%74,2). En yaygın kırık lokalizasyonu korpus sterniydi (%48,3). Tüm hastalar konservatif olarak tedavi edildi, mortalite ve ciddi kardiyak komplikasyon gelişmedi. Ortalama yatış süresi 3,24±1,15 gün olarak bulundu.

Sonuç: Elde edilen bulgular, izole sternum kırıklarının genellikle stabil seyirli olduğunu ve konservatif tedavi ile etkili biçimde yönetilebildiğini ortaya koymaktadır.

Anahtar Kelimeler: Sternum kırığı, göğüs travması, izole yaralanma, konservatif tedavi

INTRODUCTION

Sternum fractures constitute a rare but clinically important subgroup of chest trauma. Such fractures usually occur as a result of blunt trauma related to motor vehicle accidents (MVAs). The widespread use of seat belts has increased the incidence of sternal fractures due to the anterior-posterior forces generated during sudden deceleration (1,2,3). Although these fractures are not always associated with serious internal organ injuries, they should be carefully evaluated to exclude life-threatening complications, especially cardiac contusion (4,5).

Diagnosis is typically confirmed through lateral chest radiography and computed tomography (CT), with electrocardiography (ECG) and cardiac enzyme analysis employed to exclude cardiac injury. Differential diagnosis must also consider manubriosternal dislocation, sternoclavicular joint injuries, and anterior rib fractures.

Most isolated sternal fractures are managed conservatively with pain control, respiratory support, and activity modification. Surgical intervention is rarely required but may be indicated in cases involving severe displacement, persistent instability, or intractable pain.

Although such fractures often heal with conservative treatment, patients often can present with accompanying traumatic findings such as rib fractures, hemopneumothorax, and spinal injuries [6,7]. Despite their increasing recognition in clinical settings, comprehensive data on demographic features, trauma mechanisms, and treatment approaches for isolated sternal fractures are still limited.

The aim of this study was to comprehensively evaluate the demographic and clinical characteristics, trauma mechanisms, fracture locations, and treatment approaches of patients diagnosed with isolated sternal fractures.

MATERIALS AND METHODS

In this retrospective cross-sectional study, 151 patients who were admitted to Cumhuriyet University Faculty of Medicine Research and Training Hospital between January 2013 and November 2023 and diagnosed with isolated sternum fractures were examined. Data were retrieved from the hospital's electronic medical record system and when necessary, supplemented by archived patient files.

Patients were diagnosed with isolated sternal fractures based on clinical findings and confirmed by lateral chest radiography and/or thoracic CT (Figure 1). Patients with associated thoracic injuries (e.g., rib fractures, pneumothorax, hemothorax, vertebral fractures), incomplete medical records, or non-traumatic etiologies were excluded from the study.



Figure 1: Thorax CT image of sternum fracture

The evaluated parameters included age, gender, trauma mechanism, fracture localization, vital signs at admission, radiological findings, treatment methods, and clinical outcomes.

Fracture locations are classified as corpus sterni, manubrium, corpus + manubrium, xiphoid, and manubrium + xiphoid. Trauma mechanisms are divided into five main groups: MVAs, falls from heights, falls on flat ground, physical assault and earthquake. Treatment methods were classified as conservative or surgical.

Statistical analyses were performed using SPSS version 23.0. Continuous variables were expressed as mean \pm standard deviation (SD), and categorical variables as frequency and percentage. The normality of distribution for continuous variables was assessed using the Shapiro-Wilk test. Depending on data distribution, group comparisons were performed using either the independent samples t-test or the Mann-Whitney U test for continuous variables. The Chi-square test or Fisher's exact test was used for categorical variables. A p-value of <0.05 was considered statistically significant.

RESULTS

When the data of 151 patients included in the study were examined, it was determined that 108 were male (71.5%) and 43 were female (28.5%). The mean age of the cases was 51.5 ± 18.3 years, and ages ranged from 12 to 92. When the mean ages were examined according to gender, the mean age was calculated as 50.1 ± 18 years in male patients and 54.8 ± 19.1 years in female patients. Although women were older on average than men, this difference was not found to be statistically significant ($p = 0.16$).

When the trauma mechanisms causing sternum fractures were evaluated, the most common factor was found to be MVAs, and this type of trauma was detected in 112 cases (74.2%). MVAs was followed by falls from heights (25 cases, 16.6%), falls on flat ground (6 cases, 4.0%), assault (5 cases, 3.3%), and earthquake-related traumas (3 cases, 2.0%). These findings show that sternum fractures mostly develop due to high-energy traumas.

When the trauma mechanisms were compared according to gender, a significant difference was observed in the MVAs group (Table 1). In this group, 85 of the 112 patients who developed sternum fractures were male (75.9%) and 27 were female (24.1%). This difference was found to be significant in the statistical analysis ($p < 0.0001$).

Among the cases of falls from heights, 13 were male and 12 were female, and among the cases of falls from flat ground, 4 were male and 2 females, but these differences were not found to be statistically significant ($p = 0.78$ and $p = 0.25$).

Trauma Mechanism	Male n (%)	Female n (%)	p-value	Statistical Significance
Motor Vehicle Accident (MVA)	85 (75.9%)	27 (24.1%)	< 0.0001	Significant
Fall from Height	13 (52.0%)	12 (48.0%)	0.7773	Not significant
Ground-Level Fall	4 (66.7%)	2 (33.3%)	0.2482	Not significant
Earthquake	1 (33.3%)	2 (66.7%)	0.4142	Not significant

When fracture locations were examined, it was determined that the most frequently affected region was the corpus sterni (Table 2). Fractures in this region were detected in 73 patients (48.3%). This was followed by 54 fractures (35.7%) in the manubrium

region and 17 fractures (11.3%) involving the corpus + manubrium regions together. Xiphoid fractures were seen in 6 patients (4.0%), and manubrium + xiphoid fractures were seen in only 1 patient (0.7%).

Fracture Location	n (%)
Corpus Sterni	73 (48.3%)
Manubrium	54 (35.7%)
Corpus + Manubrium	17 (11.3%)
Xiphoid	6 (4.0%)
Manubrium + Xiphoid	1 (0.7%)

Total number of patients included in the analysis: $n = 151$.

When fracture locations were evaluated according to gender; Corpus sterni fractures were seen in 48 male (65.8%) and 25 female (34.2%) patients, corpus + manubrium fractures were seen in 14 male (82.4%) and 3 female (17.6%) patients, and manubrium fractures were seen in 39 male (72.2%) and 15 female (27.8%) patients (Table 3). Xiphoid and manubrium + xiphoid

fractures were observed only in male patients. As a result of the two-proportion z-test, a statistically significant difference was found in the distribution of fractures in corpus sterni ($p < 0.001$), corpus + manubrium ($p < 0.001$) and manubrium ($p < 0.001$) regions according to gender.

Fracture Location	Male n (%)	Female n (%)	p-value
Corpus Sterni	48 (65.8%)	25 (34.2%)	0.0001
Corpus+Manubrium	14 (82.4%)	3 (17.6%)	0.0002
Xiphoid	6 (100.0%)	0 (0.0%)	Not applicable
Manubrium	39 (72.2%)	15 (27.8%)	< 0.001
Manubrium+ xiphoid	1 (100.0%)	0 (0.0%)	Not applicable

Statistical comparison is not applicable due to absence of cases in one group.

When the fracture locations were compared according to gender, the most common fracture site in men was corpus sterni (44.4%), followed by manubrium (36.1%). In women, 58.1% of the fractures were observed in corpus sterni and 34.9% in manubrium.

Other locations were detected at lower rates in both genders (Table 4). As a result of the Chi-square test, it was determined that this distribution did not show a statistically significant difference in terms of gender ($p = 0.29$).

Table 4: Fracture Location by Gender with Percentages and Statistical Summary

Gender	Corpus Sterni	Corpus+Manubrium	Xiphoid	Manubrium	Manubrium+Xiphoid
Male	48 (44.4%)	14 (13.0%)	6 (5.6%)	39 (36.1%)	1 (0.9%)
Female	25 (58.1%)	3 (7.0%)	0 (0.0%)	15 (34.9%)	0 (0.0%)

Chi-square test result: $p = 0.2902$. No statistically significant difference was found between genders in terms of fractured location distribution.

During follow-up, patients' vital signs remained stable. No significant electrocardiographic changes or cardiac complications were observed. All patients were managed with conservative medical treatment, including analgesia, assisted expectoration, and postural drainage. No additional interventions or invasive procedures were required. There were no reported cases of mortality or morbidity. The mean length of hospital stay was 3.2 ± 1.2 days.

DISCUSSION

This study demonstrates that isolated sternal fractures typically result from high-energy trauma, most frequently MVAs. This finding aligns with previous reports indicating that MVAs are the leading cause of isolated sternal fractures due to anterior-posterior compression forces generated by seat belts during sudden deceleration (1–3). Hofmann et al. similarly identified MVAs as the primary mechanism in their study (8).

Anatomically, the corpus sterni was the most commonly affected site in our series, consistent with the findings of both Hofmann et al. and Klei et al. (8,9). The observed predominance in male patients may reflect increased occupational and environmental exposure to trauma among middle-aged men, as suggested by prior epidemiological data (4–6).

Clinically, the majority of patients in our study were hemodynamically stable, showed no ECG abnormalities or intrathoracic injuries, and were successfully treated with conservative measures such as analgesia, respiratory support, and early mobilization. These outcomes are consistent with the findings of Hofmann et al., who managed 98% of isolated sternal fractures conservatively without complications (8).

Our results also parallel those of Kara et al., who retrospectively analyzed 330 cases over a 10-year period and reported a low mortality rate (1.1%) and shorter hospital stays for isolated fractures, whereas associated injuries significantly increased morbidity and mortality (10). Furthermore, the systematic review by Klei et al. emphasized the limited availability of high-quality

studies and the absence of standardized treatment protocols for traumatic sternal fractures (9). While surgical management was predominant in their included studies, our findings reinforce that conservative treatment is both safe and effective in isolated cases. Conservative treatment was preferred due to the absence of displacement, hemodynamic instability, and associated intrathoracic injuries. The anatomical stability of the sternum and the low complication rate in isolated fractures further supported non-operative management.

Collectively, these findings underline the importance of distinguishing isolated sternal fractures from those occurring in polytrauma settings to prevent overtreatment and unnecessary hospital admissions.

Limitations of this study include its retrospective and single-center design, which may restrict generalizability. For future prospective, multicenter studies with larger sample sizes and standardized follow-up protocols are recommended to validate these findings and establish clearer treatment guidelines.

Ethics Committee Approval: Ethical approval was obtained from the local Clinical Research Ethics Committee (Cumhuriyet University 2023-12/50).

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Conflict of Interest: The authors declare that there is no personal or financial conflict of interest within the scope of the study.

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