

Deployed Airbag Causes Bullous Reaction Following a Motor Vehicle Accident

Katlin R. Poladian, MD; Rechelle Tull, MD; Karen S. Strenge, MD; Christine S. Ahn, MD; Amy J. McMichael, MD

PRACTICE POINTS

- This case highlights the potential for a bullous reaction following airbag deployment.
- After airbag deployment, it is important to immediately cleanse the affected areas of skin with soap and water.

Airbags can be lifesaving during a motor vehicle accident (MVA), but airbag deployment has been the cause of dermatologic injuries including irritant dermatitis, as well as thermal, friction, and chemical burns. A highly corrosive alkaline aerosol composed of sodium hydroxide, sodium bicarbonate, and metallic oxides is released during airbag deployment. We present the case of a 35-year-old man who developed a bullous reaction to released by-products from airbag deployment during an MVA.

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Airbags are lifesaving during motor vehicle accidents (MVAs), but their deployment has been associated with skin issues such as irritant dermatitis¹; lacerations²; abrasions³; and thermal, friction, and chemical burns.⁴⁻⁶ Ocular issues such as alkaline chemical keratitis⁷ and ocular alkali injuries⁸ also have been described.

Airbag deployment is triggered by rapid deceleration and impact, which ignite a sodium azide cartridge, causing the woven nylon bag to inflate with hydrocarbon gases.⁸ This leads to release of sodium hydroxide, sodium

bicarbonate, and metallic oxides in an aerosolized form. If a tear in the meshwork of the airbag occurs, exposure to an even larger amount of powder containing caustic alkali chemicals can occur.⁸

We describe a patient who developed a bullous reaction to airbag contents after he was involved in an MVA in which the airbag deployed.

Case Report

A 35-year-old man with a history of type 2 diabetes mellitus and chronic hepatitis B presented to the dermatology clinic for an evaluation of new-onset blisters. The rash occurred 1 day after the patient was involved in an MVA in which he was exposed to the airbag's contents after it burst. He had been evaluated twice in the emergency department for the skin eruption before being referred to dermatology. He noted the lesions were pruritic and painful. Prior treatments included silver sulfadiazine cream 1% and clobetasol cream 0.05%, though he discontinued using the latter because of burning with application. Physical examination revealed tense vesicles and bullae on an erythematous base on the right lower flank, forearms, and legs, with the exception of the lower right leg where a cast had been from a prior injury (Figure 1).

Two punch biopsies of the left arm were performed and sent for hematoxylin and eosin staining and direct immunofluorescence to rule out bullous diseases, such as bullous pemphigoid, linear IgA, and bullous lupus. Hematoxylin and eosin staining revealed extensive spongiolysis with blister formation and a dense perivascular infiltrate in the superficial and mid dermis composed

Dr. Poladian is from the Department of Dermatology, Harbor-UCLA Medical Center, Carson, California. Drs. Tull, Strenge, Ahn, and McMichael are from Wake Forest Baptist, Winston-Salem, North Carolina. Drs. Tull, Ahn, and McMichael are from the Department of Dermatology, and Dr. Strenge is from the Department of Pathology.

The authors report no conflict of interest.

Correspondence: Katlin R. Poladian, MD, Department of Dermatology, Harbor-UCLA Medical Center, 1000 W Carson St, Box 458, Torrance, CA 90502 (kpoladian@dhs.lacounty.gov).

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of lymphocytes with numerous scattered eosinophils (Figures 2 and 3). Direct immunofluorescence studies were negative. Treatment with oral prednisone and oral antihistamines was initiated.

At 10-day follow-up, the patient had a few residual bullae; most lesions were demonstrating various stages of healing (Figure 4). The patient's cast had been removed, and there were no lesions in this previously covered area. At 6-week follow-up he had continued healing of the bullae and erosions as well as postinflammatory hyperpigmentation (Figure 5).

Comment

With the advent of airbags for safety purposes, these potentially lifesaving devices also have been known to cause injury.⁹ In 1998, the most commonly reported airbag injuries were ocular injuries.¹⁰ Cutaneous manifestations of airbag injury are less well known.¹¹



FIGURE 1. Tense bullae on the legs with sparing of the lower right leg where there is a cast.

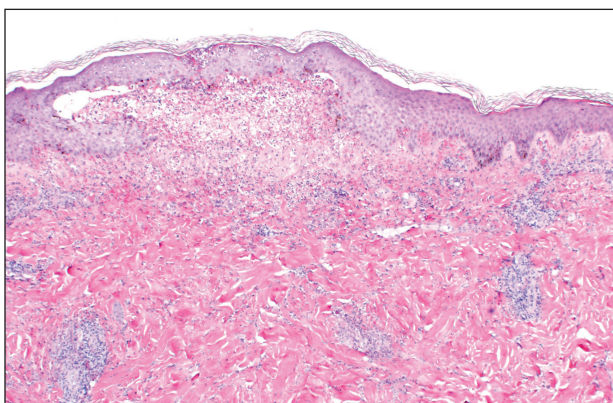


FIGURE 2. Acute epidermal spongiosis with vesicle formation and perivascular lymphohistiocytic inflammation in the superficial to mid dermis with extravasated erythrocytes (H&E, original magnification $\times 40$).

Two cases of airbag deployment with skin blistering have been reported in the literature based on a PubMed search of articles indexed for MEDLINE using the terms *airbag blistering* or *airbag bullae*^{12,13}; however, the blistering was described in the context of a burn. One case of the effects of airbag deployment residue highlights a patient arriving to the emergency department with erythema and blisters on the hands within 48 hours of airbag deployment in an MVA, and the treatment was standard burn therapy.¹² Another case report described a patient with a second-degree burn with a 12-cm blister occurring on the radial side of the hand and distal forearm following an MVA and airbag deployment, which was treated conservatively.¹³ Cases of thermal burns, chemical burns, and irritant contact dermatitis after airbag deployment have been described in the literature.^{4-6,11,12,14,15} Our patient's distal right lower leg was covered with a cast for osteomyelitis, and no blisters had developed in this area. It is likely that the transfer of airbag contents occurred during the process of unbuckling his seatbelt, which could explain the bullae that developed on the right flank. Per the Centers for Disease Control and Prevention, individuals should quickly remove clothing and wash their body with large amounts of soap and water following exposure to sodium azide.¹⁶

In 1989, the Federal Motor Vehicle Safety Standard No. 208 (occupant crash protection) became effective, stating all cars must have vehicle crash protection.¹² Prior to 1993, it was reported that there had been no associated chemical injuries with airbag deployment. Subsequently, a 6-month retrospective study in 1993 showed that dermal injuries were found in connection with the presence of sodium hydroxide in automobile airbags.¹² By 2004, it was known that airbags could cause chemical and thermal burns in addition to traumatic injuries from deployment.¹ Since 2007, all motor vehicles have been required to have advanced airbags, which are engineered to sense

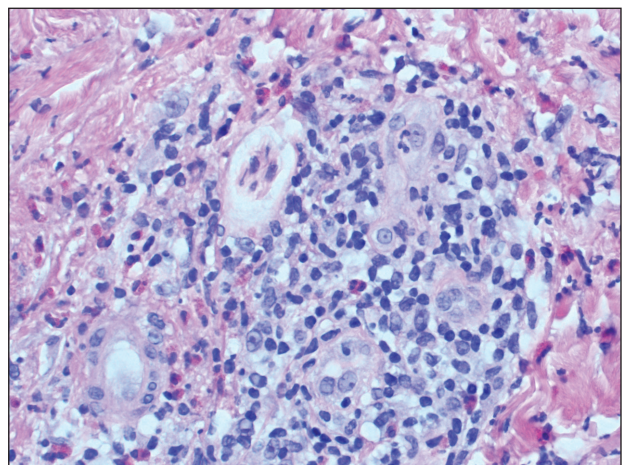


FIGURE 3. Numerous eosinophils admixed with lymphocytes surrounding a dermal blood vessel (H&E, original magnification $\times 400$).



FIGURE 4. Healing erosions and a few bullae on the legs at 10-day follow-up.



FIGURE 5. Healing erosions and bullae on the posterior aspect of the legs, with sparing on the right due to a cast, at 6-week follow-up.

the presence of passengers and determine if the airbag will deploy, and if so, how much to deploy to minimize airbag-related injury.³

The brand of car that our patient drove during the MVA is one with known airbag recalls due to safety defects; however, the year and actual model of the vehicle are not known, so specific information about the airbag in question is not available. It has been noted that some defective airbag inflators that were exposed to excess moisture during the manufacturing process could explode during deployment, causing shrapnel and airbag rupture, which has been linked to nearly 300 injuries worldwide.¹⁷

Conclusion

It is evident that the use of airbag devices reduces morbidity and mortality due to MVAs.⁹ It also had been reported that up to 96% of airbag-related injuries are relatively minor, which many would argue justifies their use.¹⁸ Furthermore, it has been reported that 99.8% of skin injuries following airbag deployment are minor.¹⁹ In the United States, it is mandated that every vehicle have functional airbags installed.⁸

This case highlights the potential for substantial airbag-induced skin reactions, specifically a bullous reaction, following airbag deployment. The persistent pruritus and lasting postinflammatory hyperpigmentation seen in this case were certainly worrisome for our patient. We also present this case to remind dermatology providers of possible treatment approaches to these skin reactions. Immediate cleansing of the affected areas of skin may help avoid such reactions.

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