BASF Chemical Emergency Medical Guidelines

Acrylonitrile (CH_2=CH-CN) C 1

Information and recommendations for doctors at hospitals/emergency departments

- **Patients whose clothing or skin is contaminated with liquid acrylonitrile can secondarily contaminate rescue and medical personnel by direct contact or through evaporation of acrylonitrile. Patients exposed only to acrylonitrile vapor (boiling point 77°C, 171°F, respectively) do not pose a significant risk of secondary contamination. Acrylonitrile´s odor provides inadequate warning of hazardous concentrations.**
- **Acrylonitrile is well absorbed by the lungs, the intestinal tract and through the intact skin. Besides local irritation exposure by any route causes systemic effects which may include respiratory, cardiovascular, CNS and hepatic disturbances.**
- **Treatment consists of supportive care and initial administration of oxygen. Specific antidotal treatment should be considered if available.**

1. Substance information

Acrylonitrile (CH_2=CH-CN), CAS 107-13-1

Synonyms: Vinyl cyanide, propenenitrile.

At room temperature (boiling point 77°C, 171°F, respectively) acrylonitrile is a clear, colorless-yellow, volatile, and flammable liquid with an unpleasant odor. It is slightly soluble in water and soluble in most organic solvents.
Acrylonitrile is used in the production of acrylic fibers, styrene plastics and adhesives. Such fibers and plastics are used in clothing, furniture, construction materials, motor vehicles and food packing.

2. Routes of exposure

Inhalation

Most exposures occur by inhalation. Acrylonitrile's odor does not provide adequate warning of hazardous concentrations. Olfactory fatigue develops rapidly. Acrylonitrile is heavier than air and may cause asphyxiation in poorly ventilated, low-lying, or enclosed spaces.

Skin/eye contact

Direct contact with liquid acrylonitrile or concentrated vapor causes severe skin irritation or corneal injury, respectively. Acrylonitrile is readily absorbed through intact skin; dermal exposure may result in systemic toxicity.

Ingestion

Ingestion of acrylonitrile causes acute toxic effects; fatal poisoning may result.

3. Acute health effects

All routes of exposure to acrylonitrile can result in systemic effects and may include shortness of breath, chest tightness, headache, drowsiness, convulsions, loss of consciousness, irregular heartbeat, low blood pressure, and jaundice. Toxicity of acrylonitrile may be due to the metabolic release of cyanide as well as to acrylonitrile itself. The onset of symptoms may be delayed up to 12 hours.

CNS

CNS signs and symptoms can evolve rapidly or be delayed. Initial symptoms are non-specific and include irritability, dizziness, nausea, vomiting, headache, and muscle weakness. Progressive signs include drowsiness, convulsions, hallucinations, loss of consciousness and coma.

Cardiovascular

Irregular heart rhythm and intractable low blood pressure may result.

Respiratory	Acute inhalation exposure can irritate the mucous membranes of the respiratory tract. Sneezing, chest discomfort, shortness of breath, and cough may result. Tachypnea and increased depth of respiration may, as poisoning progresses, result in slow, shallow, and gasping respiration and cyanosis.
Hepatic/metabolic	Lactic acidosis and elevation of serum liver enzymes may occur. Jaundice may develop within 24 hours after exposure and persist for several hours.
Dermal/ocular	Direct contact with liquid acrylonitrile or concentrated vapor causes severe skin irritation, eye irritation and lacrimation and corneal injury. Prolonged skin contact may cause large skin blisters after a delay of several hours.
Dose-effect relationships	Concentrations as low as 16 ppm for 20-30 minutes may produce headache, nausea, and irritability. 400 ppm for one hour or 2 mg/kg body weight by dermal route may be lethal.
Potential sequelae	Survivors of severe exposure may suffer a post-hypoxic encephalopathy. After serious inhalation sensitivity to irritants or pulmonary tissue destruction may develop.
Carcinogenicity	According to EC directive 1272/2008 acrylonitrile is classified as follows: Carc. 1B (known or presumed human carcinogen, classification is largely based on animal evidence)

4. Actions

Self-protection	Patients exposed only to acrylonitrile vapor do not pose significant risk of secondary contamination. Patients whose clothing or skin is contaminated with liquid acrylonitrile can secondarily contaminate other people by direct contact or through evaporation of acrylonitrile.
Decontamination	Patients exposed only to acrylonitrile vapor who have no evidence of skin or eye irritation do not need decontamination. All other require decontamination. Patients who are able and cooperative may assist with their own decontamination. If the exposure involved liquid acrylonitrile 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. 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. Remove contact lenses if present and easily removable without additional trauma to the eye.
Initial treatment	Therapy consists of supportive care. Specific antidotal measures should be considered. **If not already done, establish adequate ventilation and administer supplemental oxygen.** 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. **If not already done, establish intravenous access.**
Antidotal treatment	**Patients who have signs or symptoms of significant systemic toxicity should be evaluated for antidotal measures.** **Alternative antidotal measures:** **1) After inhalation, if not already done, where available and the physician is comfortable with administer N-acetylcysteine (NAC) i.v.**

	The recommended initial dose in severe cases (concentration in the air greater 15 ppm or oral or dermal uptake and clinical signs like dyspnea, cyanosis, convulsions, unconsciousness) is 150 mg/kg body weight i.v. administered over a period of 60 minutes followed by 50 mg/kg body weight over 4 hours and 100 mg/kg body weight over 16 hours. NAC i.v. is recommended in Germany and under investigation for FDA approval in the United States. **2) After ingestion and when signs or symptoms that indicate cyanide intoxication appear, patients should be evaluated for antidotal treatment of cyanide poisoning, if not already done. In this case please refer to the BASF Chemical Emergency Medical Guideline for CYANIDES. After administration of 4-DMAP and sodium thiosulfate, thereafter administration of N-acetylcysteine (NAC) as shown above.** **3) If not already done, and if the intravenous preparation is not available, consider oral doses of N-acetylcysteine (NAC, Mucomyst). Recommended doses are those usually given for the treatment of acetoaminophen overdose (140 mg/kg body weight loading dose, followed by 70 mg/kg body weight every 4 hours for 72 hours).** **Liver function, serum bilirubin, and prothrombin time should be monitored, if NAC is administered.**
Other treatment	**In cases of signs of respiratory tract irritation and exposure to concentrations of 15 ppm or greater, if not already done, administer 8 puffs of beclomethasone (800 µg beclomethasone dipropionate) from a metered dose inhaler. Thereafter administration of 4 puffs every 2 hours for 24 hours.** **At exposure concentrations of 100 ppm or greater administer 1.0 g methylprednisolone (or an equivalent steroid dose) intravenously.** Note: Efficacy of corticosteroid administration has not yet been proven in controlled clinical studies. If acrylonitrile was in contact with the skin, chemical irritation may result; treat as thermal burn: 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 chemical irritation may result; treat as thermal burns. Consult an ophthalmologist. Note: Any facial exposure to liquid acrylonitrile should be considered as a serious exposure.
Further evaluation and treatment	To the standard intake history, physical examination, and vital signs add pulse oximetry monitoring and a PA and lateral chest X-ray. Spirometry should be performed.
Laboratory tests	The diagnosis of acute acrylonitrile toxicity is primarily clinical, based on dyspnea and cyanosis. However, laboratory testing is useful for monitoring the patient and evaluating complications. Routine laboratory studies for all exposed patients include complete blood count, glucose, and electrolyte determinations. Additional studies for patients exposed to acrylonitrile include ECG monitoring, lactate levels, and liver functions. Chest radiography and pulse oximetry (or arterial blood gas measurements) may be useful for patients exposed through inhalation. In severe cases the venous PO_2 may be elevated so that normal gap between arterial and central PO_2 narrows. **Evidence of pulmonary edema** - hilar enlargement and ill-defined, central-patch infiltrates on chest radiography - **is a late finding that may occur 6 to 8 hours or later after exposure. The chest X-ray is typically normal on first presentation to the emergency department even with severe exposures.**

Patients who have possible exposure should be observed for a minimum of 24 hours and reexamined frequently before confirming the absence of toxic effects.
Whenever intravenous methemoglobinemia-inducing agents are used blood methemoglobin levels should be monitored. Because of continued metabolic release of cyanide, symptoms of severe poisoning may recur.
Increased cyanide and thiocyanide levels may be determined in blood, however, they do not correlate with the exposure level.
Jaundice may develop 24 hours after exposure and persist for several days.

Patient release/ follow-up instructions

Clinically asymptomatic patients exposed to a concentration of **less than 15 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 acrylonitrile 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 acrylonitrile 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 eye injuries should be reexamined in 24 hours.
If pulmonary injury has occurred post discharge spirometry should be repeated until values return to the patient's baseline values.

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Reviewed: 2020
Code: E007-010