

Objective

It is known that quaternary ammonium compounds are corrosive to the skin in higher concentrations (benzalkonium chloride: > 7.5 %) [1]. Nonetheless, even lower concentrations may cause skin irritation and damage, subject to mode and duration of exposure.

We report on a case of a child that suffered severe corrosive injury after prolonged exposure to a laundry sanitiser under occlusion.

Case Report

At around 7 in the evening, a mother put a nappy on her two-year-old daughter that had been contaminated by a spill of laundry sanitiser in the shopping bag earlier in the day. The sanitiser contained, among others, 2 to 3 % of quaternary ammonium compounds. The nappy was not wet, nor did it smell significantly of the product when the child had put it on. Only a stain on the outside of the nappy indicated contamination. The girl was then put to bed. After 2 to 3 hours, she woke up screaming and crying in pain. At this time, an approximately 5 by 10 cm erythema was visible on her left inner thigh (Figure 1).

The mother initially applied an antihistaminic to the site suspecting an insect bite, as well as oral acetaminophen for the pain. Additionally, the child was bathed to remove possibly remaining laundry sanitiser. The Poisons Information Centre was then contacted, who recommended to see a physician the following day in case of no improvement.

Around 1 a.m., the girl was presented to the emergency department due to increasing discomfort. The clinical manifestation showed in full extent around 10 a.m. the following day with extensive blistering and third-degree chemical burns (Figure 2). Surgical debridement became necessary to remove the blisters. The wound dressing was changed daily. Over the next 4 weeks, however, wound healing was protracted and deficient (Figures 3 and 4). Because of presumed deeper extension into the tissue, it was discussed whether a compression stocking was necessary.

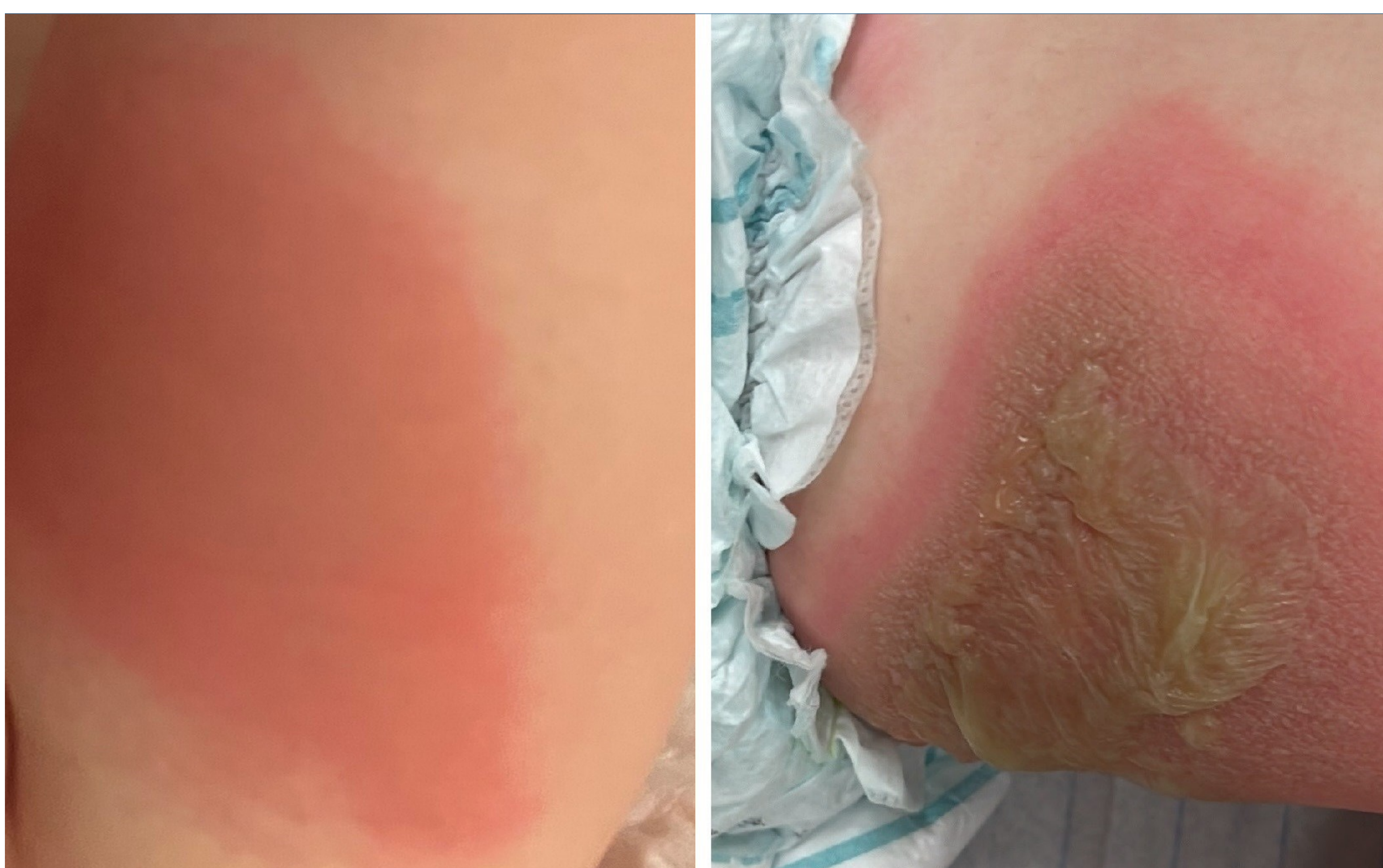


Figure 1: 2 to 3 hours after exposure **Figure 2:** 15 hours after exposure

Discussion

Quaternary ammonium compounds are believed to disrupt cell membranes by acting similarly to phospholipids and integrate into the membrane [2].

Due to these properties, (repeated) eye exposure in very low concentrations (i.e. benzalkonium chloride as a preserving agent in eye drops) can cause conjunctival and corneal damage [3], and skin exposure of high concentrations may cause chemical burns.

Conclusion

Cytotoxic effects of quaternary ammonium compounds to eyes (in low concentrations) and skin (in high concentrations) have been well documented in the literature [2,3].

However, this case demonstrates, that even concentrations deemed as not caustic may lead to severe injury, when exposure is prolonged.

Therefore, immediate and thorough decontamination after unintentional exposure to skin, and likewise eyes, is imperative to avoid corrosive injury - regardless of the concentration.

References

1. Benzalkoniumchlorid [MAK Value Documentation in German language, 2009] in The MAK-Collection for Occupational Health and Safety 1-37 (John Wiley & Sons, Ltd, 2012).
2. Alkhalifa S. et. al. Analysis of the Destabilization of Bacterial Membranes by Quaternary Ammonium Compounds: A Combined Experimental and Computational Study. *Chembiochem*. 2020 May 15;21(10):1510-1516. Epub 2020 Feb 18. PMID 31859426.
3. Goldstein MH, Silva FQ, Blender N, Tran T, Vantipalli S. Ocular benzalkonium chloride exposure: problems and solutions. *Eye (Lond)*. 2022 Feb;36(2):361-368. Epub 2021 Jul 14. PMID 34262161.



Figure 3: 8 days after surgery **Figure 4:** 14 days after surgery