Management of hydrogen fluoride injury

Notes for health professionals (forth edition)

EUROFLUOR

Eurofluor (CTEF, European Technical Committee for Fluorine)

A sector group of Cefic

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IT IS STRONGLY RECOMMENDED TO DOWNLOAD THE DOCUMENT ***GUIDELINES IN CASE OF AHF/HF EXPOSURE*** ON WEBSITE: www.eurofluor.org

Here you will find in concise flowcharts for each exposure route (skin, eyes, inhalation and ingestion) all important information for proper treatment!

Hydrogen Fluoride is corrosive to the skin, eyes, and the mucous membranes of the respiratory and digestive tracts. AHF/HF is readily absorbed into the body causing acute and severe toxic systemic effects, mainly attributable to a rapidly developing serum hypocalcemia caused by the formation of calcium fluoride or fluoroapatite, serum hypomagnesemia and serum hyperkaliemia.

AHF/HF skin burns are usually accompanied by severe pain which is thought to be due to irritation of nerve endings by increased level of potassium ions entering the extra-cellular space to compensate for the reduced levels of calcium ions which have been bound to the fluoride. **Relief of pain is an important guide to the success of the treatment; therefore local anaesthesia should be avoided.**

The extent and the intensity of these systemic complications are directly related to the amount of AHF/HF absorbed, and the concentration of the HF when in solution. There are also indications that subcutaneous AHF/HF under the burnt area may be responsible for a slow supply of fluoride ions to the circulation.

Symptoms of serious intoxications include hypotension, hypocalcemic tetany, and/or laryngospasm, often respiratory failure (possibly due to pulmonary hypertension), ventricular tachycardia, ventricular fibrillation and cardiac arrest. Renal and hepatic functions may be impaired and muscular damage may be secondary to tetany.

Industrial experience indicates that prompt treatment, as described, will prevent the development of serious injury. In the majority of cases caused by industrial accidents, little more than skin effects results after prompt treatment.

Therefore, speed is essential. Delays in first aid care or medical treatment or improper medical treatment will likely result in greater damage or may, in some cases, result in a fatal outcome.

Hydrofluoric Acid exposures are different from other acid exposures because:

⇒ AHF/HF penetrates all tissue it comes in contact with and does not remain on their surface.

⇒ Once absorbed AHF/HF rapidly dissociates into ionic Hydrogen and Fluoride.

⇒ Hydrogen is in this context of minor importance, Fluoride migrates and continues to destroy deep tissue layers as it migrates and will create soluble and insoluble compounds that are the basis for the systemic toxic effects.

⇒ And unlike other acids that are rapidly removed or neutralized, the corrosive and toxic effects may continue for days if left untreated.

Emergency 1st aid, AHF/HF burns & injury

It is essential for the safety of the rescuers to prevent inhalation and to avoid contact with AHF/HF during the rescue operation

IDENTIFY THOSE ACTIONS ALREADY TAKEN

Demands immediate contact with 1st aid team

- ☑ Remove from exposure area, and start without delay First Aid treatment regarding Skin, Eyes, Inhalation and/or Ingestion. As a rescuer: **PROTECT YOURSELF**.
- ☑ Obtain medical attention immediately. Preferably ensure that the victim is accompanied by a rescuer to ensure that appropriate treatment is provided without delay.

Skin

- ☑ **DO NOT DELAY**
- ☑ Decontamination: Go to the nearest source of water or safety shower, open the water valve, remove all your clothes, shoes and jewellery, and finally, while closing your eyes and facing the water flow, remove your goggles or respirator face mask if you are sure that there is no HF on your face any longer.
- ☑ **After undressing, rinse until Calcium Gluconate is available with a minimum of 1 minute.**
- ☑ **Massage continuously 2.5% calcium gluconate gel on the exposed area using acid resistant gloves, for at least 15 minutes after the pain disappears and** until medical attention is available.

Ingestion

- ☑ Do not induce vomiting.
- ☑ Maintain life support.
- ☑ **Bring to medical attention immediately.**

Inhalation

- ☑ **Administer 100% oxygen by mask.**
- ☑ **Nebulize 2.5% calcium gluconate** in normal saline solution continuously until medical evaluation, at least 10-15 minutes, and again especially if pain reappears.
- ☑ If respiratory assistance is needed use indirect methods such as valved ventilation masks. First aiders should be trained in indirect methods of respiratory assistance.

Eyes

- ☑ **DO NOT DELAY**
- ☑ Decontamination: Go to the nearest eye wash or clean source of water, open the water valve. Remove contact lenses (contact lenses should be prohibited), **put your eye(s) in the water flow and open and close your eye lids for 1 to 5 minutes maximum.**
- ☑ Irrigate each eye with 1% calcium gluconate solution while the individual is transported for medical evaluation by an eye specialist. If it is not allowed in your country, use 0,9% saline solution.
- ☑ **Obtain medical attention immediately**, especially specialized ophthalmic attention.

FIRST AID MANAGEMENT OF HYDROFLUORIC ACID INJURIES

Name _____

Sex M / F Age _____ Date and time _____

Form to accompany patient to hospital (please note advice to hospital on unique treatment needed by fluoride burns!)

Please make sure that hospital staff is aware of the unique characteristics of injuries caused by AHF/ HF exposures and the fact that the systemic toxic effects of the exposure will require prompt serum monitoring of fluorides, calcium, magnesium and sodium, and calcium replacement by infusion.

AHF/HF is corrosive and toxic and may cause:

1. Severe and painful burns of the skin
2. Irritation of air ways that can lead to bronchitis or even pulmonary oedema
3. Asphyxia
4. Severe and painful burns of the eyes
5. Blindness
6. Severe and painful burns of the digestive track
7. Serious toxic systemic effects, that will require specialized metabolic, surgical, thoracic, ophthalmic intervention (Intensive Care)

Note: All or any of the above effects may be delayed in onset and/or be accompanied by toxic systemic effects.

DIAGNOSTIC (TICK APPROPRIATE)

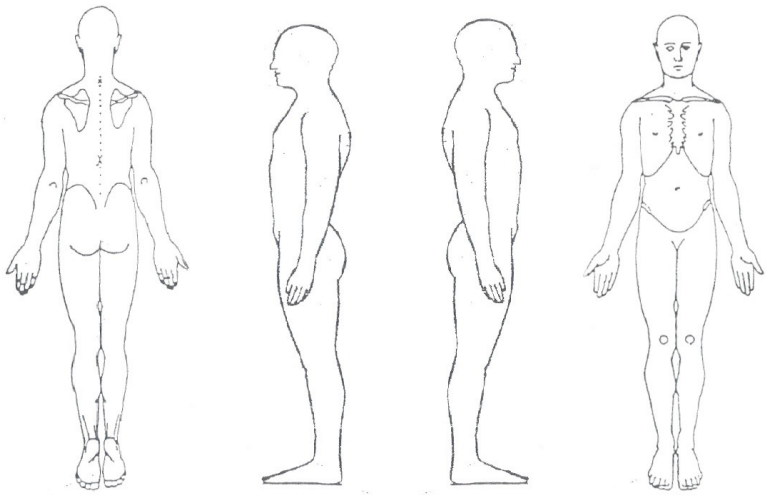
This patient was exposed to

- ❒ Anhydrous Hydrogen Fluoride
- ❒ HF _____% solution (specify)
- ❒ Other Fluoride? (specify _____)

Exposure date _____ Exposure Time _____ AM/PM

Nature of exposure: ❒ Skin ❒ Eyes ❒ Inhalation ❒ Ingestion

Affected body surface:



TREATMENT GIVEN (TICK APPROPRIATE)

- ❒ Showering, decontamination of the skin Duration _____ min.
- ❒ Showering, decontamination of the eyes Duration _____ min.
- ❒ Calcium Gluconate gel Duration _____ min.
- ❒ Eye irrigation with a 1% calcium gluconate solution Duration _____ min.
- ❒ Nebulization of a 2.5% solution of calcium gluconate Duration _____ min.
- ❒ Basic life support Duration _____ min.
- ❒ Other (specify _____) Duration _____ min.

Time between exposure and decontamination with water: _____ min.

Time between decontamination with water and other treatment: _____ min.

- ❒ Dr
- ❒ Nurse
- ❒ 1st Aider

Name and signature

Date _____ Time _____ am/pm place _____

Note to First Aider: Patients should be accompanied by a doctor or nurse whenever possible

FOR FURTHER MEDICAL INFORMATION

Telephone _____

Name _____

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First aid kit for hydrofluoric acid injuries

Instructions: The AHF/HF First Aid Kit should be placed in a controlled area near workplaces where the possibility of an exposure exists, such as production areas, storage areas, and in transportation
vehicles.

The KIT should be sealed and only opened for emergency use or for periodical inspection.

Content of the kit

A FULL SET OF UPDATED DECONTAMINATION AND FIRST AID PROCEDURES.

☑ For skin exposures

- Pairs of gloves (PVC, Nitrile or Neoprane);
- tubes of calcium gluconate gel at a 2.5% concentration;
- aluminized plastic sheets.

☑ For eye exposures

- 1 litter of a 1% calcium gluconate irrigation solution;
- 1 IV tubing set and 1 nasal O_2 cannula for calcium gluconate administration.

☑ For inhalation exposures

- Equipment for O_2 administration and nebulizing
- 500 cc. of a 2.5% calcium gluconate nebulizing solution
- respiratory bag.

☑ For general use

- Pairs of scissors for clothing removal and general use;
- flashlight;
- packs of sterile gauze;
- tourniquets;
- coldpacks;
- IV infuser.

☑ For medical use only

- Ampoules of a 10% calcium gluconate solution;
- long stainless steel needles and disposal containers;
- 1 bottle of a local eye anaesthetic;
- sterile syringes;
- tube of water soluble lubricating gel (for calcium gluconate gel preparation);
- set of airway cannulas;
- valved ventilation masks.

The following should be written on the outside

CAUTION!

To be opened only if an AHF/HF exposure occurs. If the seal on this kit is broken an immediate inspection should be made by an authorised, competent person.

Note: These are minimum quantities and may need adjustment depending on the number of potential exposure victims. Kits should be inspected once every 3 months. Used or outdated materials should be replaced immediately. The calcium gel and solutions should be protected from light, extreme heat or cold.

Disclaimer

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European Technical Committee for Fluorine(CTEF)

Eurofluor (CTEF) represents the major producers and users of hydrogen fluoride (AHF/HF) and fluoride chemicals in Europe. Eurofluor aims to assure safe production, storage, transportation and use of hydrofluoric acid.

For more information, visit our website: www.eurofluor.org

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