

Isolated Sternal Fracture – A Benign Condition?

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Abstract

Background: Fractures of the sternum may be associated with major injuries to thoracic organs, with serious consequences.

Objective: To assess the hospital course of patients diagnosed with isolated sternal fracture.

Methods: We reviewed 55 medical records of patients who were admitted with isolated sternal fracture to the emergency department during the period January 1990 through August 1999.

Results: Fifty-one patients were involved in motor vehicle accidents, and 4 sustained the injury as the result of a fall. Lateral chest X-ray upon admission was diagnostic in the majority of these patients (n=53). Electrocardiography (n=52) was abnormal in four patients – old myocardial infarction (n=1), non-specific ST-T changes (n=3). Cardiac enzymes (creatinine-kinase-MB, n=42) were pathologically elevated in five patients. Echocardiography, performed in patients with ECG abnormalities and/or elevated myocardial enzymes (n=7), was normal in these patients as well as in another 18 patients. There were no intensive care unit admissions or arrhythmias during the hospital stay, which ranged from 6 hours to 6 days (mean 2.3 ± 1.3 days, median 2 days).

Conclusion: Our findings support the view that patients with isolated sternal fracture and no abnormality in ECG and cardiac enzymes during the early hours after injury are expected to have a benign course and can be discharged home from the emergency room within the first 24 hours.

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Sternal fracture has classically been regarded as a serious and even life-threatening injury, considered to have a mortality rate as high as 24–45% [1–4]. Classically it has been associated with major complications such as myocardial contusion or rupture, and great vessel or spinal cord injury, leading to the widespread policy of admitting all patients with sternal fracture for cardiac monitoring, serial electrocardiograms, and further work-up as needed [1,5,6]. The incidence of sternal fractures has increased since wearing car seatbelts became compulsory, due to the concentrated pressure of the belt against the rib cage at the time of injury.

The purpose of this study was to determine whether isolated sternal fracture, without any other associated injury, is accompanied by any short or long-term complications. If no serious complications are to be expected, these patients may be discharged home from the emergency department with no need for admission or extensive work-up, whereas a missing diagnosis of an important injury may have significant medical consequences as well as legal ramifications.

ECG = electrocardiograph

Patients and Methods

We reviewed the medical charts of all 55 patients admitted to two medical centers with the diagnosis of isolated sternal fracture from January 1990 through August 1999. Demographic data and clinical findings including the primary complaint and mechanism of injury were collected. In addition, results of subsequent investigations obtained during the patient stay – including serial ECGs, chest radiograms, computed tomography scans, and cardiac enzyme levels – were also recorded. Patients were excluded if they had an abnormal radiographic finding such as rib fracture, pneumothorax, hemothorax, pulmonary contusion, mediastinal widening, or suspected vascular injury upon admission. Patients who had severe head, abdominal or bone injury were also excluded.

The hospital's policy was to admit any patient with sternal fracture for analgesia, cardiac monitoring consisting of serial ECGs, and subsequent radiographic investigations, as indicated.

Results

The data of the 55 patients are presented in Table 1. The majority of them (n=51) were admitted as a consequence of a motor vehicle accident. The remainder had sustained the injury as a result of a fall. Initial symptoms were pain and tenderness over the sternum in all patients. Chest X-ray (lateral view) was diagnostic in 53 patients. In two patients only high resolution CT scanning of a tender region over the sternum revealed the fracture [Figure 1]. None of the patients developed cardiac arrhythmias requiring therapeutic intervention.

Twelve-lead ECGs were performed in 52 patients upon admission. Four patients had an abnormal recording. One patient's ECG revealed signs of an old myocardial infarction, without associated rise in cardiac enzymes or cardiac instability during the 3 days of hospitalization. Among the three other patients with acute changes

Table 1. Clinical data of 55 patients with isolated sternal fracture

Male/female	32/23
Age (range)	17–84
Mechanism of injury (MVA/fall)	51/4
Chest X-ray (diagnostic)	53 (55)
ECG (pathologic)	4 (52)
Cardiac enzymes (pathologic)	5 (42)
Echocardiogram	25
Hospital stay (mean ± SD, days)	2.3 ± 1.3
(range)	(1–6)
Mortality, arrhythmias	0

MVA = motor vehicle accident.



Figure 1. Chest CT scan [a], with high resolution of a tender segment of sternum [b].

in ECG, two had associated minor and transient rise in cardiac enzymes. No patient was noted to develop new ECG abnormality or unexplained hypotension while hospitalized.

Cardiac enzymes (CK-MB) obtained in 42 patients upon admission were pathologic in 5 patients; 2 also had also ST segment changes, as mentioned earlier. Three patients with normal ECGs had transient rise in cardiac enzymes, which resolved the day after admission. In one case, enzyme levels remained elevated on subsequent measurements. All five patients with enzyme elevation, and 20 more patients had normal subsequent echocardiographic results. All patients were discharged home after a short period of observation, ranging from 6 hours to 6 days (mean 2.3 ± 1.3 days, median 2 days).

Discussion

Fractures of the sternum may be associated with major injuries to the heart, lungs and airways, or great vessels. Therefore, the policy in many centers has been to admit all patients with sternal fracture for close observation, irrespective of the mechanism of injury, or the absence of other injuries [7]. Controversy regarding the management of patients with sternal fracture still exists [8–10]. Nevertheless, it has become apparent that significant factors in the prognosis after sternal fracture are the mechanism of injury and the

presence of additional injuries. It is agreed that the seat belt and the sternum absorb a substantial part of the energy transfer that occurs at the time of collision, thereby providing protection from more severe injuries [8,11]. The association between seat-belt wearing and increased incidence of sternal fractures does not argue against seat-belt use [12]. In most patients with isolated sternal fracture in our experience, this was the mechanism of injury, and the course was indeed benign in all of them.

Recent reports on patients admitted for sternal fractures have concluded that isolated sternal fracture is a relatively benign injury and therefore does not warrant a costly work-up [7,11,13]. On the basis of our own experience and that reported in the literature, the following recommendations can be made. In a patient with clinical findings limited to the sternum and a chest X-ray confirming sternal fracture and excluding additional injuries, a normal 12-lead ECG and a negative result of cardiac enzymes in the blood should obviate the need for further work-up. Such a patient may be discharged early, after 6–12 hours of observation in the Emergency Department. A patient with either ECG changes or elevation of cardiac enzymes should have an echocardiographic examination. Since the course is expected to be benign even under these circumstances, extended observation should probably be limited to patients with persistent elevation of cardiac enzymes or positive echocardiographic findings.

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