

## HYDROGEN CYANIDE

### Background:

Hydrogen cyanide (HCN) is a pale-blue liquid at 78°F; at higher temperatures it is a colorless gas. It has a 'bitter almond' odor; however, 20 to 40 percent of individuals cannot detect the odor of HCN. Cyanide is well absorbed by inhalation and can cause death within minutes. Substantial absorption can occur through intact skin. Cyanide inhibits cytochrome oxidase and prevents oxidative phosphorylation and ATP production. The inhibition of the cytochrome oxidase increases the need for anaerobic glycolysis and leads to profound acid-base disorders. All suspected or confirmed cases of hydrogen cyanide intoxication must be reported to the local department of public health and the Illinois Department of Public Health (IDHP).

### Signs/Symptoms:

In general, the clinical signs of significant intoxication would be rapid knockdown, bradycardia, hypotension and tachypnea. Diagnostic studies will show a profound metabolic acidosis from elevated lactate.

- 1) CNS: Excitement, dizziness, nausea, vomiting and headache may be noted initially. Severe symptoms may include coma and seizures.
- 2) Cardiovascular: Early findings may include hypertension and tachycardia. Bradycardia and hypotension are more commonly seen and are considered later findings.
- 3) Pulmonary: Dyspnea, chest tightness, tachypnea, progressing to cyanosis and pulmonary edema may occur.
- 4) Metabolic: High anion gap metabolic acidosis secondary to a lactic acidosis.

### Laboratory and Diagnostic Testing:

- 1) Laboratory tests: CBC, Chem-7 (calculate anion gap), ABG, lactic acid, cyanide level
- 2) EKG: monitor (may see dysrhythmias and/or bradycardia)
- 3) CXR (may have pulmonary edema in severe poisoning)
- 4) CT scan if severe neurological effects present and exposure is not definitively confirmed

### Treatment:

#### Decontamination:

Patients who have been exposed to gas only and do not have skin or ocular irritation, do not need decontamination. Patients who have been exposed to cyanide-containing liquid or solution should be decontaminated with water; a mild soap may be used as well but is not essential. Liquid cyanide can off-gas and patients should be decontaminated prior to entry to the hospital.

#### Antidotal Therapy:

Taylor Cyanide Antidote Kit®: Contains three separate components – amyl nitrite perles, sodium nitrite and sodium thiosulfate.

#### Dosing:

##### Amyl Nitrite


- 1) Use if IV access is delayed or not possible
- 2) Crush 1-2 capsules into gauze
- 3) Have patient inhale amyl nitrite through gauze, or place gauze within facemask, over intake valve of bag-valve-mask device or port access to ET tube during assisted ventilation
- 4) Alternate every 30 seconds with 100 percent oxygen
- 5) Discontinue use when IV access obtained and sodium nitrite given. If no IV access within 3 minutes, give second capsule

*(continued, next page)*

**If you suspect a poisoning exposure from any bioterrorism agent, immediately contact your local county health department, and the Illinois Poison Center at 1-800-222-1222.**

**Sodium Nitrite**

1) Adult: 300 mg over 5 minutes or more (10 mL of a 3 percent solution)

 2) *Pediatrics: 0.19 to 0.39 mL/kg of a 3 percent solution, or if the hemoglobin is known, use the following pediatric table:*

Hemoglobin (grams)	Sodium Nitrite (mg/kg)	3 Percent Sodium Nitrite Solution (mL/kg)
7.0	5.8	0.19
8.0	6.6	0.22
9.0	7.5	0.25
10.0	8.3	0.27
11.0	9.1	0.30
12.0	10.0	0.33
13.0	10.8	0.36
14.0	11.6	0.39

**Sodium Thiosulfate**

1) Adult: 12.5 g over 10 minutes (50 mL of a 25 percent solution)

 2) *Pediatrics: 1.65 mL/kg of a 25 percent solution*

**Sodium thiosulfate may be considered as a single agent for treatment of cyanide poisoning, especially in suspected cases that have not been confirmed.**

**Adverse Effects:**

**Nitrites**

- 1) Severe methemoglobinemia  $\geq 30$  percent possible
- 2) Hypotension
- 3) Hypernatremia

**Sodium Thiosulfate**

- 1) Hypernatremia
- 2) Sulfa allergic reaction

**Cautions:**

- 1) Check methemoglobin levels 30 minutes after nitrite administration. If levels  $>30$  percent, do not use methylene blue, consider exchange transfusion.
- 2) Nitrite-induced methemoglobinemia may be detrimental in any condition with poor oxygen-carrying capacity (anemia, cardiac disease, lung disease, carbon monoxide poisoning, fire victims).
- 3) Monitor blood pressure and slow infusion rate of sodium nitrite if hypotension develops.
- 4) Asymptomatic patients should not be treated with the entire cyanide antidote kit because of inherent toxicity of nitrite-containing antidotes.

**Supportive Care:**

Monitor and support patient per standard ACLS and emergency medicine practices.