Dimethylformamide $(CH_3)_2N$-CHO B 1

Information and recommendations for paramedics and doctors at the site

- **Patients whose clothing or skin is contaminated with dimethylformamide (boiling point 153°C, 307°F respectively) can secondarily contaminate rescue and medical personnel by direct contact.**
- **Dimethylformamide is irritating when it comes in contact with the eyes, skin, and throat and causes headache, nausea, vertigo, dizziness, weakness, disorientation, and hypotension. Liver toxicity and alcohol intolerance have been noted.**
- **There is no antidote to be administered to counteract the effects of dimethylformamide. Treatment consists of supportive measures.**

1. Substance information

Dimethylformamide ($(CH_3)_2N$-CHO), CAS 68-12-2
Synonyms: DMF, formyldimethylamine
Dimethylformamide is, at room temperature, a colorless to very slightly yellow liquid with a faint amine or "fishy" odor. Though stable at normal temperatures and storage conditions, dimethylformamide may react violently with halogens, alkyl halides, strong oxidizers, and polyhalogenated compounds in the presence of iron. Decomposition products include toxic gases and vapors such as dimethylamine and carbon monoxide. It is water-soluble.
Dimethylformamide is an organic solvent with a slow evaporation rate used for polar polymers and resins, adhesives, cleaners, zinc electroplating, protective coatings, inks, film, paint removers, and in selective gas absorption. It is used in Orlon® and acrylic fiber spinning, synthetic leather, polyurethanes, wire enamels, chemical manufacturing and pharmaceutical production.

2. Routes of exposure

Inhalation

Exposures may occur by inhalation. Dimethylformamide is readily absorbed by the respiratory tract.

Skin/eye contact

Most exposures occur by direct contact. It is readily absorbed through the skin, causing systemic effects.

Ingestion

Dimethylformamide is readily absorbed from the gastrointestinal tract. However, ingestion is uncommon in occupational settings.

3. Acute health effects

Systemic

Dimethylformamide causes headache, nausea, vertigo, dizziness, weakness, disorientation, and hypotension. Liver toxicity with jaundice and altered liver enzymes and alcohol intolerance has been noted. Dimethylformamide poisoning may cause unconsciousness, respiratory and cardiovascular failure.

Respiratory

Irritation of the upper respiratory tract may be caused by dimethyl-formamide.

Dermal

Irritation of the skin, including itching and desquamation, may be caused by direct contact to liquid dimethylformamide.

Ocular

Eye contact to vapor or liquid dimethylformamide causes burning discomfort, spasmodic blinking or involuntary closing of the eyelids, redness, and tearing.

Gastrointestinal

Liver toxicity with jaundice and altered liver enzymes and alcohol intolerance has occurred after exposure via inhalation or skin contact. Anorexia, taste loss and various digestive disturbances,

including nausea, epigastric pain, vomiting, constipation, diarrhea, and colic may also occur.

Dose-effect relationships

Dose-effect relationships are as follows:

Dimethylformamide concentration		Effect
0.47-100 ppm	-	Odor detection
10 ppm	-	Alcohol intolerance
25 - 60 ppm	-	Increase of liver enzymes
500 - 3000 ppm	-	Immediately dangerous to life
10 g per oral	-	Estimated lethal dose in humans

4. Actions

Rescuer self-protection

In response situations that involve exposure to potentially unsafe levels of dimethylformamide (see below), pressure-demand, self-contained breathing apparatus and chemical-protective clothing shall be worn.
Patients whose clothing or skin is contaminated with dimethylformamide can secondarily contaminate other people by direct contact or evaporation of dimethylformamide.

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 to dimethylformamide require decontamination. Patients who are able and cooperative may assist with their own decontamination. If clothing is contaminated, remove and double-bag the clothing.
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.
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.

Initial treatment

In case of suspected dimethylformamide poisoning by ingestion or skin absorption immediate supportive measures are required, including establishment of intravenous access.
There is no specific antidote to counteract the effects of dimethyl-formamide.
The following measures are recommended if exposure by inhalation is 100 ppm or greater (depending on time exposed), if symptoms, e. g. eye irritation or pulmonary symptoms have developed, or if the exposure concentration cannot be estimated but exposure has possibly occurred:
If signs of hypoxemia or severe inhalation exposure are present,

- **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) Nebulized epinephrine (adrenaline): Mix 2mg of epinephrine (2ml) with 3ml saline 0,9%. Administer via nebulizer mask.
b) IAdministration 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.
Patients exposed to a concentration of 100 ppm or greater (depending on time exposed) and patients without available exposure measurements but suspected of being exposed to concentrations of 100 ppm or greater (depending on time exposed) should be transferred to a hospital/emergency department.
If liquid dimethylformamide has been in contact with the skin, irritation may result; treat as thermal burns.
After eye exposure, irritation may result; treat as thermal burns. Consult an ophthalmologist.
Note: Any facial exposure to liquid dimethylformamide should be considered as a serious exposure.

Patient release/ follow-up instructions

Asymptomatic patients exposed to a concentration of **less than 10 ppm** (depending on the period of time exposed) or who have had minor direct contact to liquid dimethylformamide **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 dimethylformamide 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 dimethylformamide 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) Drinking of alcohol beverages should be strictly forbidden for at least 72 hours. Alcohol intolerance has been noted.
f) Heavy physical work should be precluded for 24 hours.
g) Exposure to cigarette smoke should be avoided for 72 hours; the smoke may worsen the condition of the lungs.

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