Case #67

NAME Educational Activities Committee

Case provided by:

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A 58-year-old obese male collapses while distilling wastewater at an industrial work site. Co-workers at the other side of the room became sick as well but survived after prompt evacuation. Hazmat was informed and protective measures were taken to safeguard the scene before further investigation. The decedent arrived at the hospital in cardiopulmonary arrest smelling like rotten eggs and soon thereafter was pronounced dead. While documenting the decedent's belongings, it was noted that pennies in his pocket turned from a copper to grey color. Based upon this information, what is the recommended toxicology test?

A. Sulfhemoglobin
B. Methemoglobin
C. Thiosulfate
D. Carboxyhemoglobin
E. Hydrogen sulfide

Answer...

C. Thiosulfate

The decedent was exposed to hydrogen sulfide, BUT that is not what is typically tested for in toxicologic analysis. Exogenous sulfide is partially oxidized by hemoglobin and liver enzymes to thiosulfate. For evaluation of suspected hydrogen sulfide overexposures, blood thiosulfate monitoring is recommended. Urine thiosulfate elevation does not occur in the case of rapid fatalities but may be elevated in nonfatally exposed workers. Urinary thiosulfate levels are frequently used as a biomarker, however, a quantitative relationship between hydrogen sulfide exposure levels and urinary thiosulfate concentrations has not been established.

Other responses…

A. Sulfhemoglobin

Sulfhemoglobin is the result of oxidation of the iron in hemoglobin to a ferric state and the binding of sulfur to hemoglobin's porphyrin ring. A small fraction of normal blood exists as sulfhemoglobin due to the metabolism of endogenous sulfur. Acetanilide, phenacetin, nitrates, metoclopramide, and sulfur drugs have all been linked to producing sulfhemoglobinemia but sulfhemoglobin is not produced during exposure to hydrogen sulfide and determination of its level is not useful for documenting hydrogen sulfide exposure.

B. Methemoglobin

Methemoglobin is the result of oxidation of iron in hemoglobin from the ferrous to the ferric state. The formed methemoglobin cannot bind molecular oxygen and therefore reduces the transport of oxygen throughout the body. Common causes of methemoglobin formation include nitrates, nitrites, and oxidizing drugs. Hydrogen sulfide exposure does not produce methemoglobin.

D. Carboxyhemoglobin

Carboxyhemoglobin is a stable complex of carbon monoxide that forms in red blood cells when carbon monoxide is inhaled or following significant exposure to methylene chloride via a reaction catalyzed by CYP2E1.

E. Hydrogen sulfide

The decedent was exposed to hydrogen sulfide, which is a colorless gas known for its pungent “rotten egg” odor at low concentrations and for causing olfactory fatigue at high concentrations. It is extremely flammable and highly toxic and thought to produce systemic toxicity by inhibition of cytochrome oxidase. Its presence makes work in confined spaces potentially dangerous. Health effects depend on amount and duration of exposure. Effects range from mild, headaches or eye irritation, to very serious, unconsciousness and death. The half-life of hydrogen sulfide is unknown. Laboratories have developed tests that target sulfide and thiosulfate to detect hydrogen sulfide exposures. Hydrogen sulfide causes the atmospheric corrosion of copper. If a person is carrying copper containing items (e.g., pennies, keys, etc.) at the time exposure and those items have turned color, it is one possible indication that the person has been exposed to hydrogen sulfide.

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