FIRST AID PROCEDURE FOR RESPONDING TO HYDROFLUORIC ACID BURNS

Introduction
Hydrofluoric acid is an extremely hazardous liquid. It can cause severe skin and eye irritation or deep-seated, slow-to-heal burns. In certain cases, exposure can prove fatal. For any major exposure to HF, immediate paramedic assistance is necessary.

HF’s mode of action is to bind calcium whenever contact occurs with skin or other body tissues. Unlike the action of other acids, which are rapidly neutralized, tissue destruction and neutralization of HF may proceed for days. Because calcium is necessary for cell life, its binding can bring about rapid cell death. If the exposure is extensive, excessive amounts of calcium may be inactivated and inadequate supplies of calcium may be available for vital bodily functions.

Inform the physician treating the HF injury the nature of the chemical involved in the exposure and deliver a Material Safety Data Sheet (MSDS). Some medical providers may not commonly encounter HF. Offer as much information as possible regarding the chemical and its effects. Encourage the physician to consult an occupational specialist for further information, if needed.

Skin Contact
Skin contact with hydrofluoric acid may cause severe burns. At concentrations of less than 50% hydrofluoric acid, the burns may not manifest immediately. Fluoride ions penetrate the skin easily and, thus, the burns may be deep and can cause considerable damage. Use and application of the antidote gel should not be based on the visible observation of burns but on the knowledge of dermal contact. Be cognizant that exposure may occur under fingernails, where antidote application is especially challenging. Therefore, medical care is absolutely essential.

1. Remove the victim to a safe location. Use protective equipment when handling a contaminated victim.
2. Immediately flush the exposed skin with water for a maximum of 5 minutes. Flush well but briefly. It is critical to apply antidote as soon as possible.
3. Remove contaminated clothing during washing. Cut away clothing, if necessary, to avoid injuring affected skin.
4. While someone is assisting the patient with rinsing of the exposed skin, another lab member shall contact University Police at 456. Paramedics will be necessary for hospital transport.
5. After adequate 5-minute rinsing, apply calcium gluconate gel to the skin gently and freely. Aggressively massage the gel into the affected part (wearing gloves) and continue to reapply and massage until pain is entirely relieved. If medical assistance is delayed, apply gel every 15 minutes until pain and/or redness disappear or until the emergency rescue team arrives. If the exposure is to a hand, the gel may be placed in a latex glove and the glove placed over the hand to maintain beneficial contact with the affected area.
   - Use as many tubes of calcium gluconate gel as required by the directions but throw away all tubes that have been opened during first aid treatment of the injury. Opened tubes should not be saved for later reuse. Fresh tubes are sealed for sterility protection.
   - Following an incident involving use of the gel, ensure that the supply of gel remains adequate. Replace the gel when the expiration date is exceeded.
6. All hydrofluoric acid burns are to be evaluated by a physician, usually in the emergency room setting. This includes burns to a very small area of the skin and those treated with gel. Further reapplication of antidote gel or other medical procedures may be necessary at the emergency room in order to prevent reversion of the acid burn.

Eye contact
Hydrofluoric acid can cause severe eye burns, with destruction or opacification of the cornea. Blindness may result from severe or untreated exposures. Immediate first aid is necessary.

1. Immediately flush eye(s) for at least 5 minutes.
2. Irrigate the eye repeatedly with 500-1000 ml of a 1% calcium gluconate solution applied through a syringe.
3. Call for prompt emergency room transport. Apply ice-water compresses during transport.
4. Send the patient to an eye specialist as soon as possible.

**Inhalation**
Concentrated solutions and anhydrous hydrofluoric acid produce pungent fumes on contact with air. These fumes can cause nasal congestion and bronchitis, even in low concentrations. Burns that occur when the vapors or liquid contact the oral mucosa or upper airway may cause severe swelling, to the point of airway obstruction.

1. Immediately move the victim to fresh air and seek medical attention. Trained medical responders will be necessary to administer oxygen and nebulized calcium gluconate.
2. Keep the victim warm, quiet, and relatively comfortable.
3. If breathing has stopped, start artificial respiration at once.

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**CALCIUM GLUCONATE GEL AS AN ANTIDOTE TO HYDROFLUORIC ACID BURNS ON SKIN**

1. *Calcium Gluconate 2.5% Topical Gel* can be purchased from
   - Attard’s Minerals, 5081 Field Street, San Diego, CA, 92110, phone (619) 275-2016; [http://attminerals.com/other_items.htm](http://attminerals.com/other_items.htm). Price varies based on size of the container. Discounts available based on order size. Shipping and handling is $10. No minimum order is required.
   - Pharmascience Inc., 175 Rano St., Buffalo, NY, phone (716) 852-4477. Contact the company for pricing and shipping information but a minimum order of 3 tubes is required. Pharmascience will add a shipping and handling fee.
   - VWR, [https://www.vwrsp.com/catalog/product/index.cgi?catalog_number=101320-858&inE=1&highlight=101320-858](https://www.vwrsp.com/catalog/product/index.cgi?catalog_number=101320-858&inE=1&highlight=101320-858). (NU preferred vendor)

ORS does not endorse any specific calcium gluconate supplier. The vendors listed above are simply the companies known to offer the gel.

This gel is available without a prescription (although please be aware that it is not approved by the FDA). Gel is packaged in 25-gram tubes. Prices are current for April 1999.

FYI, ORS stocks two tubes on each campus: one in the first aid pack and one in the wasteroom. The philosophy behind the stock distribution is to have the gel immediately available in any location where HF may be handled. Some lab workers keep gel supplies ready-to-grab on the air foils (sills) of the fume hoods where they will be working with this highly corrosive agent.

2. If the commercial gel product is not available, an emergency in-house version can be prepared for treatment of hydrofluoric acid burns on skin. This homemade gel is composed of 3.5 grams of calcium gluconate powder mixed into 5 ounces of water-soluble lubricant such as K-Y Jelly or Surgilube.

Pre-made stock should be kept on-hand whenever HF is to be used. There is little time for deliberation and searching for the tubes. HF users may want to run practice drills for possible HF incidents to guarantee that they can follow appropriate procedures quickly and automatically.

3. A local pharmacy may also be available to prepare antidote gel. The pharmacist may choose to substitute magnesium for calcium.

**NOTE:** The major action of either of these two gels, commercial or homemade, is to provide excess (or substitute) calcium stores so that bone tissue does not act as the calcium supply. The calcium from the gel will function as a fluoride scavenger to generate calcium fluoride, a product that may be excreted from the
body. Removal of calcium from blood and tissue by fluoride ion attack results in a serious, frequently life-threatening condition known as hypocalcemia.

All HF burns require a medical evaluation, whether treated with gel or not.

REFERENCES
