BASF Chemical Emergency Medical Guidelines

Cyanides (CN); Hydrocyanic acid 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 cyanides.**
- **Patients exposed only to cyanide vapor do not pose a significant risk of secondary contamination. Patients whose clothing is contaminated with cyanide-containing liquids may secondarily contaminate rescue and medical personnel by direct contact or through evaporation of cyanides.**
- **Cyanide poisoning may lead to death within minutes. Given reason to believe that cyanide-containing material is present, severe hypoxic signs in the absence of cyanosis suggest the diagnosis.**
- **In case of suspected cyanide poisoning immediate administration of 100% oxygen is crucial. If the patient is symptomatic use the recommended cyanide antidotes.**

1. Substance information

Cyanide (CN)
Cyanides are the salts of hydrocyanic acid (e.g. Cyanogen potassium and similar). Their physical and chemical properties are dependent on the nature of the chemical in question. The odor of cyanide compounds does not provide adequate warning of hazardous concentrations.
Alkaline cyanide salts are used for gold and silver ore extraction, metal heat treating, electroplating as well as for the production of dyes, pigments, and as fumigants and insecticides.
Cyanide can also be released by hepatic metabolism from various nitrile compounds that are used in the production of plastics or occur naturally in plants.

2. Routes of exposure

Inhalation

All respirable forms of cyanide are readily absorbed via the lung.

Skin/eye contact

Cyanide is absorbed through skin or mucous membranes, although the onset of toxic symptoms may be delayed. Exposure to cyanides may result in skin and eye irritation.

Ingestion

Most cyanides are immediately absorbed from the gastrointestinal tract. Alkali salts of cyanide are toxic only when ingested.

3. Acute health effects

Cyanide combines with the ferric ion in mitochondrial cytochrome oxidase, thus inhibiting oxidative phosphorylation and ATP production. The cellular anoxia and inhibition of oxidative metabolism places increased demand on anaerobic glycolysis, which results in lactic acidosis.
Initially the patient may experience flushing, tachycardia, tachypnea, headache, and dizziness. This then may progress to metabolic acidosis, agitation, stupor, coma, apnea, generalized seizures, bradycardia, hypotension and death.
Burning sensation of the mouth and throat, and equally redness of the eyes have occurred.

4. Actions

Rescuer self-protection

If the zone which has to be entered by the rescuer is suspected of containing cyanide, pressure-demand, self-contained breathing apparatus and chemical-protective clothing shall be worn.

Patients whose clothing is contaminated with cyanide-containing liquids may secondarily contaminate rescue and medical personnel by direct contact or through evaporation of cyanides.

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.

„CRASH"-Decontamination

a) Rescue with cyanides contaminated, unconscious patients or patients who are unable to move (critically ill/injured patients according to the ABCDE approach) from the danger zone immediately. The use of appropriate personal protective equipment and self- protection have top priority
b) Start Basic Life Support if necessary (e.g. bleeding control with Tourniquet, cardiac massage etc.)
c) In a safe zone: fast and complete removal of clothing using a rescue knife or trauma shears (approx. 1 minute)
d) Short rinsing off with plenty of water (approx. 1 minute)
e) Place patient on a clean rescue sheet. Consider heat preservation. Transport the patient to the handover area to emergency medical services (approx. 1 minute).

Initial treatment

Speed is critical. For symptomatic patients, provide treatment - 100% oxygen and specific antidotes as needed. Treatment should be given simultaneously with decontamination procedures.
Treatment with antidotes should be given under medical supervision to unconscious patients who have known or strongly suspected cyanide poisoning (see *Antidotes* below).

Decontamination

All patients with suspected exposure to cyanide-containing solutions require decontamination.
Patients who are able and cooperative may assist with their own decontamination. If not already done, rapidly remove and double-bag contaminated clothing while flushing exposed skin and hair with plain water for 5 minutes. Protect eyes during flushing of skin and hair. Assure that exposed skin and hair have been flushed with plain water for at least 5 minutes.
Assure that exposed or irritated eyes have been irrigated with plain water or saline for 5 minutes. If not, continue eye irrigation during other basic care or transport. Remove contact lenses if present and easily removable without additional trauma to the eye.
In case of ingestion do not induce emesis. Perform gastric lavage and give a slurry of activated charcoal as soon as possible. Isolate gastric washings and vomitus; they may evaporate hydrogen cyanide.
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.

Antidotal treatment

The following treatment with antidotes should be given under medical supervision to unconscious patients who have known or suspected cyanide poisoning. The availability of antidotes may vary due to statutory and regulatory differences among different countries.
Note: In some countries administration of 0.2-0.4 ml amyl nitrite via anesthesia bag is recommended before the following treatment.

If 4-dimethyl aminophenol (4-DMAP) is available, the following method of treatment should be applied: Administer immediately 4-DMAP intravenously, usually in a dose of 3 to 5 mg/kg body weight (i.e. 1 ampule of 250 mg 4-DMAP in an adult).
If 4-DMAP is not available, infuse sodium nitrite intravenously as soon as possible. The usual adult dose is 10 to 20 ml of a 3% solution infused over no less than 5 minutes. Monitor blood pressure during sodium nitrite administration. Slow the rate of infusion if hypotension develops.
Next, after 4-DMAP as well as after sodium nitrite administration, infuse a 10% solution of sodium thiosulfate (100 mg/kg body weight). Do not treat methemoglobinemia, unless 4-DMAP was overdosed or the assumed diagnosis of cyanide poisoning is revised.
Sodium thiosulfate may also be administered to conscious but symptomatic patients with suspected cyanide poisoning.

Please note that conscious patients should neither receive 4-DMAP nor sodium nitrite.
As an alternative to the combination of 4-DMAP / sodium nitrite and sodium thiosulfate the administration of high-dose hydroxycobalamin (which combines with cyanide to form non-toxic cyanocobalamin) is preferred in some countries. Hydroxycobalamin (70 mg/kg body weight; usually 5 g in an adult) has to be administered intravenously within 20-30 min. A second and third dose, but not more than 15 g in total, may be considered, in particular in case of refractory cardiac arrest or collapse.
Symptomatic patients should be transported to a hospital/emergency department.

Patient release/ follow-up instructions

Patients who remain **asymptomatic for 2 hours after exposure and have not received antidotes 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 cyanide compounds 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 cyanides 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; smoke may worsen the conditions of the lungs.

In this document BASF has made a diligent effort to ensure the accuracy and currency of the information presented but makes no claim that the document comprehensively addresses all possible situations related to this topic. This document is intended as an additional resource for paramedics and doctors at the site in assessing the condition and managing the treatment of patients exposed to cyanides. It is not, however, a substitute for the professional judgement of a paramedic or a doctor and must be interpreted in the light of specific information regarding the patient available to such a paramedic or doctor and in conjunction with other sources of authority.

BASF SE
Corporate Health Management
Carl-Bosch-Straße 38
67056 Ludwigshafen
Germany

BASF Corporation
Medical Department
100 Campus Drive, M/S F 221
Florham Park, NJ 07932
USA

Reviewed: 2020
Code: E008-009