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Bilateral chemical eye injury resulting from airbag deployment

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Introduction

Airbags constitute an important safety feature found in modern vehicles. This report describes a case where a significant ocular injury was sustained as a consequence of airbag deployment, to raise awareness of this cause of chemical injury and to highlight the initial management.

Case report

A 47-year male driver's car collided head on with another at approximately 60mph, resulting in the deployment of the frontal airbag located within the steering wheel. The driver was using a seatbelt. Immediately after impact his vision was cloudy and both eyes were painful. At the Emergency Department (ED) both corneas were cloudy with marked chemosis (fig 1). The pH of each eye was high at 8.0-8.5 (normal range 7.0-7.4). Both eyes were irrigated with 750ml of normal saline and the pH had decreased to pH 7.5. At emergency ophthalmology review, his best-corrected visual acuity as 6/9 right eye and 6/12 left eye. Both eyes had total corneal epithelial defects with significant limbal ischaemia and thrombosis of the surrounding conjunctival blood vessels (fig 2). Further pH testing revealed a secondary rise to 8.0; therefore each eye received a further 3 litres of normal saline irrigation. He received a combination of oral vitamin C, doxycycline comprising topical therapy and preservative-free 0.1% dexamethasone, 0.5% chloramphenicol, 10% potassium ascorbate, 0.25% timolol and 1% cyclopentolate. At discharge, his vision was 6/36 bilaterally and large central corneal epithelial defects remained; these took a further 3 weeks to close. He was unable to return to work for six months due to disabling light sensitivity and ocular discomfort. One year after injury his vision has improved to 6/12 right eye and 6/9 left eye despite corneal scarring. Clinically there is evidence of bilateral corneal scars and vascularisation as a result of permanent limbal stem-cell compromise (fig 3 and fig 4). He is likely to require anterior segment reconstruction surgery in the future, with an allograft stem cell transplant being considered.



Figure 1. Right eye demonstrating hazy cornea and chemosis



Figure 2. : Left eye demonstrating peri-limbal ischaemia (thrombosis of conjunctival blood vessels adjacent to peripheral cornea)



Figure 3. Right eye. Diffuse corneal hazy scarring and corneal vascularisation resulting from loss of corneal stem cells near the limbus at 3 and 9 o'clock positions.



Iris

- Irrigate using Normal Saline/Ringers Lactate
- Otherwise sterile water/clean water if nothing else available
- Use an irrigation device to direct flow across eye
- Irrigate for minimum of 30 minutes
- Retest ph after 5 minutes folowing completing of irrigation
- Repeat eye irrigation until ph stable between 7.0-7.4
- Record baseline visual acquity and perform detailed examination
- Establish specific chemical involved (including concentration) **Box 1: Immediate medical management of chemical eye injury**



Figure 4. Right eye. Corneal scarring and corneal vascularisation at follow up appointment

Haematoma Laceration Orbital fracture Subconjunctival Haemorrhage Abrasion Iritis Hyphaema (blood in front of iris) Traumatic cataract Dislocation Tears Detachment Commotio retinae (bruising) Rupture of eye Table 1: Ocular injuries associated with blunt trauma • Measure baseline ph in each eye • Apply topical anaesthetic drops (e.g. Proxymetacaine)

Remove all solid material by sweeping fornices with cotton bud

• Insert an eyelid speculum (if available)

Discussion

Airbags in motor vehicles are inflated by the oxidation of a sodium azide (NaN3) propellant system, which generates large quantities of nitrogen gas [1]. Byproducts of this combustion process create a hot alkaline aerosol containing sodium hydroxide, sodium carbonate, carbon dioxide and metallic oxides [2]. Airbag-related ocular injuries are either attributable to blunt trauma from striking the airbag, which may involve virtually every ocular structure [3] (Table 1), or result from chemical injury due to exposure to the alkaline Emergency aerosol. management comprises prompt irrigation and the removal of residual chemical debris from the eye (Box 1). The most important intervention is copious irrigation using normal saline or any neutral irrigation fluid until pH of the eye has normalised. Topical anaesthetic drops can reduce pain and involuntary lid closure (blepharospasm) and thus increase the effectiveness of the irrigation. All particulate matter should be removed using a moistened cotton-bud tip. Eyelashes, lids and the corneal fornices should be examined, and the upper lids must be everted to ensure that they are not harbouring any material (Box 2). Same-day ophthalmology referral is recommended for all chemical eye injuries.

Conclusion

RTC first responders or ED personnel should be aware of ocular exposure to a noxious alkaline aerosol from an airbag. Immediate irrigation with any neutral fluid and serial pH sampling remains the priority, to minimise morbidity and optimise future visual rehabilitation.

References

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