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Olgu Sunumu / *Case a Report*

Locking Placement and Surgical Management in Sternal Fractures

Aysun Kosif
Onur Derdiyok
Serdar Evman

Sternal Kırıklarında Kilitleme ile Yerleştirme ve Cerrahi Yönetimi

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ABSTRACT

Flail chest is the most severe form of blunt thoracic trauma and is defined as the disruption of the sternum fractures or costochondral joints as a result of at least two fractures of three or more of the ribs on the anterior or lateral side of the chest wall. Life-threatening physiopathologic changes can affect the clinical condition of patients at any moment. Flail chest is defined as the inward movement of the broken segment while breathing while moving outward. Surgery is the only option in case of significant deformity involving the chest wall, inconsistent breathing dynamics, lung or diaphragmatic injury, and significant deformity requiring prolonged mechanical ventilation. In this article, we present reconstruction of the chest wall with AO-ASIF (Arbeitsgemeindschaft fur Osteosynthesefragen) osteosynthesis plate, which we performed in a patient with posttraumatic sternal fracture and paradoxal respiration.

Keywords: *sternum fractures, locking compaction place, thoracic surgery*

ÖZ

Yelken göğüs künt toraks travmasının en ağır şeklidir ve göğüs duvarının ön veya lateral tarafında kaburgaların 3 veya daha fazlasının kırılmasının bir sonucu olarak sternum kırıklarının veya kostokondral eklemlerin bozulması olarak tanımlanır. Yaşamı tehdit edici fizyopatolojik değişiklikler, herhangi bir anda hastaların klinik durumunu etkileyebilir. Yelken göğüs, dışa doğru hareket ederken nefes alırken kırılan bölümün iç tarafa hareketi olarak da tanımlanır. Göğüs duvarını, tutarsız solunum dinamiklerini, akciğer veya diyafragma yaralanmasını ve uzun süreli mekanik ventilasyonu içeren önemli bir deformite durumunda cerrahi tek seçenek. Bu makalede, travma sonrası sternum kırığı ve paradoksal solunum hastalarında yaptığımız AO-ASIF (Arbeitsgemeindschaft fur Osteosynthesefragen) osteosentez plakası ile göğüs duvarı rekonstrüksiyonu sunuldu.

Anahtar kelimeler: *sternum kırıkları, kilitleme kompaksiyon plak, torasik cerrahi*

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Onur Derdiyok
SBÜ. Süreyyapaşa Göğüs Hastalıkları ve Göğüs Cerrahisi EAH
Göğüs Cerrahisi Kliniği
İstanbul - Türkiye
derdiyokonur@gmail.com
ORCİD: 0000-0001-9994-8501

A. Kosif 0000-0002-9490-9826
S. Evman 0000-0002-1672-966X
SBÜ. Süreyyapaşa Göğüs Hastalıkları ve Göğüs Cerrahisi EAH
Göğüs Cerrahisi Kliniği
İstanbul - Türkiye

INTRODUCTION

Sternum fracture occurs in 3-8% of thoracic traumas. Most sternal fractures resolve with conservative treatment, but can lead to severe dysfunctional conditions such as severe chest pain, dyspnea, persistent cough and paradoxical motion of the chest wall in a few cases with instability or significant displacement. With treatments such as corset fixation and bed rest, or sternal fractures resulting in complete

cortical deterioration can be managed conservatively. Conservative treatment, however, in apparently displaced sternal fractures, can often result in sternal uncoiling, chronic pain, and paradoxical respiration due to multifaceted motion in patients who fall frequently [1]. In our study, we presented a patient who developed paradoxical respiration after a traffic accident, treated with sternal osteosynthesis plate and chest wall reconstruction.

CASE PRESENTATION

A 48-year-old man applied to our emergency department after sustaining blunt chest trauma resulting from a traffic accident. Fracture or crepitation was not palpated on physical examination. Sternal region was sensitive to palpation. Vital findings were stable. The airway did not cause any disturbance in breathing and circulation. On posterior anterior (PA) chestotX-ray, rib or sternum fractures could not be detected (Figure 1). A thoracic computed tomography (CT) examination revealed a sternal fracture in only one section (Figure 2). After the first intervention in the emergency department, he was detained in the intensive care unit (ICU). During the next two days of conservative management (pain control, negative balance of fluids, O_2 support, and chest physiotherapy) the pain and general condition of the patient did not improve. Because of paradoxical respiration developed approximately 72 hours after the traffic accident, the patient was connected to mechanical ventilation (Figure 3). The length of the screws was pre-determined with the aid of CT scan adjusted to the distance between the anterior and posterior cortices of the rib cage. Under general anesthesia, with the patient laid in supine position a vertical

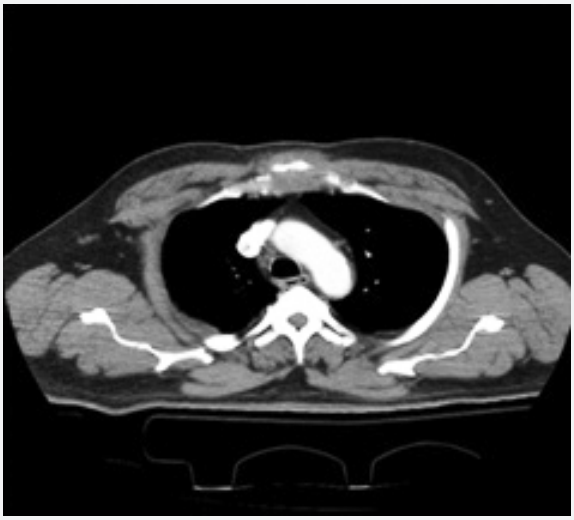

Figure 2. Thoracic CT showed a fracture of approximately 1 cm in size in the sternum.

Figure 1. Posterior anterior chest X-ray or sternum fracture was not detected. pneumothorax or hemothorax.

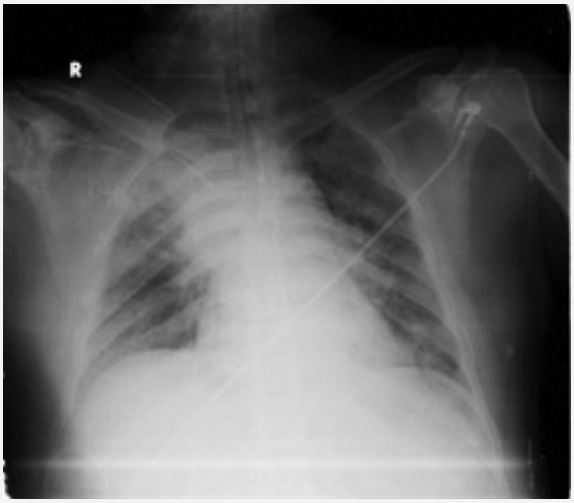

Figure 3. Density enhancement in the right hemithorax upper zones and mediastinal upper regions on anterior posterior chest X-ray following paradoxical breathing.

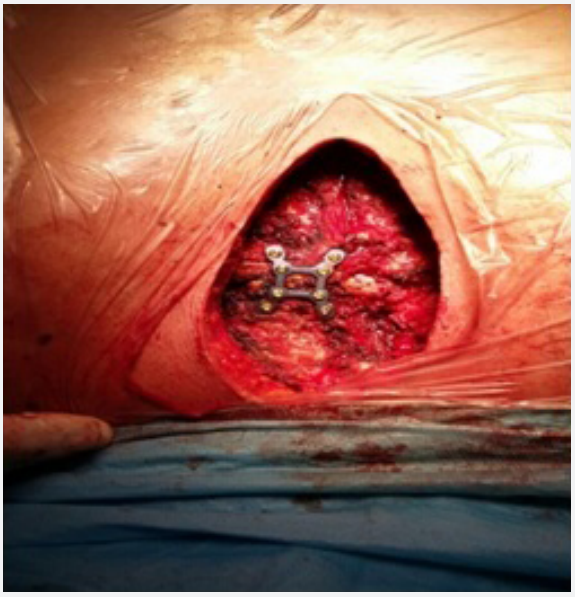

Figure 4. The fracture was reduced and secured with the help of screws by using a lock plate.

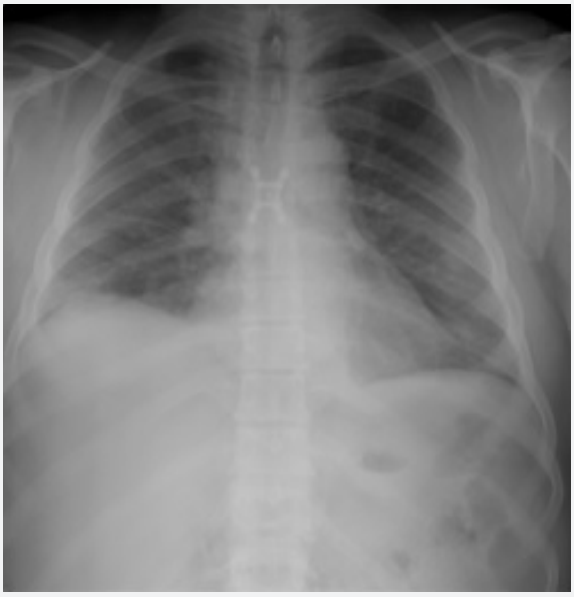

Figure 5. Postoperative 2 days posterior anterior chest X-ray.

incision was made on the palpable deformity in the middle line instead of the fracture. The hematoma was evacuated; the fracture was reduced and secured with the help of screws by using a lock plate (Figure 4). After 24 hours postoperatively, the patient was separated from the mechanical ventilation (Figure 5). He was discharged four days postoperatively. No pathology was observed in 3 month follow-ups.

DISCUSSION and CONCLUSIONS

Blunt chest trauma is usually detected after a traffic accident. Flail chest is seen in 6% of blunt chest trauma patients and results in a in-patient mortality of up to 33% [2]. In addition, morbidity rates are higher related to the frequent need for mechanical ventilation, accompanying injuries, all complications associated with intubation and ventilator-associated pneumonia. Traditional flail chest management consists of pain control (including epidural anesthesia), use of noninvasive ventilation and mechanical ventilation [3]. This is reflected by relatively long and costly accommodation in the ICU which has been investigated only in a few randomized controlled studies [4].

The most common treatment for a thoracic fracture is corset fixation and bed rest or steel wire fixation. Conservative treatment, however, often fails in the case of apparently displaced sternal and rib fractures. Possible indications for surgical treatment include severe or persistent pain; respiratory failure requiring mechanical ventilation; deformity or instability of the sternum as well as displaced, overlapping, or crushed fractures; steeper upright posture and restraint of trunk movement [5]. Divisi et al. indicated that the possible injury of the underlying vascular structures should also be taken into consideration. Steel wire fixation is widely used in longitudinal sternotomies, but usually fails in horizontal fractures and in boiling. Various methods have been explored to overcome this problem. These include increasing tensile strength, and even incorporating strand iron plates to increase intramedullary coverage. However, due to the low number of cases using the methods described, it has been stated that experimential trials will be reduced [6].

The use of lock plates is important due to their advantages in biological internal fixation. The principle of a locked plate is based on the fixation between

the threaded screw head and the threaded screw hole of the plate. Thus, the locked plate acts as an internal fixator with the advantage of a minimized bone-bone interface that preserves periosteal blood circulation below the plate [7]. In order to correct the anatomic shape and normal function of the chest wall, it is necessary to keep each sternal piece in the correct position by neutralizing the sternal shear forces. Within this context, anterior sternal coating provides the best balance and is therefore often used increasingly. The advantage of stability using plaques instead of wires is described for the closure of the sternum after median sternotomies [8]. In their study, Madjarov et al. found that early surgical intervention in sternal fractures can reduce the incidence of pulmonary complications [9].

As a result, these techniques seemed difficult because of the wide exposure of the sternal fragments and difficult positioning of the intramedullary pins. In our clinical experience, use of titanium plate internal fixation was decided because it was a quick, easy and minimally invasive procedure. The use of titanium plaque and locking screws offers a reliable method for successful treatment of sternal unbonding and dislocation fractures.

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