Chemical Emergency Medical Guideline

Information and recommendations for first responders and patients

Chlorformiates

CAS No.: 79-22-1; 541-41-3; 24468-13-1; 108-23-6; 592-34-7

GHS symbols:

GHS05
Corrosive

GHS06
Acute toxicity

Signal word: Danger

Hazard statements:

For detailed information on the H statements for the individual substances within this group, it is recommended to consult the relevant safety data sheets provided by the distributor or official databases (e.g. https://echa.europa.eu/de/search-for-chemicals).

Overview

- Before the first aider approaches a patient, they must ensure that there is no danger to themselves from chloroformates.
- There is no danger from contact with patients who have only been exposed to chloroformate gases. However, a patient who is wet with liquid chloroformates or solvents containing chloroformates, or whose clothing is wet with them, may endanger other people through direct contact or through chloroformates being released into the air.
- Chloroformates cause severe irritation of the lungs. Due to the slow decomposition in the alveoli, symptoms and severe lung damage can occur even 24 hours after exposure. Signs of fluid accumulation in the lungs (shortness of breath, blue-red discoloration of the skin and mucous membranes, sputum, coughing) usually only appear several hours after exposure, even in severe cases.
- There is no known specific antidote. Treatment depends on the extent of exposure and the symptoms.

Table of Contents

1. Information about the substance

Methyl chloroformate (CH_3-OCOCl), CAS 79-22-1
Synonyms: methyl chloroformate, methoxycarbonyl chloride
At room temperature, methyl chloroformate is a colorless to yellowish, clear liquid with a melting point of -61°C and a boiling point of 71°C.
Methyl chloroformate is the methyl ester of chloroformic acid, a phosgene derivative. Methyl chloroformate should not be confused with methyl chloroform (1,1,1-trichloroethane).

Ethyl chloroformate (C_2H_5-OCOCl), CAS 541-41-3
Synonyms: chloroformic acid ethyl ester, ethoxycarbonyl chloride
Ethyl chloroformate is a colorless-yellowish, clear liquid at room temperature with a melting point of -80°C and a boiling point of 93°C.

2-Ethylhexyl chloroformate (C_8H_{17}-OCOCl), CAS 24468-13-1
Synonyms: Ethyl hexyl chloroformate, ethoxyhexyl carbonyl chloride
At room temperature, 2-ethylhexyl chloroformate is a colorless to yellowish, clear liquid with a melting point of -55°C and a boiling point of 100°C.

Isopropyl chloroformate (C_3H_7-OCOCl), CAS 108-23-6
Synonyms: Chlorformic acid isopropyl ester, isopropoxycarbonyl chloride
At room temperature, isopropyl chloroformate is a colorless to yellowish, clear liquid with a melting point of -70°C and a boiling point of 34°C.

Butyl chloroformate (C_4H_9-OCOCl), CAS 592-34-7
Synonyms: butyl chloroformate, butoxycarbonyl chloride
Butyl chloroformate is a colorless-yellowish, clear liquid at room temperature with a melting point of -70°C and a boiling point of 138°C.

Chlorformates are used dissolved in solvents. They have a sharp, pungent and oppressive odor. They slowly decompose into hydrochloric acid when exposed to moisture. Chlorformates are an important starting material in the manufacture of many chemicals such as isocyanates, polyurethanes, polycarbonates, dyes, pesticides and medicines.

2. Exposition

2.1. Inhalation

Exposure to chloroformates occurs mainly through inhalation or skin/eye contact. The odor of chloroformates is not sufficient warning. Even low concentrations can pose a hazard. The irritating effect can be mild and delayed, meaning that chloroformates can have a long-lasting effect without being noticed. Chloroformates are heavier than air and spread along the ground.

2.2. Skin/eye contact

Chlorformiates can cause irritation and chemical burns to moist or wet skin or eyes. Absorption through the skin is possible.

2.3. Ingestion

Ingestion of chloroformates can cause irritation of the mouth, throat and stomach.

3. Acute health effects

In most cases, exposure to chloroformates occurs through inhalation of the gas. Low exposure to chloroformate gases normally causes irritation of the eyes and upper respiratory tract. However, these irritating effects may initially be so mild that the affected person does not immediately leave the area.
If chloroformates are inhaled over a longer period, or if the concentration is very high, severe respiratory disorders can occur, which can lead to impaired gas exchange in the lungs, pneumonia and death.

The symptoms immediately after exposure to chloroformates due to irritation of the upper respiratory tract may be mild (burning throat, coughing, feeling of pressure), but severe lung damage with fluid accumulation in the lungs can still occur 24 hours after exposure. Chloroformates can lead to respiratory and cardiovascular failure.

If the skin is wet or damp, contact with gaseous chloroformates can cause skin irritation or redness. High gas concentrations can cause redness and tearing of the eyes, while eye contact with liquid chloroformates can result in clouding of the eye surface and later in permanent damage to the eye.

Single exposure or single inhalation of chloroformates, from which the affected person recovers quickly, does not normally cause delayed or lasting health effects.
Some individuals who have inhaled large amounts of chloroformates have developed permanent respiratory disorders and were subsequently more susceptible to infectious lung diseases.

4. Measures

4.1. Self-protection of first aiders

If there is a suspicion that the area the helper must enter contains chloroformates, a self-contained breathing apparatus and a chemical protection suit must be worn.
Contaminated equipment should not be used. There is no danger from contact with patients who have only been exposed to chloroformate gases. A patient who is wet with liquid or chloroformate-containing solvents, or whose clothing is wet with such substances, may endanger other people through direct contact or through the release of chloroformates.

4.2. Rescue

Patients should be removed 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 themselves. The "A, B, C scheme" 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 only been exposed to gaseous chloroformates and show no signs of skin or eye irritation do not require any special cleaning measures, unlike all others.
If possible, patients should assist in their own cleaning. If liquid chloroformates or solvents containing chloroformates have contaminated clothing, this should be removed and securely wrapped.
Rinse affected skin and hair with water for at least 15 minutes. Protect the eyes during rinsing. Other important emergency measures should be continued during this time.
If the eyes have been exposed to chloroformates or if there is eye irritation, rinse with water or neutral saline solution for 15 minutes. Remove any contact lenses, if possible, without additional risk to the eye. Continue other important first aid measures during this time.

4.4. Further measures

Anyone who may have been exposed to chloroformiates should seek medical attention immediately.

4.5. Instructions for further rules of conduct

Consult your family doctor or the emergency department of the nearest hospital if any abnormalities or symptoms occur within the next 24 hours, in particular:

- Coughing, wheezing or whistling breath
- Difficulty breathing or shortness of breath
- Increased pain or abnormalities in the affected skin areas or eyes
- Pain or tightness in the chest

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