Corneal abrasion and alkali burn secondary to automobile air bag inflation

Angela Scarlett, Paul Gee

A 59-year-old woman self presented to the emergency department with a painful right eye following a motor vehicle accident. She had reduced visual acuity and the eye had an alkaline pH with complete corneal uptake of fluorescein. Diagnosis of corneal abrasion and alkali burn to her right eye secondary to inflation of a driver's automobile airbag was made. The eye was irrigated with normal saline. Such injuries, although rare, can easily be identified within the emergency department by the history of exposure, evidence of facial injuries or burns, and an alkaline pH in the inferior cul-de-sac of the eye. Early detection and management with ophthalmology review is therefore imperative to prevent irreversible visual impairment.

A 59-year-old woman presented herself to the emergency department with a painful right eye following a motor vehicle accident. Two hours previously she had been the driver of a car hit on the side at approximately 30 km/h by another vehicle. The front seat drivers' air bag was deployed. Immediately following impact she could smell a burning odour and her right eye became painful with blurred vision. She was not wearing glasses at the time. No other injuries were sustained. Past medical history was unremarkable with no previous ocular trauma.

Examination revealed a right periorbital facial burn and reduced visual acuity in the right eye; 6/12 left eye, 6/60 right eye with pin hole. The right eye had a pH measured at 9 which reduced to 8 after 2 litres of normal saline flush. Amethocaine eye drops were applied for analgesia. Fluorescein drops were also applied, with complete corneal

uptake of the marker and fluorescence with ultraviolet examination (fig 1).

The patient was reviewed by ophthalmology and diagnosed with a corneal epithelial defect and discharged on chloramphenicol ointment. At follow-up her vision had returned to normal with no ongoing impairments.

DISCUSSION

Airbags in motor vehicles consist of a nylon bag and an inflator unit with a triggering device. They are designed to inflate when a significant deceleration force triggers an electromechanical sensor. The inflated bag is designed to protect the vehicle occupant's upper body and head from striking some part of the vehicle's interior. The air bag is inflated by the oxidation of a sodium azide pellet, which rapidly generates nitrogen gas. Most airbags inflate within 25 ms. The reaction produces an alkaline aerosol consisting of

sodium hydroxide, carbon dioxide, sodium bicarbonate, and metallic oxides. The air bag itself does not have to rupture in order for this aerosol to be released.^{1 2}

The use of such air bags have been shown to significantly reduce morbidity and mortality, reducing fatalities by at least 24%; however, there are also a number of injuries directly related to the use of air bags including ocular trauma. The incidence of ocular injury secondary to air bags is 2–3%.³ The number of lives saved by air bags generally outweighs the risk of eye injury and indeed ocular injuries still occur in the absence of air bag inflation.

Airbag related ocular injuries are either attributable to the mechanical force of the airbag, involving virtually every ocular structure including angle recession, lens subluxation, traumatic iritis, vitreous, intraretinal or subretinal haemorrhage, retinal tear, or injury secondary to the highly corrosive alkaline aerosol. The latter injuries are more common, the most common being that of keratitis and corneal abrasion as presented in this case study.² The alkali aerosol causes saponification of cell membrane fatty acids resulting in disruption of the cell membrane and potential necrosis and hydrolysis of glycosaminoglycan with collagen denaturation due to the hydroxyl ion. The subsequent inflammatory response causes further cellular damage.

The incidence of injury is influenced by a number of variables including the orientation of the occupant's head at the time of impact, distance from the steering wheel, unrestrained occupants, and inflation force. Whether the occupant is wearing glasses affects the pattern of injury, with greater risk of burns/keratitis occurring in those without glasses, but direct injury greater in those wearing glasses. Furthermore, those who have undergone refractive surgery are at increased risk of developing severe injuries secondary to compromised corneal integrity.⁴

Ocular alkali burns secondary to air bag deployment can be easily recognised in the emergency department by the history of exposure, evidence of facial injuries or burns, and evidence of alkaline pH in the inferior cul-de-sac of the eye. If treated appropriately incidence of complications can be reduced. Such injuries can result in permanent visual impairment. Early detection and management with ophthalmology follow-up is therefore imperative.

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Figure 1 Complete corneal uptake of fluorescein. Informed consent was obtained for publication of this figure.

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Informed consent was obtained for publication of fig 1.

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IMAGES IN EMERGENCY MEDICINE

Oesophageal dilatation due to a paraoesophageal hernia and gastric volvulus as a cause of stridor

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An elderly woman presented in shock with audible stridor, respiratory distress, and a large air filled mass palpable either side of the thyroid cartilage in the anterior triangle of the neck and supraclavicular regions. A large paraoesophageal hernia with massive oesophageal dilatation was confirmed by a chest radiograph (fig 1). Further examination revealed the air filled sack was covering the glottis extending from the posterior pharyngeal wall. Intra-oral manual posterior displacement/compression of the air filled mass revealed grade 1 intubating conditions. A laparoscopic repair of a paraoesophageal hernia and gastric volvulus was performed as an emergency, with further surgery

Figure 1 Large paraoesophageal hernia with massive oesophageal dilatation.

to decompress a massively dilated oesophagus filled with inspissated compacted food stuff.

Respiratory distress has been reported in an adult due to a large paraoesophageal hernia,¹ but this case highlights an interesting cause of stridor, previously not reported in the literature, with the appropriate emergency management.

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