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 pas-
senger) was involved in a road traffic accident resulting in the
deployment of the ipsilateral airbag. During activation, air-
bags 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, oedema-
tous, 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. These are mainly superficial burns
requiring conservative therapy. There are several mech-
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) 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 hyfrazoic
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-tem-
perature gases and various other metallic oxides are also
released producing a corrosive alkaline aerosol.

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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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.

References