



Air bag-mediated fatal craniocervical trauma: a case report

Hava yastığı kaynaklı ölümcül kraniyo-servikal travma: Olgu sunumu

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This case report describes a four-year-old girl (102 cm, 17 kg) who sustained fatal craniocerebral injuries as a result of an inflating automobile air bag. The car struck the lid of the sewer system, which was 15 cm above the ground level, at a low speed, and both the driver and passenger air bags inflated. Despite the fact that air bag usage has lessened both the possibility and severity of occupant injuries in frontal collisions, case reports of serious injuries and even deaths especially in children due to air bag deployment, particularly during low speed impacts, highlight the need for changes in both system design and possibly the threshold speed of air bag deployment.

Key Words: Air bag-mediated injury; autopsy; child; forensic science; motor vehicle accident.

Bu yazıda, otomobil kazasında açılan hava yastığı nedeniyle kraniyo-servikal yaralanmayla olay yerinde ölen 4 yaşındaki bir kız çocuk (102 cm, 17 kg) sunulmaktadır. Hastanın öyküsünde düşük hızla seyreden otomobilin yerden sadece 15 cm yükseklikteki bir kanalizasyon logar kapağına çarpmasıyla sürücü ve yolcu hava yastığının açılması mevcuttu. Hava yastığının özellikle önden çarpışmalarda sürücü ile yolcunun yaralanma ihtimalini ve derecesini belirgin şekilde azalttığı bilinmektedir. Ancak, ön koltukta oturtulan çocuklarda düşük hızla olan çarpmalar sonrası da hava yastığının açılmasıyla ölümcül ciddi yaralanmaya sebep olabileceğini gösteren bu türden olgular, sistem tasarımının ve hava yastığı açılmasındaki eşik değerin yeniden değerlendirilmesi gereğini göstermektedir.

Anahtar Sözcükler: Hava yastığı kaynaklı yaralanma; otopsi; çocuk; adli bilimler, trafik kazası.

Traffic accidents are the leading cause of injury-related deaths in many countries.^[1] Many efforts have been taken to reduce the risk of death and serious injuries among both drivers and occupants. Air bags designed to protect occupants in frontal crashes, e.g., are reported to have saved an estimated 900 lives since the late 1980s.^[2]

Despite the fact that air bag usage has lessened both the probability and severity of occupant injuries in frontal collisions, case reports of serious injuries and deaths especially in children due to air bag deployment, particularly during low-speed impacts, have created controversy surrounding their usage.^[3-5]

We report herein a four-year-old girl who sustained fatal craniocerebral injuries as a result of an inflating

automobile air bag after the vehicle struck the lid of the sewer system at a low speed.

CASE REPORT

The patient, a four-year-old girl (102 cm, 17 kg), was sitting on a 15-year-old boy's lap in the front passenger seat of a 2000 model automobile. The front underside of the car struck a lid of the sewer system, which was 15 cm above ground level, while travelling at a low speed, and both the driver and passenger air bags inflated (Fig. 1). After deflation of the air bags they noticed the severe injuries to both children. The girl was pronounced dead on admission to the hospital and the boy had severe facial injury. The final diagnosis for the boy was left Lefort III, right Lefort II and bilateral Lefort I fractures. He was hospitalized in the

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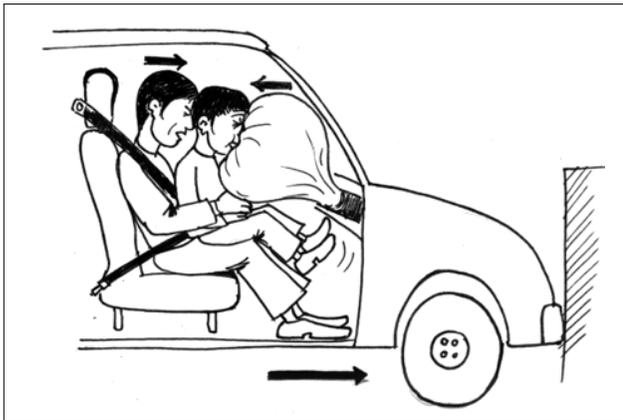


Fig 1. Schematic illustration showing inflation of the airbag and position of the children at the time of impact.



Fig 2. Abrasions and contusions involving the victim's face and anterior neck.

plastic and reconstructive surgery department of the hospital and the girl was sent to the Institute of Forensic Medicine for forensic autopsy.

Widespread abrasions and contusions involving the anterior neck and face were detected on external examination. There were lacerations inside the lips (Fig. 2). Necropsy examination revealed hemorrhage of the scalp in the frontal region, diffuse subarachnoidal hemorrhage over the cerebral convexities and diffuse contusion in the right temporal lobe. Examination of the cranial vault revealed the linear fracture starting from the right parietal region and passing through the medial cranial fossa ending at the level of the crista galli (Fig. 3).

There was diffuse hemorrhage in the cervical region (Fig. 4). The C₂ vertebral body was completely dislocated from the lower cervical spine with transection of the spinal cord at this level. Other injuries noted at autopsy were abrasion of the right forearm and lacerations around the orbital region.

No toxic substances were found in the toxicological analysis of the blood and urine. On microscopic analysis of internal organ sections, diffuse subarachnoidal

bleeding in the brain, intraalveolar fresh bleeding and severe hyperemia in the lungs, and severe hyperemia in the myocardium, liver and kidney were detected.

DISCUSSION

Motor vehicle accidents remain a leading cause of mortality and morbidity in many countries. In the United States and Canada, for example, over 40,000 victims are reported annually.^[1] Many efforts have been made to increase the security level of occupants of vehicles, and following refinement in seat belts, development of air bags created a new era in the security options in new automobiles. Both engineering data and the data obtained from studies of road traffic accidents show a definite effect of the air bag system in reducing the fatalities.^[3,6]

Despite the fact that air bags have emerged as a routine part of the automobile's safety system in almost all newly produced automobiles, there now exists an increasing number of articles showing air bag-mediated injuries, some of which are fatal.^[7-9] Air bag deployment has been reported to lead to ocular injury, barotraumas to the ears, and abrasion and contusions especially in face, neck and chest regions. Facial and

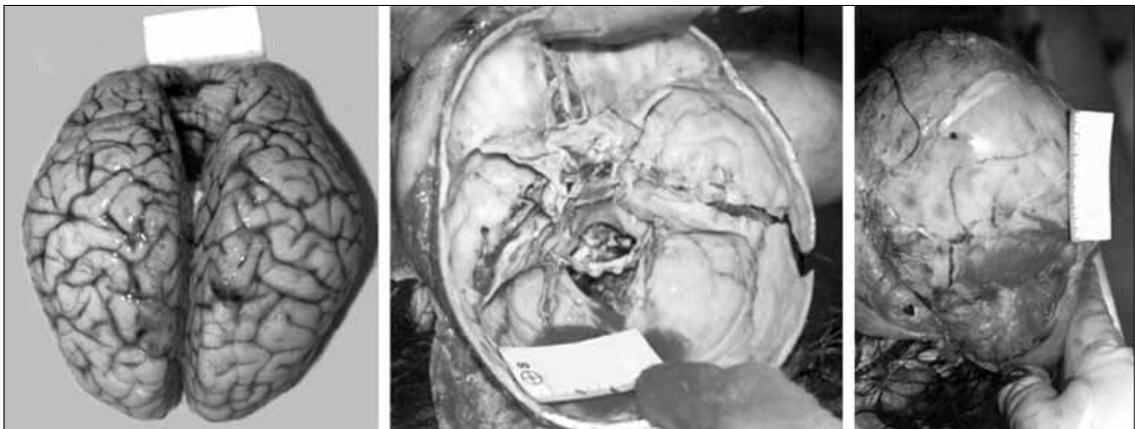


Fig 3. Diffuse subarachnoidal hemorrhage and skull fracture.

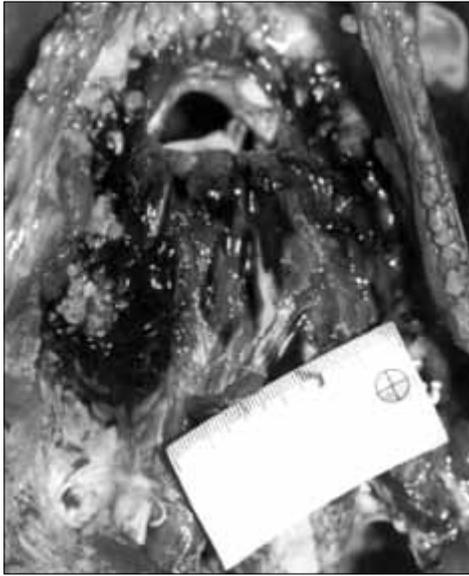


Fig 4. Diffuse hemorrhage in the cervical region on internal examination.

corneal burns and pulmonary contusions were also reported to result from air bag deployment. Most of these traumas were attributed to the so-called “bag slap” effect of deployed air bags.^[3,10-12]

Although rare, air bag-related fatalities were also reported by some authors. Smock and Nichols^[13] described a case of fatal acute subdural hematoma in a driver whose car grazed a highway guard rail, causing air bag deployment. Lancaster et al.^[14] reported atrial rupture and cardiac tamponade in a young woman involved in a low-speed collision (10-15 miles/hour [mph]). Willis et al.^[3] reported fatal craniocervical trauma in a five-year-old child as a result of an inflating automobile air bag. Autopsy of this case revealed complete dislocation of the C₂ vertebral body and transection of the spinal cord at that level. The low speed (5-10 mph) at the time of collision causing the deployment of the air bags in this case is striking.

In the present case, a four-year-old child sustained immediately fatal craniocervical injuries from the impact of the inflating air bag to the face and chin. A violent distraction-hyperextension of the neck associated with an impact of the occipital region to the face of the teenaged boy caused skull fracture and dislocation and spinal cord transection at the C₂ level.

Despite the important recommendation that all children aged less than 13 years must travel in the back seat using age- and site-appropriate restraints, parents continue to let their children travel in front passenger seats.^[15] There is a widespread confidence

about the threshold level of deflation of the air bags and therefore parents generally rule out the possibility of deflation at lower speeds and in minor collisions. In cases of short distance travels with low speed, parents permit small children to travel in front passenger seats, overlooking the manufacturer’s advice. In some instances, as in our case, parents feel that it is safe for a small child to travel in an older child’s lap in the front passenger seat.

This case report emphasizes the importance of restrictions for children not to travel in front passenger seats even in instances of short-distance trips at low speeds.

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