

# Sternal fracture due to airbag injury: case report

## Hava yastığına bağlı sternum kırığı: Olgu sunumu

Nazmiye Selçuk KAPISIZ,<sup>1</sup> Berkant ÖZPOLAT,<sup>2</sup> Fahri KAPISIZ,<sup>1</sup> Ertan YÜCEL<sup>2</sup>

Although airbags reduce the overall risk of injury and death from motor vehicle accidents, the airbag may cause injuries during deployment. We present a case of apparently isolated sternal fracture caused by airbag deployment during a motor vehicle crash and we discuss the ultrasonographic diagnosis. We also examine the mechanism of injury caused by the airbag.

**Key Words:** Airbag; sternal fracture; traffic accident.

Hava yastıkları araç kazaları nedeniyle oluşabilecek yaralanma ve ölüm risklerini azaltmakla birlikte açılmasına bağlı yaralanmalara neden olabilmektedir. Bu olgu sunumunda, bu şekilde oluşan bir göğüs kemiği kırığı, ultrasonografik tanısı ve yaralanma mekanizması incelenerek sunuldu.

**Anahtar Sözcükler:** Hava yastığı; sternum kırığı; trafik kazası.

Although airbags reduce the overall risk of injury and death from motor vehicle accidents, injuries attributed to airbag deployment have been extensively reported, among them thoracic injuries including thoracic hemorrhage, all types of cardiac injuries, great vessel lacerations, lung injury, rib fractures, crushing chest injury, flail chest, and thoracic spine fractures with spinal cord laceration.<sup>[1]</sup>

We present a very rare case of acute isolated sternal fracture caused by airbag deployment in which ultrasound was used for the diagnosis. We also examine the mechanism of injury caused by the airbag.

### CASE REPORT

A 50-year-old male (height: 165 cm, weight: 80 kg) unrestrained driver was involved in a 70 km/hr speed (patient's self-report) frontal vehicular crash that resulted in the deployment of both front-side airbags. Just before the collision, he suddenly turned the steering wheel to the left, causing damage to the right front of the vehicle.

In the initial assessment in the emergency department, severe tenderness and ecchymosis over the sternum were present. As the lateral chest radiograph was insufficient, a transsternal ultrasonography was also performed, confirming the diagnosis of suspected non-

displaced sternal fracture (Fig. 1). Further investigation included a computed thoracic scan revealing the same condition with no other visceral injury (Fig. 2). The patient was found to be hemodynamically stable. Cardiac assessment by electrocardiogram was normal, and echocardiography and creatinine kinase B subunit assay did not demonstrate any cardiac injury. After a short ward stay, he was discharged uneventfully.

### DISCUSSION

The airbag patent was issued in 1953 and became available as an optional passive restraint system in motor vehicles in 1973.<sup>[2]</sup> Airbag design varies among makes, models, and production years. Generally, airbags consist of three components: sensors that detect the longitudinal velocity change of the vehicle during a crash, an electronic unit that monitors the system and the module that houses the inflator and the bag.<sup>[3]</sup>

Although studies have found that airbags reduced driver fatalities in broadly frontal crashes by nearly 20-30%,<sup>[4]</sup> they may contribute to injuries and even death in children and adults.<sup>[2]</sup>

Deployment occurs at a speed of 200 mph using stored gas inflation in a short time duration of 30-50 milliseconds with a great force. It was reported that in low-speed crashes, the injuries induced by the de-

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<sup>1</sup>Department of Cardiovascular Surgery, Balıkesir State Hospital, Balıkesir; <sup>2</sup>Department of Cardiovascular Surgery, Yıldırım Beyazıt Training and Research Hospital, Dışkapı, Ankara, Turkey.

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<sup>1</sup>Balıkesir Devlet Hastanesi, Kalp Damar Cerrahisi Kliniği, Balıkesir; <sup>2</sup>Dışkapı Yıldırım Beyazıt Eğitim ve Araştırma Hastanesi, Kalp Damar Cerrahisi Kliniği, Ankara.

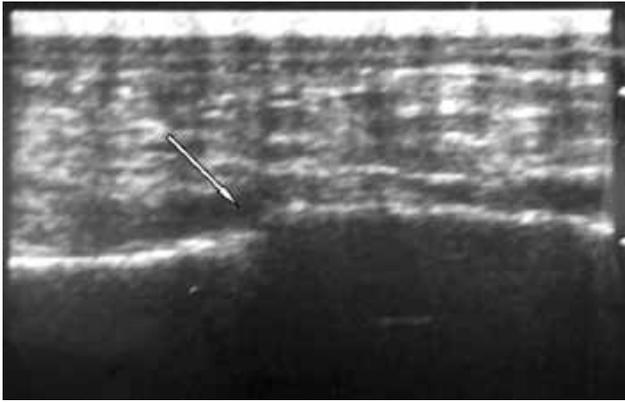


Fig. 1. Sternal ultrasonography showing fracture.



Fig. 2. Computed tomography showing sternum fracture.

ploying airbag may be more serious than injuries that would have occurred otherwise, and many people would have survived. Thus, at that time, a dual stage airbag was proposed to adjust the force of inflation according to the severity of the crash and whether or not the passenger was wearing a safety belt.<sup>[2-5]</sup>

The incidence of sternal fracture as a result of motor vehicle collisions has been reported as between 1.36-3% in different series. Sternal fracture is more common in females, the elderly and seatbelt wearers. It has a mortality of 0.7%. It is reported that there was no association with serious visceral chest injury including cardiac contusion.<sup>[6,7]</sup>

In vehicle collisions, the seatbelt prevents the driver from moving forward onto the steering wheel and the deploying airbag. Airbags reduce mortality by one-fourth and wearing a seatbelt reduces mortality by three-fourths. In a head-on collision, airbag deploy-

ment and wearing a seatbelt were found to decrease the risk of death by over 80%.<sup>[8]</sup> In this case, the driver had no seatbelt and was driving too close to the steering wheel (an admitted habit according to the patient's self-report), which was the actual seat position at the time of the crash and near the airbag deployment zone. In this position, he received the full force of the airbag deployment (a European-type tethered airbag), and the lack of seatbelt protection moved him forward to the deploying airbag. At collision time, deceleration of the vehicle was from 70 km/hr and the airbag deflation speed was 200 km/hr. The force of direct impact between the unrestrained driver and inflating airbag was likely to have caused the sternal fracture. However, the airbag may have prevented a more severe thoracic trauma because there were fewer external signs of trauma on the neck and chest.

Lesions of the thoracic skeleton can sometimes be a problem in radiological diagnosis. Since the lateral chest X-ray was insufficient in showing the fracture, transsternal ultrasonography was performed and confirmed the diagnosis of suspected nondisplaced sternal fracture showing clear fracture signs, which we think was another indication for ultrasound.

Cars are increasingly being equipped with airbags, and airbag-related injuries are likewise increasing. In frontal or near-frontal crashes, airbag deployment is effective in reducing the most severe and fatal injuries, whereas in low-severity crashes, airbag deployment can induce injuries. Manufacturers must improve airbag deployment technology to reduce injuries. The drivers using a vehicle with an airbag must wear a seatbelt and sit in the correct position to prevent injuries.

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