

Isolated sternal fractures: a hallmark of violent injury

İzole sternum kırıkları: Şiddetli bir yaralanmanın işareti

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Background: Sternal fractures are rare injuries compared to fractures of other bones, and their main cause is traffic accidents. We evaluated isolated sternal fractures that were treated by surgical or nonsurgical interventions.

Methods: Forty-seven patients (38 men, 9 women; mean age 38 years; range 27 to 70 years) were treated for isolated sternal fractures. The patients were evaluated in terms of location, shape, and type of fractures, treatment methods, and complications. Posteroanterior and left lateral chest radiograms were used for the diagnosis.

Results: Forty-one patients (87.2%) were injured by a traffic accident and the majority of these patients (n=36) wore a seat belt. Sternal fractures were localized in the mid-gladiolus in 29 patients (61.7%). Five patients had an unseparated sternomanubrial fracture, and four patients had sternal fracture in the lower one-third of the sternum. Seven patients had presternal hematoma. The average time from injury to treatment was 6.3 hours. Four patients (8.5%) had pneumothorax. Electrocardiography showed ST-T changes in nine patients (19.2%). Eight patients were managed by closed manipulation with hyperextension of the spine, and 13 patients with separated and unstable sternal fractures were managed by surgical fixation with steel wiring. No complications or mortality occurred. The mean hospital stay was 8.3 days (range 4 to 13 days).

Conclusion: The management of patients with isolated sternal fractures is usually conservative. However, some patients may require surgery. In order to prevent possible cardiac and cardiovascular complications, electrocardiographic and cardiac enzymatic changes should be monitored.

Key words: Accidents, traffic; chest pain/etiology; fracture fixation/methods; sternum/injuries/surgery; wounds, nonpenetrating.

Amaç: İzole sternal kırıklar diğer kemik kırıkları ile kıyaslandığında nadir görülür. Bu kırıkların en sık nedeni trafik kazalarıdır. Bu çalışmada, cerrahi veya cerrahi dışı girişimlerle tedavi edilen izole sternum kırıkları değerlendirildi.

Çalışma planı: Çalışmada göğüs travması sonucu oluşan izole sternum kırığı nedeniyle tedavi edilen 47 hasta (38 erkek, 9 kadın; ort. yaş 38; dağılım 27-70) kırığın yeri, şekli, tipi, tedavi yöntemleri ve komplikasyonlar açısından incelendi. Kırık tanısı, arka-ön ve yan göğüs radyografileri ile kondu.

Bulgular: İzole sternum kırıklarının nedeni 41 hastada (%87.2) trafik kazaları idi ve bu hastaların çoğunluğu (n=36) emniyet kemeri kullanıyordu. Yirmi dokuz hastada (%61.7) kırık yeri orta gladiolustaydı. Beş hastada ayrılmamış sternomanubrial kırık vardı. Dört hastanın kırığı 1/3 alt sternumdaydı. Yedi hastada presternal hematoma saptandı. Yaralanma ile tedavi arasında geçen ortalama süre 6.3 saat idi. Dört hastada (%8.5) pnömotoraks saptandı. Dokuz hastanın (19.2%) elektrokardiyografisinde ST-T değişikliği görüldü. Sekiz hasta, omurga hiperekstansiyona getirilerek kapalı manipülasyonla tedavi edilirken, sternal kırığı parçalı ve hareketli olan 13 hastaya çelik tel ile cerrahi redüksiyon yapıldı. Hastalarda komplikasyon veya mortalite görülmedi. Ortalama hastanede kalış süresi 8.3 gün (dağılım 4-13 gün) bulundu.

Sonuç: İzole sternum kırıklarının tedavisi genellikle konservatiftir; ancak, bazı hastalarda cerrahi tedavi gerekebilir. Bu hastalarda kalp ve büyük damar yaralanma olasılıklarına karşı kardiyak enzimlerin ve EKG değişikliklerinin izlenmesi gerekir.

Anahtar sözcükler: Kaza, trafik; göğüs ağrısı/etyoloji; kırık tespiti/yöntem; sternum/yaralanma/cerrahi; yaralanma, delici olmayan.

Sternal fractures are rare injuries compared to fractures of other bones. Sternal fractures generally occur in motor-vehicle accidents (64%), and their occurrence is uncommon in blunt and penetrating chest traumas.^[1] Victims of

accidents, especially older persons, are at high risk for sternal fractures if they are right front passengers using a seat belt.^[1,2] The repair of these fractures is variable with varying degrees of success. Conversely, data are limited

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on the surgical treatment of sternal fractures after blunt chest trauma, because most are managed nonoperatively with little morbidity and mortality. Surgical reduction is usually performed in cases with debilitating pain and fracture displacement. However, unhealed old sternal fractures are associated with significant pain leading to disability.^[3] We evaluated isolated sternal fractures that were treated by either surgical or nonsurgical interventions in our clinic.

PATIENTS AND METHODS

A total of 47 patients (38 men, 9 women; mean age 38 years; range 27 to 70 years) were treated in our department with the diagnosis of isolated sternal fracture (without fracture on other costae) between 1990 and 2007. The results of the surgical and non-surgical interventions were reviewed in terms of location, shape, complications, management, and type of fractures. Posteroanterior and left lateral chest radiograms were used for the diagnosis.

RESULTS

Forty-one patients (87.2%) with sternal fractures were injured by a traffic accident and 36 of them wore a seat belt. Sternal fractures were localized in the mid-gladiolus in 29 patients (61.7%). Five patients had an unseparated sternomanubrial fracture, and four patients had sternal fracture in the lower one-third of the sternum (Table 1). In 13 patients, the fractured segment was separated and overridden. Seven patients had presternal hematoma. The average time from accident to the operation was 6.3 hours. Four patients had pneumothorax. Electrocardiography showed ST-T changes in nine patients and increased levels of CPK, SGOT and LDH were noted in 16 patients.

Eight patients were managed by closed manipulation with hyperextension of the spine, and 13 patients (27.7%) were managed by surgical fixation with steel wiring. No complications occurred. There was no mortality. The mean hospital stay was 8.3 days (range 4 to 13 days).

DISCUSSION

It has been reported that although seat belt reduces the incidence of serious and fatal injuries in automobile accidents in about one-fourth of cases, seat belt itself is associated with certain injuries such as fractured sternum.^[4]

Sternal fractures are relatively rare compared to other fractures.^[5,6] The incidence is on the incline because of increasing number of automobiles with high speed capability.^[7] Sternal fractures accounted for 0.9% of all thoracic traumas evaluated in our department.

Table 1. Clinical characteristics of the patient group

	n	%
Sex (n=47)		
Male	38	80.6
Female	9	19.2
Site of sternal fracture		
Lower sternum	3	6.4
Mid-body	39	83.0
Xiphoid	5	10.6
ST-T change on the electrocardiogram		
Absent	38	80.6
Present	9	19.2
Abnormal CPK, SGOT or LDH levels		
Absent	31	66.0
Present	16	34.0
Management		
Conservative	34	72.3
Surgical fixation	13	27.7

Sternal fractures occur either with a direct blow onto the anterior chest wall as occurs in traffic accidents or, less commonly, with a violent flexion-compression injury to the thoracic spine often accompanied by significant spine and head trauma.^[5] The etiology was a traffic accident in most of our cases (87.2%). Fractures usually involve the sternomanubrial joint.^[7] In our series, the fractures commonly occurred at the mid-body. The most striking finding in these cases was the overriding fracture segments forming a wedge, which caused trouble during open reduction.

It is thought that violent pain on the anterior chest wall may be related with a sternal fracture. Visible signs such as ecchymosis, hematoma, or contusion may be present in the anterior chest wall. There was marked pre-

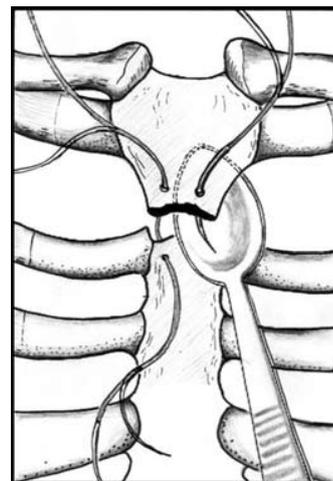


Fig. 1. Insertion of a sterile table-spoon under the proximal segment of the fracture to prevent injury to the underlying structures.

sternal hematoma in seven of our cases. The separated fracture was palpable because of overridden fragments in all the patients. The diagnosis is definitive when sternal fragments are seen in lateral chest roentgenograms. The fragments were overridden in 13 patients.

After the patient's condition is stabilized, sternal fracture can simply be managed by closed manipulation.^[8,9] This approach was preferred in seven of our patients because the fracture line was regular with minimal overriding. When closed reduction fails, open reduction and internal fixation may be necessary. Surgery is required in the following conditions: (i) chest wall mobility and the need for stabilization of the chest wall to prevent pulmonary insufficiency, (ii) violent pain, (iii) deformity caused by fracture, (iv) overridden fragments, and (v) failure of closed reduction.^[3,7] In our series, surgical fixation was applied in 13 patients (27.7%). Either a longitudinal mid-sternal incision^[7] or a transverse incision parallel to the fracture line^[5] is preferred. In most of our cases, a longitudinal midline incision (8-10 cm) was made over the fracture side. Reduction can be achieved with internal fixation using Steinman or Kirschner pins or heavy wire sutures or with external fixation. We fixed the sternum with heavy wire sutures across the fracture site. Heavy wires were passed through both the inner and outer tables of the sternum. We placed a spoon in order not to injure the substernal structures (Fig. 1). Full recovery of fracture is expected within 1.5 to 3 months.

In conclusion, sternal fracture should be suspected and managed accordingly after verifying the diagno-

sis in any patient with sternal pain following thoracic injury. Cardiac contusion should also be kept in mind in cases with sternal fractures along with appropriate electrocardiographic and radiological evaluations.

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