Splashed by a clear liquid

CLINICAL INTRODUCTION
A 35-year-old male presented with painful skin rash for 2 hours after a clear liquid splashed onto his legs when a car drove past him and squelched a roadside container on a street populated by small-sized factories. Burning sensation and pain developed in 10 min. He called on the emergency room after irrigation. His trousers were intact, wet but not slippery, and had a pungent sour odour.

QUESTION
What is the best answer for the clear liquid?
A. It is a strong alkaline fluid
B. It is concentrated sulfuric acid
C. It is concentrated hydrofluoric acid
D. It is 50% of hydrogen peroxide

For the answer see page 475

Figure 1  Erythematous, centrally greyish changes can be seen over both thighs and knees. The patient felt a sharp pain, deep into the bone, leading him to tightly grasp his thighs to try to relieve it.

Figure 2  Necrotic changes with depression of the skin over the left knee.
Splashed by a clear liquid

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ANSWER: C

The affected skin had a blue-greyish depression with surrounding erythema and blisters (figures 1 and 2), a picture of liquefacitive necrosis. This was suggestive of an alkaline injury; however, the pH of liquid on the trouser, measured by litmus paper, was 1, suggesting an acid.

The free H⁺ ion in strong sulfuric acid solution would result in not only coagulum formation on skin but also break down fabrics, causing burnt holes in clothing, but the patient’s trousers were intact. Concentrated hydrogen peroxide, a strong oxidant, could cause severe burns of mucosa but should not damage intact skin. Hydrofluoric acid can cause similar skin changes to those seen, but because it is a weak acid, will not affect clothing. Fluoride ion was detected by ion exchange chromatography from a 5 cm × 5 cm wet fabric cut from left knee area.

Hydrofluoric acid is widely used for etching, polishing or cleaning glass, ceramics and walls and rust removing. Its dissociated H⁺ ion causes skin damage and leaves fluoride ion that penetrates deep into the tissues, binding to and sequestering Ca²⁺ and Mg²⁺ ions, producing extensive tissue destruction. Irrigation with copious amount of water and treatment with calcium or magnesium compounds intravenously or locally are the conventional therapy for hydrofluoric acid burns. In this case, the affected skin was then covered with calcium gluconate-soaked gauze, which drastically reduced the pain. Systemic toxicity like hyperkalaemia, hypocalcaemia or hypomagnesaemia was not observed, but the wound required skin graft because of extensive tissue necrosis.

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Contributors K-WY was a trainee of toxicology, cared for this case and prepared the manuscript. S-YC performed the fluoride ion identification test. D-ZH cared for this case and prepared the manuscript.

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