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CASE REPORT

Paediatric alkaline and thermal burn injury due to airbag deployment: A public health risk

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Case

A 4-year-old boy (forward-facing, restrained front-seat passenger) was involved in a road traffic accident resulting in the deployment of the ipsilateral airbag. During activation, airbags expel sodium azide, which oxidizes immediately on exposure to the air producing sodium hydroxide. This potent alkali, in combination with the high-temperature gases released, can cause burns. In this case, both chemical and thermal burns were sustained to the left side of face. An element of mechanical friction burn was also apparent. On admission, the child had oedematous lips and facial swelling, in addition to 2% superficial partial thickness burns confined to the face (Fig. 1). The eyes were erythematous, oedematous, and the conjunctival surface had a pH of 8. This injury necessitated intubation for a total 48 h, with 24 h on PICU. The eyes required copious irrigation with normal saline to reduce the pH. The burns healed in 7 days with conservative management (Bacitracin ointment). Fortunately, there were no long-term sequelae.

Discussion

Thankfully, the literature shows that most airbag-related injuries are minor, typically involving the upper extremity or head or neck.² These are mainly superficial burns requiring conservative therapy. There are several mechan-

isms of burn injury causation due to normally functioning airbags:

- (1) Direct contact with the hot expelled gases.
- (2) Contact with the hot airbag itself and melting of clothing from either of these contacts.³
- (3) Friction burns.
- (4) Chemical burns: airbag canisters contain the chemicals sodium azide and cupric oxide. Water may react with sodium azide to form highly toxic and explosive hydrazoic acid. These chemicals are converted to sodium hydroxide, which can cause significant chemical burns. Rapid deceleration due to an impact causes the ignition of a sodium azide cartridge, which releases nitrogen gas to inflate the nylon rubber bag. Numerous high-temperature gases and various other metallic oxides are also released producing a corrosive alkaline aerosol.¹

A standard trauma-protocol must be followed for all such injuries. Special attention must be given to exclude occult injuries to the cervical spine and to the eyes. A low threshold for intubation is required for all facial burns, but especially those in children where facial swelling can rapidly obstruct an initially patent airway and then necessitate a surgical airway. The potential for systemic toxicity should also not be forgotten.

Causes of airbag-related injuries:

- Burns
- Ocular injuries
- Systemic toxicity (hypotension, bradycardia, headaches)
- Head, neck and facial fractures

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Figure 1 Airbag-related injury necessitating intubation.

Conclusion

For over 10 years, airbag design has been modified to reduce the risk of injury to occupants whilst maintaining their life-saving function. It would be of benefit to consider further

changes to these devices as they continue to pose a threat to children and adults, inflicting unnecessary injuries over and above those that might be expected in a high-speed collision scenario. The magnitude of the risk is multiplied when children are unrestrained or restrained improperly. It would seem appropriate that vehicles should have a mandatory performance standard which requires the suppression of automatic airbag deployment if a child is located in the front passenger seat.

Conflict of interest statement

The authors have no conflicts of interest.

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