



Ocular injury related with airbag deployment: A case report

Fatih Çalışkan^a, Hızır Ufuk Akdemir^{a*}, Latif Duran^a, Celal Katı^a, Yücel Yavuz^a, Şahin Çolak^b

^aDepartment of Emergency Medicine, Faculty of Medicine, Ondokuz Mayıs University, Samsun, Turkey

^bEmergency Service, Haydarpaşa Numune Training and Research Hospital, İstanbul, Turkey

ARTICLE INFO

Article History

Received 08 / 09 / 2013

Accepted 29 / 10 / 2013

* Correspondence to:

Hızır Ufuk Akdemir
Department of Emergency Medicine,
Faculty of Medicine,
Ondokuz Mayıs University,
Samsun, Turkey
e-mail: hufukakdemir@hotmail.com

Keywords:

Airbag
Emergency service
Ocular injury

ABSTRACT

The most severe airbag-related injuries occur in the orbital region. Eye injuries related with airbag deployment is usually defined under two headings as mechanical injury and alkali chemical injury. In addition to two types of injuries, there may be penetrating injuries accompanying them. Although eye injuries related to airbag deployment are rarely seen, they are extremely important that may result in potential poor clinical results. Treatment of eye injuries depends on the size and type of injury. A case who had monocular injury related to airbag deployment after a motor vehicle accident was presented in this article. Forty-two-years old male patient was admitted to our emergency room after a motor vehicle accident. He had complaints of pain in the face and neck. On his physical examination, there was a patchy lesion compatible burn injury in the right half of face and minimal redness in the right eye and periorbital area. In the follow-up of the patient had no radiological evidence of pathology requiring surgical intervention, an increase of redness in the right eye and a swelling of lower-right eyelid were detected. His cornea was found to be intact, but there was a minimal subconjunctival bleeding in the eye examination of the patient who had a normal visual acuity and intraocular pressure. The patient was discharged on the second day of admission after symptomatic treatment.

J. Exp. Clin. Med., 2013; 30:399-401

1. Introduction

Airbags have gained wide acceptance in today's society following congressional mandates requiring airbag installation in all passenger vehicles, vans, pickup trucks, and sport utility vehicles (Duma et al., 1996). Although airbags have been shown to decrease the incidence of severe morbidity and mortality related to motor vehicle crashes, the current literature demonstrates that they can cause serious eye injuries. Published injuries include eyelid lacerations, periorbital fractures, corneal abrasions, hyphemas, lens dislocations, angle recessions, corneoscleral lacerations, alkaline corneal burns, cyclodialysis, retinal detachments, retinal and vitreous hemorrhages, and traumatic macular holes (Lee et al., 2001). We discuss a case who had a burn injury on his face and eye after motor vehicle accident resulting airbag deployment. We try to emphasize the importance of airbag-

related traumas and airbag related ocular alkali injury as a prediagnosis after motor vehicle accidents.

2. Case

A 42 year-old man was brought to our emergency department following a car accident by emergency paramedics. He was removed from his car by paramedics and the opened airbags were shown by paramedics (Fig. 1). The patient did not remember the accident, but his Glasgow coma scale (GCS) score was 15 on admission. He had complaints of pain in the right half of his face and a pain in his neck with any movement. On physical examination, there was a patchy lesion (5x10 cm) compatible burn injury in the right half of face and minimal redness in the right eye and periorbital area, but there was no swelling in periorbital area at that time. The patient had no complaint of blurred



Fig. 1. The opened airbags in the car during the accident

vision. There was a tenderness on the right zygomatic arch with palpation. The other system examinations were normal. In laboratory tests were leukocyte count:9.24 thousand/uL, hemoglobin:15.9 g/dL, platelet count:266 thousand/uL. The routine biochemistry tests were within normal ranges. The brain, cervical and maxillofacial computed tomography (CT) were performed. The brain and cervical tomography were normal. The abdominal ultrasonography was normal. There were a thickness of subcutaneous soft tissue adjacent to right zygomatic arch and an increase in the density, but no fracture was observed in the maxillofacial CT (Fig. 2). Plastic surgeon suggested a symptomatic treatment for facial wounds. The patient was hospitalized to our emergency observation room for follow-up.

On his control physical examination findings performed due to complaint of blurred vision and pain on the right eye after sixth hours of follow-up, there were an increase of redness in the right eye, swelling in the right-lower eyelid (Fig. 3). After that, the patient was consulted to an ophthalmologist. In the examination, visual acuity, intraocular pressure were normal and the cornea was intact, but minimal subconjunctival

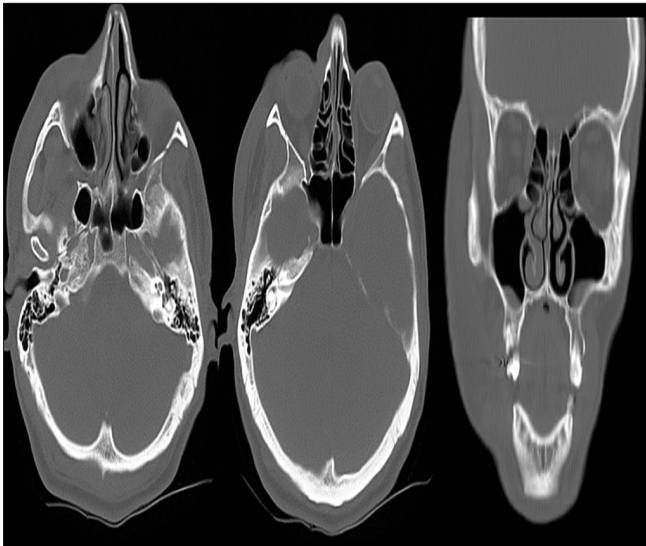


Fig. 2. Soft tissue thickness in the maxillofacial CT

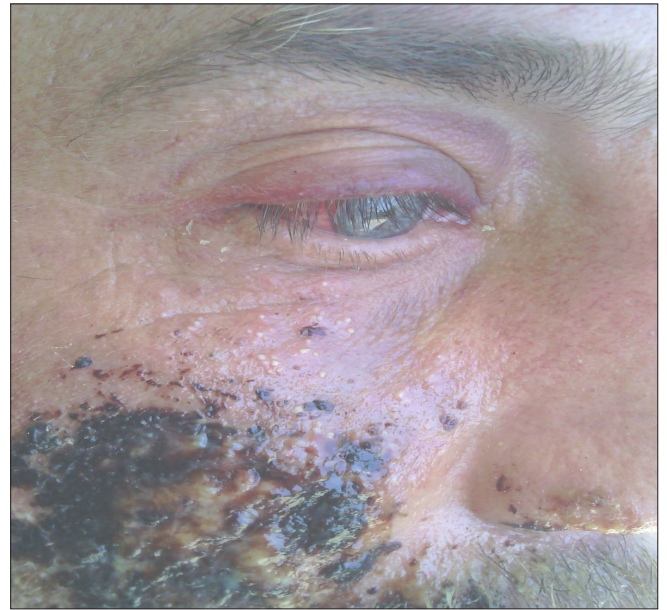


Fig. 3. Redness in the right eye, swelling in the right-lower eyelid of the patient

hemorrhage was detected. After the optometry, symptomatic treatment was suggested. After decreasing of complaints, the patient was discharged with suggestion ophthalmology and plastic surgery control on day two of follow-up.

3. Discussion

The widespread use of airbags has significantly decreased the incidence of serious morbidity associated with motor vehicle accidents. Driver deaths are 28% lower than drivers of cars with seat belts only, and hospital admissions are 24% lower among drivers of cars with airbags compared to those without airbags (O'Neill, 1992; Zador and Ciccone, 1993). Airbag deployments may cause eye injuries. Although the injuries are usually monocular and involve the driver, they can be binocular and occur in passengers and at varying speeds of impact (Zador and Ciccone, 1993; Lee et al., 2001). There was an eye injury related with airbag deployment in our patient who was a car driver.

Duma et al. (1996) divide airbag-induced eye injuries into two categories, mechanical injury and alkaline chemical injury. There is another description as a penetrating injury (Vichnin et al., 1995). Mechanical injury occurs as a direct result of the tremendous force and velocity with which airbags contact the eyes and surrounding tissues. The force of the airbag is transmitted to the eye in an anterior-posterior direction with subsequent deformation of the fixed anatomic structures resulting in many anterior segment injuries (Lee et al., 2001). In our patient, a redness in the right eye and swelling in lower-right eyelid were occurred due to mechanical effect of airbag.

Studies by Schreck et al. (1995) demonstrated airbag deployment at an average speed of 100 mph (range 50-200 mph). In standard crash tests, airbag inflation occurs 15 ms after impact, and it is fully expanded 50 ms after impact. Because of this rapid inflation, mechanical injuries are common and produce a variety of injuries. Eyelid trauma, corneal injury, and hyphema are most common injuries (Lee et al., 2001). Periorbital fractures, lens dislocation, corneoscleral laceration, retinal detachments, vitreous and

retinal hemorrhages, choroidal rupture, and macular holes also have been described (O'Neill, 1992; Zador and Ciccone, 1993; Lee et al., 2001). On the admission, our patient had a patchy lesion in the right half of face and minimal redness in the right eye and periorbital area, there was a tenderness on the right zygomatic arch with palpation. After sixth hours of follow-up, an increase of redness in the right eye and lower - right eyelid were occurred.

Inflation of the airbag is triggered by a sodium aside propellant system. Sodium aside is converted to nitrogen, promoting airbag expansion. By products from the reaction are formed and released from venting holes in the back of the airbag. These products include heat and alkaline aerosols, such as sodium hydroxide, sodium carbonate, and other metallic oxides. If the venting system does not function adequately, the heat and alkaline chemicals produced during the reaction can burn holes in the airbag, resulting in exposure of the eyes to alkaline substances, some of which crystallize and deposit in the fornices. Spectacles may provide an element of protection against chemical injury by acting as a barrier between the alkaline chemicals and the eyes (Zador and Ciccone, 1993; Lee et al., 2001). In our case, the lesion on the face and eye may be related to chemical injury after airbag deployment. The increasing complaint during follow-up was supported this diagnosis; but there was no ophthalmologic examination finding without subconjunctival hemorrhage. Subconjunctival hemorrhage may be related to mechanical and / or chemical injury after airbag deployment in our patient.

Penetrating injuries are less common than mechanical injuries. Although spectacles may offer protection from chemical trauma, they may create an increased risk for penetrating injuries. It has been suggested that frames cause increased risk for more serious ocular injury and poor prognosis (Lee et al., 2001). Five cases involved bilateral eye injuries related with airbag deployment, were identified by Lee et al. (2001). Four patients sustained bilateral ocular injury were wearing eyeglasses (Lee et al., 2001). Eyeglass wearing was shown as an additional risk factor after airbag deployment according to a study including admissions to emergency department for 4-years period by Vichnin et al (Vichnin et al., 1995). We learned that he had no eyeglasses in the accident. No finding suggested to a penetrating trauma was found in the eye examination of patient had an injury on his only one eye.

According to study of Lee et al. (2001), 94 cases were

detected associated with airbag deployment. Twenty-four of these cases involved bilateral eye injuries. Fifteen people were wearing glasses on airbag deployment. Common injuries in this group included eyelid trauma and contusions, corneal abrasions, and hyphema. The most severe injuries included two patients with retinal detachments and two patients with ruptured globes. Three patients had vitreous hemorrhages. Nine patients in the review had ruptured globes, of which only two had useful vision after repair. Six of the nine injuries were related to blunt trauma, whereas three were caused by penetrating objects into the eye (Lee et al., 2001).

Management of eye injuries depends on the type and extent of injury. Assessment of hyphema size is best done at the slit lamp with direct light. Small hyphemas can be managed by an ophthalmologist on an outpatient basis with bed rest, topical cycloplegic agents, and topical corticosteroids. Severe hyphemas will warrant hospitalization by an ophthalmologist. Corneal abrasions are also best assessed at the slit lamp with fluorescein dye. If the etiology of the abrasion is not chemical, it may be treated like a normal corneal abrasion with antibiotic ointment or drops and possible patching in non-contact lens wearers. Alkaline exposure warrants immediate referral to ophthalmology because of the high risk for corneal damage. When checking the pH of lacrimal fluid, a pH above 7.4 warrants immediate irrigation with normal saline with the pH checked immediately after irrigation and 30 minutes later. In addition, one should examine the fornices for foreign objects and sweep them to remove any alkaline deposits (Lee et al., 2001). Our patient with subconjunctival hemorrhage treated symptomatically.

Despite reported cases in the literature, Lehto et al. (2003) we found that the risk of severe eye injury from airbags was very low (0.4%) in fatal or relatively serious accidents. Although airbags can have some eye-threatening side effects, they do help save lives (Lehto et al., 2003).

The patients should be evaluated for potential ocular injury related with airbag deployment in motor vehicle accidents. The visual acuity, integrity of eyelid and eyeball, pH determination of tear, the bone structure and soft tissue lesions of the orbital cavity should be evaluated in the first eye examination in the emergency department. In the presence of vision loss, alkali chemical injury or severe traumatic injury, patient should be consulted to an ophthalmologist. Chemical injury and ocular injury after motor vehicle collisions should be found within the diagnoses of doctors in emergency department.

REFERENCES

- Duma, S.M., Kress, T.A., Porta, D.J., Woods, C.D., Snider, J.N., Fuller, P.M., Simmons, R.J., 1996. Airbag-induced eye injuries: A report of 25 cases. *Trauma*. 41, 114-119.
- Lee, W.B., O'Halloran, H.S., Pearson, P.A., Sen, H.A., Reddy, S.H., 2001. Airbags and bilateral eye injury: Five case reports and a review of the literature. *J. Emerg. Med.* 20, 129-134.
- Lehto, K.S., Sulander, P.O., Tervo, T.M., 2003. Do motor vehicle airbags increase risk of ocular injuries in adults? *Ophthalmology*. 110, 1082-1088.
- O'Neill B., 1992. Effectiveness of air bags. *N. Engl. J. Med.* 326, 1091.
- Schreck, R.M., Rouhana, S.W., Santrock, J., D'Arcy, J.B., Wooley, R.G., Bender, H., Terzo, T.S., DeSaele, K.H., Webb, S.R., Salva, D.B., 1995. Physical and chemical characterization of airbag effluents. *J. Trauma*. 38, 528-532.
- Vichnin, M.C., Jaeger, E.A., Gault, J.A., Jeffers, J.B., 1995. Ocular injuries related to air bag inflation. *Ophthalmic. Surg. Lasers*. 26, 542-548.
- Zador, P.L., Ciccone, M.A., 1993. Automobile driver fatalities in frontal impacts: Air bags compared with manual belts. *Am. J. Public Health*. 83, 661-666.