Chemical Emergency Medical Guideline

Information and recommendations for first responders and patients

Hydrogen fluoride/hydrofluoric acid

CAS No.: 7664-39-3

GHS symbols:

GHS05
Corrosive

GHS06
Acute toxicity

Signal word: Danger

Hazard statements:

H310	Fatal if in contact with skin.
H314	Causes severe skin burns and serious eye damage.
H301+H331	Toxic if swallowed or inhaled.

Overview

- Patients who have hydrofluoric acid on themselves or their clothing may endanger others through direct contact or hydrofluoric acid vapors.
- Hydrofluoric acid is a highly corrosive chemical that can cause extremely painful wounds.
- Fluoride ions are absorbed very well and quickly into the body via all routes of exposure. Hydrofluoric acid can therefore also cause systemic poisoning with disorders of the central nervous system, cardiovascular failure, kidney failure and respiratory arrest.
- Immediate cleaning is the most important measure: before removing clothing, carefully rinse the affected eyes, skin and hair with plenty of water.
- Early administration of calcium and/or magnesium can counteract the systemic effects of hydrofluoric acid.

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1. Information about the substance

Hydrogen fluoride / hydrofluoric acid (HF) CAS 7664-39-3.
Aqueous solutions of hydrogen fluoride are referred to as hydrofluoric acid.
Hydrogen fluoride is a pungent-smelling, colorless, clear liquid that boils at 19-20°C and emits thick smoke in moist air. The vapors of hydrofluoric acid are also toxic.
When hydrofluoric acid with a concentration > 40% is heated, hydrogen fluoride is released.
Hydrogen fluoride is also produced during the hydrolysis of various fluorides (cobalt fluoride, phosphorus pentafluoride, silicon tetrafluoride, sulfur tetrafluoride). Hydrofluoric acid is a strong acid that reacts with many compounds to produce intense heat and can form highly flammable and explosive substances. It attacks metal, glass and stone and dissolves silicon, and must therefore be stored in plastic, lead, wax or paraffin bottles. Hydrofluoric acid is used in the production of inorganic fluorides and in the surface treatment of glass and metals (cleaning, etching, enameling). As a diluted solution, it is used as an industrial and household cleaner and as auxiliary material in the electronics and semiconductor industries.

2. Exposition

2.1. Inhalation

The absorption of large quantities of fluoride ions through inhalation of hydrofluoric acid vapors can lead to systemic poisoning. The strong irritant effect of hydrofluoric acid serves as a clear warning of dangerous concentrations.

2.2. Skin/eye contact

Exposure to hydrofluoric acid occurs mainly through skin contact. Fluoride ions are absorbed very easily and quickly through the skin and eyes and can thus lead to systemic poisoning. If more than 160 cm² of skin (an area approximately the size of two palms) is affected, there is a risk of severe systemic effects. Even low concentrations (less than 2%) can cause severe skin and eye burns if exposure is prolonged.

2.3. Ingestion

Accidental ingestion of hydrofluoric acid quickly leads to severe burns of the mucous membranes in the throat, esophagus and gastrointestinal tract, as well as systemic poisoning symptoms upon absorption. In adults, fatalities have been reported after ingesting as little as 1.5g of hydrofluoric acid.

3. Acute health effects

Contact with hydrofluoric acid can cause fluorine to react with the body's own calcium. This can result in a significant drop in calcium levels and other metabolic changes with fatal consequences. Cardiac arrhythmia, cardiovascular and renal failure may occur. Fluoride ions can cause coma and respiratory arrest through a direct toxic effect on the central nervous system.

Inhalation usually causes throat irritation and coughing. Rapid development of respiratory problems with chest pain, shortness of breath, swelling in the throat and fluid accumulation in the lungs may occur. Lung damage can continue to increase over a period of several hours.

Contact with hydrofluoric acid can cause very painful burns to the eyes, skin and gastrointestinal tract. Skin contact may cause redness, swelling, blistering and whitening of the skin.

Brief contact with hydrofluoric acid in very low concentrations generally does not cause delayed effects or long-term damage. If treatment is inadequate, symptoms may still occur after 24 hours. Chemical burns, skin injuries and tissue and eye damage caused by chemical burns can be irreversible; extensive scarring or tissue damage may occur.

4. Measures

4.1. Self-protection of first aiders

If there is a suspicion that the area the helper must enter contains hydrofluoric acid as vapor or liquid, a self-contained breathing apparatus and a chemical protection suit must be worn. Contaminated equipment must not be used.
A patient whose clothing or skin is contaminated with hydrofluoric acid may endanger other people or medical personnel through direct contact or through hydrofluoric acid vapor. The release of high concentrations of hydrofluoric acid vapor/smoke can lead to the absorption of hydrofluoric acid on clothing; cleaning must be carried out with appropriate care and attention to personal protection.

4.2. Rescue

Patients should be rescued from the danger zone immediately. If they are unable to walk unaided, they should be removed from the danger zone quickly using appropriate means, taking care to protect yourself. The "A, B, C procedure" has absolute priority.

A) Clear the airways (check for blockages caused by the tongue or foreign objects)
B) Ventilation (check the patient's breathing, if necessary, begin ventilation with adequate self-protection, e.g. breathing mask)
C) Circulation (begin resuscitation for any person who does not respond to verbal commands and is not breathing normally)

4.3. Cleaning

Patients who have been exposed to hydrofluoric acid require immediate cleaning measures. If possible, patients should assist in their own cleaning.
If the eyes have been exposed to hydrofluoric acid or if there is eye irritation, rinse immediately with clean water or neutral saline solution. Remove any contact lenses, if possible, without causing additional danger to the eyes. Other important emergency measures must be continued during this process.

Immediately rinse the affected skin and hair areas with plenty of clear water for at least 5 minutes before removing clothing. If clothing is wet with liquid hydrofluoric acid, remove it taking care to protect yourself and pack it securely.
Be sure to protect eyes while rinsing skin and hair. As soon as calcium gluconate gel 2.5% is available, apply it to the affected skin areas. It is important to wear suitable protective gloves when massaging the calcium gluconate gel into the affected areas. If medical assistance is not immediately available, reapply the gel to the affected skin every 15 minutes and rinse the skin areas with plenty of water in between.

If swallowed, do not induce vomiting under any circumstances. Vomit may contain hydrofluoric acid and can therefore be just as dangerous. Anyone contaminated with hydrofluoric acid should immediately take 200-300 ml of water (or milk) and/or stomach acid neutralizing agents – e.g. magnesium hydroxide, calcium carbonate – in tablet/suspension form.

4.4. Further measures

Anyone who has had contact with hydrofluoric acid or hydrofluoric acid vapors should seek medical treatment immediately.

4.5. Instructions for further rules of conduct

Consult your family doctor or the emergency department of the nearest hospital immediately if any of the following symptoms occur within 24 hours:

- Increased pain, redness/burning or similar symptoms in the affected skin areas or eyes
- Coughing, wheezing or whistling breath
- Difficulty breathing, shortness of breath or breathlessness
- Pain or tightness in the chest area

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