



<b>REGION 11 CHICAGO EMS SYSTEM PROTOCOL</b>	Title: Cyanide Exposure - ALS
	Section: Toxins and Environmental
	Approved: EMS Medical Directors Consortium
	Effective: December 6, 2023

## **CYANIDE EXPOSURE - ALS**

### **I. PATIENT CARE GOALS**

1. Remove patient from toxic environment.
2. Assure adequate ventilation, oxygenation, and correction of hypoperfusion.

### **II. PATIENT PRESENTATION**

*Cyanide is a colorless gas or white crystal which binds to the ferric ion in cells, blocking the enzyme cytochrome oxidase, thus preventing the use of oxygen by the cell's mitochondria, leading to cellular hypoxia. While it has a characteristic "bitter almond smell", genetically only 40% of the population can smell it.*

#### **A. Inclusion Criteria**

1. **Depending on its form, cyanide can enter the body through inhalation, ingestion, or absorption through the skin.** Cyanide should be suspected in occupational or other smoke exposures (e.g., firefighting), industrial accidents, chemical warfare, and terrorism (whenever there are multiple casualties of an unclear etiology).
  - a. Early signs of cyanide exposure are non-specific and include: headache, confusion, dyspnea, chest tightness, and nausea.
  - b. Other symptoms of cyanide exposure may include: mydriasis (pupil dilation), hypertension, tachypnea, vomiting, and tachycardia.
2. High concentrations of cyanide will produce:
  - a. Markedly altered level of consciousness, including rapid collapse
  - b. Seizures
  - c. Respiratory depression or respiratory arrest
  - d. Cardiac dysrhythmias and hypotension

#### **B. Exclusion Criteria**

None



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**III. PATIENT MANAGEMENT**

**A. Assessment**

1. Remove patient from toxic environment and decontaminate as indicated.
2. Assess ABCDs and, if indicated, expose the patient, and then re-cover the patient to assure retention of body heat.
3. Assess vital signs (pulse, blood pressure, respiratory rate, neurologic status assessment) including pulse oximetry (which may not correlate with tissue oxygenation in cyanide/smoke exposure).
4. Attach a cardiac monitor and examine rhythm strip for arrhythmias.
  - a. Perform a 12-lead ECG.
5. Check blood glucose level and treat as appropriate.
6. Monitor pulse oximetry and ETCO<sub>2</sub>.
7. Monitor patient for signs of hypoxia (pulse oximetry less than 94%) and respiratory decompensation regardless of pulse oximetry reading.
8. Identify the specific agent of exposure, time of ingestion/inhalation, and quantity/timing of exposure.
9. Obtain patient history including cardiovascular history and prescribed medication.
10. Obtain other pertinent patient history.
11. Perform physical exam.

**B. Treatment and Interventions**

There is no widely available, rapid, confirmatory cyanide blood test. Many hospitals will not be able to rapidly assess cyanide levels. **Therefore, treatment decisions must be made on the basis of clinical history AND signs and symptoms of cyanide intoxication.**

**For the patient with an appropriate history and physical findings:**



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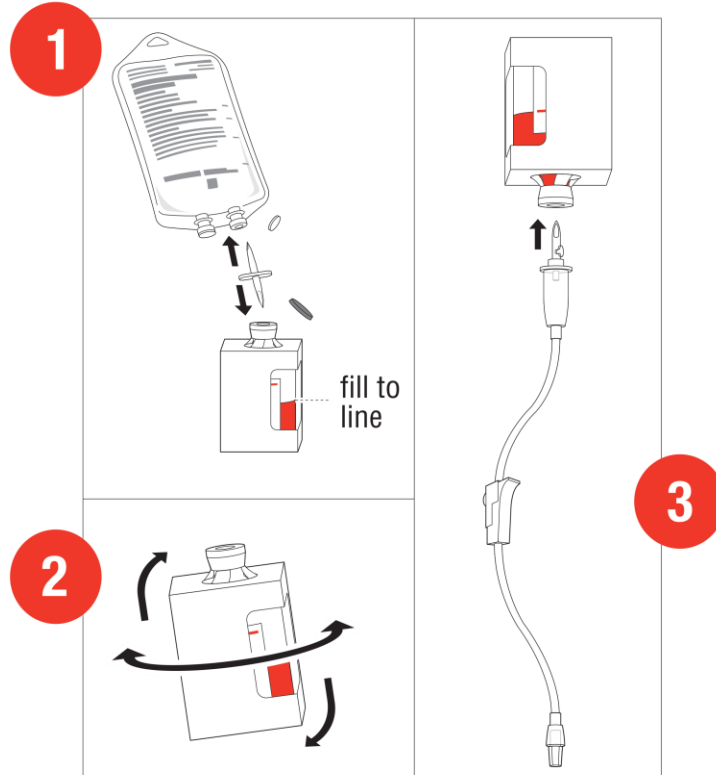
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- Including exposure to products of combustion with smoke inhalation from closed-space fires; **AND**
  - Manifesting one or more significant cyanide exposure signs or symptoms (markedly altered level of consciousness, seizures, respiratory depression or respiratory arrest, cardiac dysrhythmias and hypotension).
1. Administer 100% oxygen via non-rebreather mask, CPAP, or bag valve mask.
  2. Prepare and administer hydroxocobalamin (Cyanokit).
    - a. Reconstitute: Place the vial in an upright position. Add 200 ml of 0.9% Sodium Chloride Injection to the vial using the transfer spike. Fill to the line.
    - b. Mix: The vial should be repetitively inverted or rocked, not shaken, for at least 60 seconds prior to infusion. Visually inspect the solution for particulate matter and color prior to administration. Discard solution if particulate matter is present or solution is not dark red.
    - c. Infuse vial: Using vented intravenous tubing, hang and infuse over 15 minutes.



Reference from CYANOKIT (BTG Pharmaceuticals) - <https://cyanokit.com/treatment-with-cyanokit>



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3. Dosing

- a. Adult: Initial dose is 5 grams administered over 15 minutes slow IV
- b. Pediatric: Hydroxocobalamin 70 mg/kg (reconstitute concentration is 25 mg/mL) with a maximum dose of 5 grams.

4. Use a separate IV line for administration of hydroxocobalamin infusion.

5. If seizure, treat per Seizure Protocol.

**C. Patient Safety Considerations**

1. In the event of multiple patients, be sure to wear appropriate PPE during rescue evacuation from the toxic environment.
2. Hydroxocobalamin is safe for treatment of cyanide poisoning in pregnant patients.
3. There is a risk of anaphylaxis or other hypersensitivity reactions after administration of hydroxocobalamin (Cyanokit); for new onset chest tightness, edema, urticaria, pruritis, dyspnea, or rash treat per Anaphylaxis and Allergic Reaction Protocol.
4. There is a risk of substantially increased blood pressure after hydroxocobalamin (Cyanokit) administration; monitor blood pressure during therapy.

**IV. NOTES/EDUCATIONAL PEARLS**

- A. Pulse oximetry accurately reflects serum levels of oxygen but does not accurately reflect tissue oxygen levels therefore should not be relied upon in possible cyanide and/or carbon monoxide toxicity.
- B. After hydroxocobalamin has been administered, pulse oximetry levels are no longer accurate and skin, tears, and urine will all turn red. This flushing should not be interpreted as an allergic reaction.
- C. If the patient ingests cyanide, it will react with the acids in the stomach generating hydrogen cyanide gas. Be sure to maximize air circulation in closed spaces (ambulance) as the patient's gastric contents may contain hydrogen cyanide gases when released with vomiting or belching.