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Enclosed Space Fires and Cyanide Poisoning

Cyanide is a potent toxin that can cause rapid clinical deterioration and death if not recognized quickly. The most common etiology of cyanide exposure in the U. S. is through hydrogen cyanide (HCN) formation in enclosed space fires. HCN is a byproduct from the burning of plastics, vinyl, rubber, wool and many other natural and synthetic materials that are in insulation, floor coverings, furnishings and other materials found in buildings and homes. Approximately one-half of those in enclosed space fires have detectable levels of HCN.

Cyanide is a chemical asphyxiant that binds to the ferric ion in cytochrome oxidase and inhibits oxidative phosphorylation, thereby halting cellular respiration. Toxic effects occur quickly after an exposure and may include altered mental status (drowsiness, dizziness, confusion, loss of consciousness), seizures, rapid and deep breathing progressing to apnea, early hypertension followed by hypotension, dysrhythmias and anion gap metabolic acidosis. Soot in the mouth, nose or sputum predict smoke inhalation and cyanide exposure in a fire.

Normal oxygen saturation on pulse oximetry is expected as there is adequate oxygen in the blood yet inability to use the oxygen that is present. An elevated lactate concentration and a venous blood gas with a high partial pressure of oxygen and a high oxygen saturation are highly suggestive of cyanide toxicity. Serum cyanide concentrations can be measured, but results aren't usually available in a timely manner.

Initial treatment consists of removing the patient from the environment while protecting the rescuer with personal protective equipment, followed by 100% oxygen. There are two antidotal products currently available for cyanide poisoning: hydroxocobalamin (Cyanokit®) and a sodium nitrite/sodium thiosulfate kit. Hydroxocobalamin is preferred for smoke inhalation patients with suspected cyanide toxicity, and can safely be given by prehospital providers as well as in emergency departments. Unlike sodium nitrite/sodium thiosulfate, hydroxocobalamin does not produce methemoglobinemia which compromises the blood's already low oxygen-carrying capacity in the presence of carbon monoxide poisoning, nor does it produce hypotension. Hydroxocobalamin chelates cyanide and forms cyanocobalamin (vitamin B12) which is excreted in the urine. The adult dose of hydroxocobalamin is 5 grams infused over a period of 15 minutes, with the dose repeated if necessary. The pediatric dose is 70 mg/kg, up to a maximum of 5 grams. Due to its red color, hydroxocobalamin causes red-colored urine and skin reddening that may last up to 2 weeks. Other adverse effects include transient hypertension, rash, nausea and headache. Also due to its color, hydroxocobalamin interferes with pulse oximeter, carboxyhemoglobin measurements, and the colorimetric determination of many laboratory parameters. Blood for laboratory testing should be drawn prior to administering hydroxocobalamin. To download a fact sheet on hydroxocobalamin, go to <http://bit.ly/AntidoteFacts>.



Did you know?

Poison Centers are working to ensure that health care providers are familiar with cyanide poisoning.

Go to <http://bit.ly/CyanideGraphic> to download an infographic on enclosed space fires and cyanide exposure. The infographic was developed by Strategic Consultants International (SCI) and Postgraduate Institute for Medicine (PIM), with assistance by the American Association of Poison Control Centers. We suggest that you distribute this to your prehospital providers and/or emergency department staff to help in the recognition and treatment of cyanide poisoning from smoke inhalation. And, as always, poison center specialists and toxicologists are available 24/7 to help with diagnosing and managing suspected cyanide poisonings: 800-222-1222.

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