

Chemical Burn Injury Secondary to Airbag  
Deployment: A Case Report and Literature  
Review

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## Abstract

**Background:** Burn wounds caused by airbags deployment are infrequent, and with the increasing use of these safety feature in cars the documentation and sharing of the information related to these injuries is important to help improve the design of airbags and give the treating clinicians some background knowledge when treating injuries of similar nature.

**Case presentation:** This is a case report of lady who sustained a chemical burn injury to her finger following the deployment of airbags when she had a frontal car collision. The pH of the wound has helped to establish the pathophysiology of the wound.

**Conclusion:** Thorough history and examination help to detect minor injuries which can be overlooked otherwise. Airbags are associated with both friction and chemical burns, and pH of the burn wound helped in differentiating between them, and decides on first aid and appropriate management and follow ups.

## Introduction

With the increasing use of airbags, the improved safety of passengers is undisputed, with the combination of seatbelt with airbags preventing mortality and reducing gravity of injuries [1]. However, the airbags can cause injuries directly attributable to their deployment, with the spectrum of these injuries ranging from simple abrasions to rarely fatal head injury [2]. Many of the injuries are so infrequent and minor that we usually do not find clinical data related to them.

## Case Presentation

A 26-year-old lady self-presented to the Accidents and Emergency Department at Pinderfields General Hospital, Wakefield, following a frontal collision driving at 25 miles/hour, complaining of burning pain of her hand dorsum. After being cleared from ATLS point of view, hand examination showed partial thickness burn over the eponychial fold of her index finger and full thickness burn over her middle finger middle phalanx, with surrounding erythema. The pH of these wounds was found to be 10. These features are consistent with chemical burns; where they appear well demarcated with sharp edges and with a splash shape (Figure 1).

After assessment, the wounds were irrigated with saline until the pH normalized to 7, and antiseptic dressing was applied. She was discharged on simple oral analgesia and follow up appointment was arranged in the regional burns unit.



Figure 1: Airbags deployment chemical burns of the index and middle fingers.

## Outcome and Follow-Up

The patient was reviewed later at the Burns Unit, and her burn completely healed within 2 weeks without any complications, and was discharged with appropriate scar care few weeks later.

## Discussion

Air bags in cars are inserted for protection against injuries to the passengers. With the use of seatbelts combined with airbags, the number of mortalities and serious injuries has been markedly reduced. Zador and Ciccone reported that the combination of the air bag with seat belt reduced the incidence of fatal injury in front-impact crashes in cars by 28% compared to that with seat belt only [3].

Despite their importance with regards to improved safety is undisputed, infrequently air bags deployments result in injuries. These injuries range from irritant dermatitis to an unlikely event of death. The spectrums of these injuries are determined by position of passenger, use of seatbelt restraint and for ocular injuries wearing of glasses [4]. According to Ulrich, the most common type of injury was abrasion (63.6%), followed by contusion, laceration, and burn comprising 7.8% of all injuries [5]. Chemical ophthalmic burns are important to diagnose early and characterized reduced visual acuity, with the eye giving alkaline pH measurement and complete corneal uptake of fluorescein. The eye should be irrigated with normal saline [6].

Hallock proposed classification of burns caused by air bag deployment, and classified thermal burns into two types: direct burn from high temperature gases and indirect burn due to melting of clothing [3]. The former is a burn related to contact with the expelled hot gases. These cases usually involve the upper extremities; as the exhaust vents are located on the rear of the bag [4].

Chemical burns incurred by airbags are mostly of minor severity and most affected body parts are upper extremities, as was the case with patient, followed by face and chest [6].

Airbags are made of nylon and are retained in the steering wheel central area. Rapid deceleration activates electrical mechanism that triggers a series of chemical reactions that ignite a sodium azide pellet, with the pellet reacting with potassium nitrate leading to the very rapid production of a large amount of high-temperature nitrogen

gas, as well as sodium hydroxide and other gases, causing the bag to inflate within 20 hundredths of a second (300 km/h) [5]. Moments after the airbag deployment, the gases produced dissipate through the small pores of the fabric. However, deflation occurs within 2 seconds; allowing the occupant to move [7]. These high-temperature gases produce a corrosive alkaline aerosol able to cause thermal and alkali chemical burns [7]. However, Heimlich has indicated that these strong alkalis are no longer being produced, with recent model air bags are not expected to cause chemical burn [3].

## Conclusion

A detailed history and examination of a patient should be done in case of road traffic accident to avoid missing injuries of minor or subtle nature. Airbags deployment can cause either thermal or chemical burns and the pH of the wound may help in establishing the diagnosis. The occurrence of such injuries resulting from safety equipment like airbags and seatbelts should never undermine their role in passenger's safety, however, should encourage development of innovations lowering the risk of injuries associated with them. Measuring the burn pH can help establish the diagnoses and decide on appropriate treatment.

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