

J03: Cyanide

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Introduction

Cyanide is a molecule consisting of a carbon atom triply bonded to a single nitrogen atom. It can form compounds which are also known as cyanides. It is both naturally occurring and synthetic with many cyanide-containing compounds resulting in powerful, fast acting poisons.

Hydrogen cyanide is a colourless gas with a faint, bitter, almond-like odor. Sodium cyanide and potassium cyanide are both white solids with similar odours in damp air. Cyanide salts and hydrogen cyanide are used in electroplating, metallurgy, the production of organic chemicals, photography, plastics manufacturing, the fumigation of ships, and some mining processes. Fires involving modern building materials, plastics, and furnishings can also produce large amounts of cyanide, and individuals exposed to the smoke from these fires can have significant cyanide exposures.

Essentials

- **On-Call consultation required** when attending cases of suspected cyanide exposure.
- Rescue of unconscious victims exposed to cyanide gas must only be done by trained personnel equipped with self-contained breathing apparatuses and protective clothing.
- Patients must be decontaminated. Remove clothing to limit off-gassing and secondary contamination.
- Severe, acute cyanide poisoning is usually associated with rapid onset of central nervous system symptoms, including unconsciousness and seizures. Cardiovascular effects, such as hypotension and tachycardia, and metabolic acidosis, are common.
- Hydrogen cyanide and the inorganic cyanide salts rapidly produce symptoms following acute exposure. Death may occur within minutes. Exposure to cyanide-containing compounds may result in a delayed onset of symptoms.
- Hydroxocobalamin is the first-line antidote to cyanide poisoning.

Additional Treatment Information

- Topical exposure to concentrated solutions of cyanide salts can cause skin burns as well as systemic toxicity. Skin flushing may be observed from systemic effects. Remove and dispose of contaminated clothing. Flush skin and eyes thoroughly with soap and water and treat symptomatically as for ingestion.
- Inhalation of cyanide-containing gases produce respiratory tract irritation. Massive exposure may cause a sudden loss of consciousness and death from respiratory arrest within minutes. Cyanogen chloride can cause delayed pulmonary edema.

Referral Information

Asymptomatic patients should be monitored for at least six hours following acute exposure. The monitoring period should be extended to at least 24 hours following exposure to nitriles or cyanide-releasing compounds. Conveyance is mandatory.

General Information

- Signs and symptoms of cyanide toxicity include:
 - Tachycardia, mild transient hypertension progressing to hypotension, bradycardia, and cardiovascular collapse
 - Tachypnea is common initially with progression to respiratory depression and respiratory arrest; pulmonary edema may develop
 - Headaches, anxiety, dizziness, agitation and confusion are common in early stages; patients may become obtunded or seize
 - Nausea and vomiting may develop; ingestion of caustic, alkaline cyanide salts may cause gastrointestinal

- bleeding
 - Metabolic acidosis with hyperlactatemia is characteristic of severe cyanide poisoning; hyperglycemia may also occur
- Cyanide inhibits the activity of cytochrome oxidase A3 in the mitochondria, preventing aerobic respiration. The resulting shift to anaerobic metabolism produces an excess of lactate. Effects are most prominent in brain and cardiovascular tissues.
- Cyanides are rapidly absorbed by ingestion, inhalation, and through contact with mucosal membranes. Symptoms may be seen within seconds to minutes of exposure.
- Air concentrations of 200-300 ppm of hydrogen cyanide may be rapidly fatal.
- The "bitter almond" odour of hydrogen cyanide is not a reliable indicator of danger – many individuals are unable to detect this odour.
- The estimated lethal dose to an adult is 50 mg of hydrocyanic acid and 200-300 mg of an inorganic cyanide salt.
- Patients have survived > 1 g potassium cyanide ingestion with prompt antidote therapy.

Interventions

First Responder

- Remove patient and decontaminate as required
 - Remove and dispose of clothing
 - Flush exposed skin and mucosal membranes with soap and water
 - → [PR05: Patient Decontamination](#)
 - If eyes are involved, flush with a gentle stream of water for at least 15 minutes
- Keep the patient warm and protect from further heat loss
- Place the patient in a position of comfort, as permitted by clinical condition
- Protect the airway and assist ventilations as necessary
 - → [B01: Airway Management](#)
- Provide supplemental oxygen via non-rebreather face mask
 - → [A07: Oxygen Administration](#)

Emergency Medical Responder – All FR interventions, plus:

[OnCall consultation required](#) when attending cases of suspected cyanide exposure.

- Convey with notification

Primary Care Paramedic – All FR and EMR interventions, plus:

- Consider vascular access and treatment of hypotension
 - → [D03: Vascular Access](#)

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- Consider push-dose [EPINEPHrine](#) for hypotension refractory to fluids
- Control seizures if necessary
 - → [F02: Seizures](#)

Critical Care Paramedic – All FR, EMR, PCP, and ACP interventions, plus:

- [Hydroxocobalamin](#)
- Correct metabolic acidosis
- Seizures refractory to benzodiazepines should be managed with barbiturates

References

1. Agency for Toxic Substances and Disease Registry (ATSDR). [\[Link\]](#)

2. ATSDR - Division of Toxicology and Human Health Sciences (DTHHS). 2018. [\[Link\]](#)
3. British Columbia Drug and Poison Information Centre. [\[Link\]](#)

