F. OVERDOSE/POISONING: CYANIDE POISONING

1. Inclusion Criteria
   Depending on its form, cyanide can enter the body through inhalation, ingestion, or absorption through the skin. Cyanide should be suspected in occupational or smoke exposures (e.g., firefighting), industrial accidents, natural catastrophes, suicide and murder attempts, chemical warfare, and terrorism (whenever there are multiple casualties of an unclear etiology).

   Non-specific and early signs of cyanide exposure (inhalation, ingestion, or absorption) include the following signs and symptoms: anxiety, vertigo, weakness, headache, tachypnea, nausea, dyspnea, vomiting, and tachycardia.

"High concentrations of cyanide" will produce:
- Markedly altered level of consciousness
- Seizure
- Respiratory depression or respiratory arrest or
- Cardiac dysrhythmia (other than sinus tachycardia)

The rapidity of onset is related to the severity of exposure (inhalation or ingestion) and may have dramatic, immediate effects causing early hypertension with subsequent hypotension, sudden cardiovascular collapse, or seizure/coma.

ALERT

PATIENTS WHO HAVE SUSTAINED A BURN AND/OR TRAUMATIC INJURY SHOULD BE GIVEN TREATMENT SPECIFIC TO THOSE INJURIES, INCLUDING APPLYING SPINAL PROTECTION, IF INDICATED. THE SMELL OF (BITTER) ALMONDS IS NOT A RELIABLE SIGN AND THE CLINICIAN SHOULD NOT ATTEMPT TO INHALE LOCAL AIR NOR PATIENT BREATH TO DETERMINE IF THE ALMOND SMELL IS PRESENT.

BE SURE TO ASSESS FOR EVIDENCE OF TRAUMATIC OR MEDICAL CAUSES FOR PATIENT'S ALTERED MENTAL STATUS.

2. Treatment:
   a) Remove the patient from the source of exposure. (In the smoke inhalation victim, maintain appropriate clinician respiratory protection, SCBA.)
   b) Restore or maintain airway patency.
   c) Administer 100% oxygen via non-rebreather mask or bag-valve-mask.
   d) Provide aggressive advanced airway management.

OVERDOSE/POISONING: CYANIDE POISONING (CONTINUED)

e) Establish IV access with LR.
f) Use glucometer and treat patient accordingly.
g) There is no widely available, rapid, confirmatory cyanide blood test. 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 manifesting one or more of "high concentrations of cyanide" signs or symptoms:

(1) Collect a pre-treatment blood sample in the appropriate tube for lactate and cyanide levels.

(2) If patient history is suggestive of CO inhalation, follow Overdose/Poisoning: Carbon Monoxide/Smoke Inhalation Protocol

(3) If patient (adult or pediatric) has a reported oral cyanide ingestion and does not manifest signs and symptoms meeting administration criteria, medical consultation is required for administration of hydroxocobalamin (consider simultaneous consultation with poison control and medical consultation).

(4) ADULT: Administer hydroxocobalamin. Initial dose is 5 grams administered over 15 minutes SLOW IV. Each 2.5 gram vial of hydroxocobalamin for injection is to be reconstituted with 100 mL of LR and administered at 10–15 mL/minute.

An additional 5 gram dose may be administered with medical consultation.

(5) PEDIATRIC: Administer hydroxocobalamin 70 mg/kg (reconstitute concentration is 25 mg/mL). Each 2.5 gram vial of hydroxocobalamin for injection is to be reconstituted with 100 mL of LR and administered at 10–15 mL/minute. Maximum single dose is 5 grams.

ALERT

HYDROXOCOBALAMIN MAY CAUSE TEMPORARY RED DISCOLORATION OF THE SKIN, URINE, AND MUCOUS MEMBRANES (WHICH IS NOT TO BE CONFUSED WITH THE RARE SIGN OF CARBON MONOXIDE POISONING). THE DEVICES THAT RELY ON COLORIMETRY (E.G,. PULSE OXIMETER AND CO LEVEL) WILL BE INTERFERED WITH BY THE COLOR CHANGE AND ARE NOT RELIABLE FOR PATIENT ASSESSMENT.

NOTIFY HOSPITAL OF ADMINISTRATION OF HYDROXOCOBALAMIN AND DO NOT ADMINISTER SODIUM THIOSULFATE THROUGH THE SAME IV, AS THIS MAY CAUSE CRYSTALLINE PRECIPITATION.

HYDROXOCOBALAMIN

1. Pharmacology

Hydroxocobalamin is a form of Vitamin B-12.

2. Pharmacokinetics

Hydroxocobalamin binds to the cyanide ion, forming cyanocobalamin, which is excreted in the urine.

3. Indication

Signs and symptoms of high concentrations of cyanide exposure with an appropriate clinical history are indications for treatment as there is no widely available, rapid, confirmatory cyanide blood test.

"High concentrations of cyanide" will produce:

- Markedly altered level of consciousness
- Seizure
- Respiratory depression or respiratory arrest or
- Cardiac dysrhythmia (other than sinus tachycardia)

Mechanism of action of **cyanide** in the body

Cyanide inhibits mitochondrial cytochrome oxidase and hence blocks electron transport, resulting in decreased oxidative metabolism and oxygen utilization. Lactic acidosis occurs as a consequence of anaerobic metabolism. The oxygen metabolism at the cell level is grossly hampered.

Cyanide is rapidly absorbed from the stomach, lungs, mucosal surfaces, and unbroken skin.

The lethal dose of potassium or sodium **cyanide** is 200 to 300 mg, and of hydrocyanic acid is 50 mg. Effects begin within seconds of inhalation and within 30 minutes of ingestion. The rapidity of onset is related to the severity of exposure (inhalation or ingestion) and may have dramatic, immediate effects causing sudden cardiovascular collapse or seizure/coma.

Initial effects of poisoning include headache, faintness, vertigo, excitement, anxiety, a burning sensation in the mouth and throat, breathing difficulty, increased heart rate, and hypertension. Nausea, vomiting, and sweating are common.

Smell of almonds is not a reliable sign and the clinician should not attempt to inhale local air nor patient breath to determine if the almond smell is present.

HYDROXOCOBALAMIN (CONTINUED)

4. Contraindications

Patients with known anaphylactic reactions to hydroxocobalamin or cyanocobalamin

5. Adverse Effects

a) Reddish discoloration of the skin and urine (which is not to be confused with the rare sign of carbon monoxide poisoning). The devices that rely on colorimetry (e.g., pulse oximeter and CO level) will be interfered with by the color change and are not reliable for patient assessment.
b) Rash
c) Increased blood pressure
d) Nausea
e) Headache
f) Decreased white cell count
g) Injection site reactions
h) Allergic reactions have been observed.

6. Precautions

a) Notify hospital of administration of hydroxocobalamin and do not administer sodium thiosulfate through the same IV, as this may cause crystalline precipitation.
b) Administer slowly over 15 minutes.
c) Watch for administration sight reactions.
d) Monitor for hypertensive response to administration.

BE SURE TO ASSESS FOR EVIDENCE OF TRAUMATIC OR MEDICAL CAUSES FOR PATIENT'S ALTERED MENTAL STATUS.

7. Dosage

a) Collect a pre-treatment blood sample in the appropriate tube to assess cyanide level.
b) ADULT: Administer hydroxocobalamin. Initial dose is 5 grams administered over 15 minutes SLOW IV. (Each 2.5 gram vial of hydroxocobalamin for injection is to be reconstituted with 100 mL of LR and administered at 10–15 mL/minute.).

An additional 5 gram dose may be administered with medical consultation.

c) PEDIATRIC: Administer hydroxocobalamin 70 mg/kg (reconstitute concentration is 25 mg/mL). Each 2.5 gram vial of hydroxocobalamin for injection is to be reconstituted with 100 mL of LR and administered at 10–15 mL/minute. Maximum single dose 5 grams.
d)  If patient (adult or pediatric) has a reported oral cyanide ingestion and does not manifest signs and symptoms meeting administration criteria, consider medical consultation for administration of hydroxocobalamin.