

Chemical burn due to trifluoroacetic anhydride

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Case Report

A 21-year-old woman was studying chemistry at university. While she was pipetting 100% trifluoroacetic anhydride during an experiment, the pipette holder suddenly separated from the pipette and trifluoroacetic anhydride liquid spilled over her left thigh and right upper arm. Her teacher quickly washed her thigh and arm with large amounts of water for 30 min. After this, he soaked her thigh and arm with diluted bicarbonate for a while, washed them with water again and brought her to our hospital.

She developed an oedematous erythema on her left thigh and right upper arm associated with some discoloration. There was no vesiculation, bulla formation or erosion. She complained of severe pain. After treatment with betamethasone valerate ointment for several hours, the pain gradually subsided. Application of 8.5% calcium gluconate to the erythematous region increased the pain and azulene ointment was substituted for the calcium gluconate. A

week later, the sites became ulcerated. We applied silver sulfadiazine ointment and the ulcers healed gradually. It took 50 days for complete epithelization of all lesions. There remain hyperpigmentation and hypertrophic scarring, and local compression with a pressure sponge is still being applied.

Comment

Trifluoroacetic anhydride readily reacts with water and is hydrolysed to trifluoroacetic acid (TFA) (Fig. 1). TFA is a liquid which fumes in air and is among the strongest carboxylic acids (1). Among protic solvents, ionizing power is highest for solvents that form the strongest hydrogen bonds, that is, the solvents with the most acidic hydrogens. Because of powerful electron withdrawal by the fluorine atoms, TFA is a powerful ionizing solvent (2).

Because of the difference in electron withdrawal activity between fluorine atoms and chlorine atoms, TFA caused much more severe ulceration in our case than would have trichloroacetic acid (TCA) with a similar chemical structure to TFA. A variety of preparations with different concentrations of TCA are frequently utilized for chemical peeling (3). Complications of TCA peeling include hyperpigmentation, photosensitivity, and hypertrophic scar formation (3). Our patient also developed hyperpigmentation and hypertrophic scar formation on the leg and arm.

Hydrofluoric acid burns may cause severe systemic effects because

of fluoride ion release (4). Fluoride ions bind and deplete calcium and may cause severe hypocalcemia or hypomagnesemia. Calcium gluconate gel application and/or its intralesional injection is recommended for hydrofluoric acid burns. Although TFA does not release fluoride ions, we treated this patient with a calcium gluconate soak which, on the contrary, intensified her pain.

To our knowledge, this is the first case of chemical burn due to TFA in the English literature. Although TFA does not produce fluoride ions, we should bear in mind that it is a very potent acid and may give rise to severe burns.

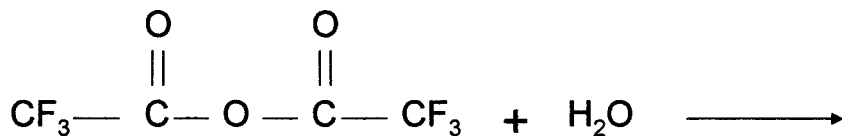
References

1. Beyer H, Walter W. *Handbook of Organic Chemistry*. London: Wolfgang Walter Prentice Hall, 1996.
2. Morrison R T, Boyd R N. *Organic Chemistry*, 5th edn. Boston: Allyn and Bacon, 2001.
3. Roenigk R K, Roenigk Hh. *Roenigk and Roenigk's Dermatologic Surgery: Principles and Practice*. New York: Marcel Dekker, 1996.
4. Asvesti C, Guadagni F, Anastasiadis G, Zakopoulou N, Danopoulou I, Zographakis I. Hydrofluoric acid burns. *Cutis* 1997; 59: 306–308.

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Trifluoroacetic anhydride



Trifluoroacetic acid (TFA)

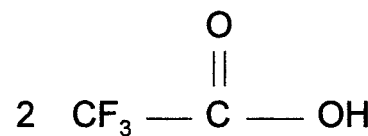


Fig. 1. Structure of trifluoroacetic anhydride