



CASE REPORT

# Cryogenic burns from aerosol sprays: a report of two cases and review of the literature

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## KEYWORDS

Cryogenic burn; Aerosol

**Summary** Cryogenic burns are uncommon. We present two patients who presented to a Regional Burns Unit on consecutive days with almost identical burn injuries caused by exposure to a unique source of sub-zero temperature, the spray from an aerosol deodorant. The clinical features and management of the cases are outlined, and we discuss the mechanism of a cryogenic burn.

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Burns due to contact with sub-zero temperature are uncommon, with only seven such cases seen at The Welsh Centre for Burns and Plastic Surgery between March 1995 and December 2001.

We recently treated two teenage girls, school-mates of each other, who sustained identical burns due to sustained contact with the sprayed contents of an aerosol can of deodorant.

A 13-year-old schoolgirl was referred to the Burns Centre complaining of pain and discomfort around a one week-old burn to her forearm which she claimed to have sustained from contact with a hot cooker hob.

There was a 4 cm diameter necrotic mixed depth burn on the volar aspect of the girl's proximal forearm.

Twenty four hours after the first girl presented, a second teenager, aged 14, was referred with similar burns to that of the first child, one to the forearm (Fig. 1) and one to the ankle. She admitted that

these were caused by sustained exposure to the stream of contents from an aerosol can of deodorant. She told us that she and her friend (patient 1) had both sprayed their skin with the aerosol, holding the nozzle approximately 1 cm from the skin surface, for period of 20-30 s in order to achieve an 'anaesthetic effect' over the area. The reasons for this were not clear, however it was stated that this had been done 'out of curiosity'.

Slow blistering of the skin with worsening pain one week later had forced this teenager to seek attention. The first teenager subsequently admitted the true cause of her injury.

The first girl's burn was initially treated with dressings until the wound was clean and after 2 weeks an unhealed area was excised and split skin grafted. She was discharged from follow-up 2 months later.

The second girl's burns were less deep than that of the first girl and were treated conservatively.

The exact mechanisms by which freezing causes a cutaneous burn is not clear and several have been postulated, including hypertonic

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Fig. 1 Cryogenic burn on the forearm of girl two.

damage, intracellular ice formation and circulatory changes due to endothelial damage to cells and arteriospasm causing hypoxia.<sup>1</sup>

Heat burns cause protein denaturation and such injuries can result in significant damage to the collagen framework of the dermis resulting in the significant scarring seen with such insults. Protein denaturation is not a feature of cold burns and unless the freezing contact is particularly prolonged such injuries do not produce significant scarring, as the dermal collagen is preserved.<sup>2</sup> The significance of this is that it may be appropriate to manage cold burns conservatively for a longer period than one would a heat burn in the expectation that the

preservation of dermal integrity may give a better cosmetic result with expectant treatment than would be achieved with early excision and grafting.

Factors that determine whether exposure to a freezing source will cause a burn include the rate of freezing, the temperature and duration of exposure and the thawing rate. It has been shown that in dogs a burn can be caused by cooling skin to below 10 °C.<sup>3</sup>

We sought to investigate the cooling effect of an aerosol body spray with a simple experiment. Using a can of body spray of the kind used by the two girls we sprayed the contents onto the bulb of an alcohol thermometer from a distance of 1 cm and recorded the temperature reached at intervals of 5 s. The results were then plotted on a graph using Microsoft Excel. This simple, if somewhat crude, experiment demonstrated that a temperature of 0 °C was achieved by the five-second mark and -15 °C was reached after only 20 s of spraying (Fig. 2).

Although this demonstration of the cooling effect of a deodorant aerosol spray will not accurately reflect the actual temperatures achieved of the skin, it does confirm that such sprays can produce freezing temperatures and thus have the capacity to cause a cold burn.

Lacour and Le Coultre reported on an eight-year-old boy who sustained a forearm burn after spraying

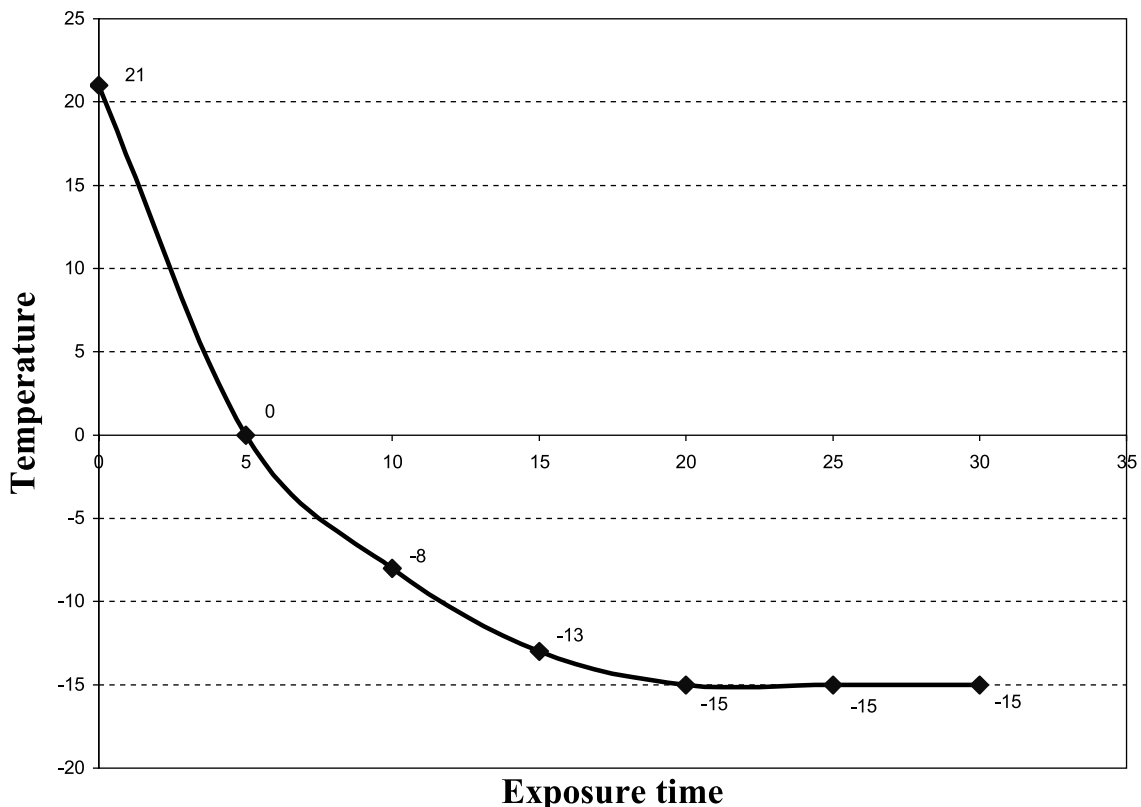


Fig. 2 Graph of temperature, as recorded by an alcohol thermometer, with time of exposure to the aerosol body spray.

his arm with a toilet air freshener aerosol at close range for an unknown period of time. The aerosol in question used butane and propane as propellants. They showed that such a spray could produce a temperature of  $-40^{\circ}\text{C}$  when sprayed onto a toluene thermometer at close range and attributed this cooling effect to be due to the low boiling points of the propellants ( $-42.2^{\circ}\text{C}$  for propane and  $-0.6^{\circ}\text{C}$  for butane).<sup>4</sup>

Deodorant sprays of the type used by our patients also contain butane and propane as propellants.

Another paper reported on a case of superficial oral mucosa frostbite in a soldier who had been spraying an aerosol as an inhalant to try and get 'high' on the propellant chemicals.<sup>5</sup>

We contacted the manufacturers of the deodorant aerosol used by the girls who informed us that they are aware of the potential for their product to cause burns if sprayed on skin at close range for a prolonged period of time both as a result of the Lacour and Le Coultre paper and from occasional reports from consumers. For this reason their cans of aerosol deodorant carry a warning (in small print)

advising that the product be sprayed from a distance of 15 cm and that prolonged spraying be avoided.<sup>6</sup>

These two cases highlight a little known potential for harm of aerosol sprays and we have urged the Manufacturers to be more specific in the warnings printed on their products.

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