BASF Chemical Emergency Medical Guidelines

Formaldehyde (HCHO) B 1

Information and recommendations for paramedics and doctors at the site

- **Before approaching the patient, the paramedics and doctors at the site must make sure that they do not risk exposing themselves to formaldehyde.**
- **Patients exposed only to formaldehyde gas or vapor do not pose a significant risk of secondary contamination. Patients whose clothing or skin is contaminated with an aqueous solution of formaldehyde can secondarily contaminate rescue and medical personnel by direct contact or through evaporation of formaldehyde.**
- **Formaldehyde vapor is irritating when it comes in contact with the eyes, skin, and upper respiratory tract causing eye irritation, coughing, chest pain and dyspnea. Laryngospasm and signs of pulmonary edema (shortness of breath, cyanosis, expectoration, cough) may occur. Formaldehyde is a potent skin sensitizer.**
- **There is no antidote to be administered to counteract the effects of formaldehyde. Treatment consists of supportive measures.**

1. Substance information

Formaldehyde (HCHO), CAS 50-00-0
Synonyms: formalin, formic aldehyde, methanal, methylene oxide.
Formaldehyde is, at room temperature, a nearly colorless gas with a sharp or pungent odor. Its vapor is flammable and explosive. Because the pure gas trends to polymerize, it is usually used as an aqueous solution of 30–50 % formaldehyde, containing up to 15 % methanol as a stabilizer. Formaldehyde is widely used in the manufacture of plastics, resins, and urea-formaldehyde foam insulation. Formaldehyde-containing resins are found in construction materials (plywood, particle board, and fiberboard) and are used in the processing of paper and the production of carpets, paints, and furniture.

2. Routes of exposure

Inhalation

Most exposures occur by inhalation or skin/eye contact.
Formaldehyde's odor and irritant properties generally provide adequate warning of hazardous concentrations. Olfactory fatigue and tolerance may occur. However, persons who are sensitized to formaldehyde may react to concentrations below the odor threshold. Formaldehyde is slightly heavier than air and may cause asphyxiation in poorly ventilated, low-lying, or enclosed spaces.

Skin/eye contact

Formaldehyde vapor or aqueous solutions can cause irritation and burns to the skin and the eyes.

Ingestion

Ingestion of aqueous solutions can result in severe corrosive injury to the esophagus and stomach. Nausea, vomiting, and abdominal pain may occur.

3. Acute health effects

Respiratory

Exposure to low concentrations of formaldehyde usually causes sore throat and coughing. Rapid development of respiratory distress with chest pain, dyspnea, laryngospasm and pulmonary edema may occur with inhalation of high concentrations of formaldehyde gas or vapor.

Pulmonary injury may progress over several hours. After severe exposure, respiratory and cardiovascular failure may occur.

Dermal	Burning pain, redness, inflammation, blisters and burns of the skin and mucous membranes may be caused by concentrated formaldehyde vapor or aqueous solutions.
Ocular	Low vapor concentrations cause burning discomfort, spasmodic blinking or involuntary closing of the eyelids, redness, and tearing. Corneal burns may occur at high concentrations or with exposure to aqueous solutions.
Ingestion	Ingestion of aqueous solutions may cause sore throat, nausea, vomiting, abdominal pain, and cyanosis. After severe exposure ulceration, edema of the glottis, asphyxia, and respiratory and cardiovascular failure may occur.
Dose-effect relationships	Dose-effect relationships are as follows:

Formaldehyde vapor concentration		Effect
0.05-1.0 ppm	-	Odor detection (some tolerance develops)
0.5-3 ppm	-	Mild irritation of eyes and upper respiratory tract
3-10 ppm	-	Moderate irritation of eyes and upper respiratory tract
5-30 ppm	-	Chest pain, dyspnea, coughing, nausea and vomiting
50-100 ppm	-	Toxic pneumonitis and pulmonary edema
>100 ppm	-	Fatal
Solution (amount ingested)		
20-200 mg	-	Mild gastric and pharyngeal discomfort
600-200 mg	-	Dry and sore throat, vomiting, cyanosis, rapid and irregular pulse
5,000-10,000 mg	-	Severe pain, ulceration, edema of the glottis, asphyxia, death

4. Actions

Rescuer self-protection	**In response situations that involve exposure to potentially unsafe levels of formaldehyde (see above), pressure-demand, self-contained breathing apparatus and chemical-protective clothing shall be worn**. Patients exposed only to formaldehyde gas do not pose a significant risk of secondary contamination. Patients whose clothing or skin is contaminated with a solution of formaldehyde can secondarily contaminate other people by direct contact or through evaporation of formaldehyde.
Patient recovery	Patients should be removed from the contaminated zone immediately. Patients who are unable to walk may be removed on backboards or stretchers; if these are not available, carefully remove/transport patients with appropriate action to a safe zone, taking into account your self-protection. Immediate priorities must follow the "**A, B, C's**" (Airway, Breathing, Circulation) of resuscitation.
Decontamination	Patients exposed only to formaldehyde gas or vapor who have no evidence of skin or eye irritation do not need decontamination. All others require decontamination. Patients who are able and cooperative may assist with their own decontamination. If the exposure involved liquid formaldehyde and if clothing is contaminated, remove and double-bag the clothing. **Assure that exposed skin and hair have been flushed with plain water for at least 15 minutes**. If not, continue flushing during other basic care and transport. Protect eyes during flushing of skin and hair. **Assure that exposed or irritated eyes have been irrigated with plain water or saline for at least 15 minutes**. If not, continue eye irrigation during other basic care and transport. Remove contact lenses if present and easily removable without additional trauma to the eye.

Initial treatment

Therapy will be empiric; there is no antidote to be administered to counteract the effects of formaldehyde.
The following measures are recommended if the airborne exposure concentration is 3-10 ppm or greater (depending on time exposed), if symptoms, e. g. eye irritation or pulmonary symptoms have developed, or if no exposure concentration can be estimated but exposure has possibly occurred:
- **Administration of oxygen**
- **Administration of 8 puffs of beclomethasone (800 µg beclomethasone dipropionate) from a metered dose inhaler.**

Patients with severe clinical respiratory symptoms (e.g. bronchospasms, stridor) should be treated as follows:
a) Nebulization of adrenaline (epinephrine): 2 mg adrenaline (2 ml) with 3 ml NaCl 0.9% and inhale through a nebulizer mask.

b) Administration of a ß2-selective adrenoceptor agonist, e.g., four strokes of terbutaline or salbutamol or fenoterol (one stroke usually contains 0.25 mg of terbutaline sulfate; or 0.1 mg of salbutamol; or 0.2 mg of fenoterol); this may be repeated once after 10 minutes. Alternatively, 2.5 mg salbutamol and 0.5 mg atrovent may be administered by nebulizer mask.
If inhalation is not possible, administration of terbutaline sulfate (0.25 mg to 0.5 mg) subcutaneously or salbutamol (0.2 mg to 0.4 mg over 15 minutes) intravenously.

c) Intravenous administration of 250 mg methylprednisolone (or equivalent steroid dose).

Patients with clinical signs of a toxic lung edema (e.g. foamy sputum, wet crackles) should be treated as follows:
a) Start CPAP-therapy (Continuous Positive Airway Pressure Ventilation).
b) Intravenous administration of 1000 mg methylprednisolone (or an equivalent steroid dose) is recommended.

Intubation of the trachea or an alternative airway management should be considered in cases of respiratory compromise. When the patient's condition precludes this, consider cricothyrotomy if equipped and trained to do so.

Note: Efficacy of corticosteroid administration has not yet been proven in controlled clinical studies.
If formaldehyde vapor or aqueous solutions have been in contact with the skin, irritation or chemical burns may result; treat as thermal burns: adequate fluid resuscitation and administration of analgesics, maintenance of the body temperature, covering of the burn with a sterile pad or clean sheet.
After eye exposure irritation or chemical burns may result; treat as thermal burns. Immediately consult an ophthalmologist.
Note: Any facial exposure to aqueous solutions of formaldehyde should be considered as a serious exposure.
In case of ingestion of formaldehyde, **do not induce emesis, do not perform gastric lavage.**
Patients exposed to an airborne concentration of 3-10 ppm or greater (depending on time exposed) or with ingestion of formaldehyde as well as patients without available exposure measurements but suspected of being exposed to concentrations

of 3-10 ppm or greater (depending on time exposed) should be transferred to a hospital/emergency department.

Patient release/ follow-up instructions

Asymptomatic patients exposed to an airborne concentration of **less than 3 ppm** (depending on the period of time exposed) **as well as patients who have a normal clinical examination and no signs or symptoms of toxicity may be discharged after an appropriate observation period in the following circumstances:**

a) The evaluating physician is experienced in the evaluation of individuals with formaldehyde or irritant gas exposure.
b) Information and recommendations for patients with follow-up instructions are provided verbally and in writing. Patients are advised to seek medical care promptly if symptoms develop or recur.
c) The physician is comfortable that the patient understands the health effects of formaldehyde and the provided follow-up instructions.
d) Site medical is notified, so that the patient may be contacted at regular intervals in the 24-hour period following release.
e) Heavy physical work should be precluded for 24 hours.
f) Exposure to cigarette smoke should be avoided for 72 hours; the smoke may worsen the condition of the lungs.

Patients who have serious skin or eye injuries should be reexamined in 24 hours.
Post discharge spirometry should be repeated until values return to the patient's baseline values.

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