CASE REPORT

Toxic effects of hydrogen sulfide: experience with three simultaneous patients

H. Kfir¹, S. Rimbrot¹,² and A. Markel¹,²

From the ¹Department of Internal Medicine A, Haemek Medical Center, Afula, Israel and ²Faculty of Medicine, Technion, Haifa, Israel

Address correspondence to A. Markel, Department of Internal Medicine A, Haemek Medical Center, Afula 18101, Israel. email: markel_ar@clalit.org.il

Learning Point for Clinicians-H₂S-QJM

Hydrogen sulfide (H₂S) is a colorless gas found in the industry and in places such as sewers. It can cause severe intoxication resulting in respiratory and neurological damage, and even death.

Three men with intoxication by this compound are described.

Methods for prevention of this problem should be urgently implemented.

Case report

Three healthy workers attending cleaning operation were found in a critical condition inside a 5-m sewage manhole.

The first victim, a 50-year-old man entered the pit and after a few minutes collapsed and lost consciousness. Another worker, a 22-year-old man entered the manhole to rescue him, but suddenly developed shortness of breath, stupor and rapidly entered an unconscious state. A third worker attempting to reach the other two co-workers felt dizzy and collapsed into the sewage as well.

An emergency medical team arrived at the site of the accident 30 min later and found the first victim unresponsive, with general cyanosis and no vital signs and pronounced his death. The second victim was admitted to Intensive Care Unit with adult respiratory distress syndrome (ARDS), pneumonitis, subcutaneous emphysema and pneumothorax (Figure 1A), requiring chest drainage. An electrocardiogram (ECG) showed ischemia and marked ST segment elevation (Figure 1B).

Septic shock followed, together with hyperglycemia, rhabdomyolysis and a clinical picture of liver shock. Acinetobacter baemanny was isolated from various blood cultures. Prolonged intubation required tracheostomy.

Diarrhea ensued and blood cultures were positive for salmonella. After specific antibiotic therapy was initiated, gradual improvement was noted and the patient was weaned from the respirator. His condition gradually improved and he was discharged 30 days after admission.

The third victim, a 19-year-old man, was admitted to the Heart Unit with orthopnea, high blood pressure and renal and heart failure. Aspiration pneumonia was diagnosed. Creatine phosphokinases increased to 6000. An echocardiography showed myocarditis. Later, diarrhea, weakness and sporadic chest pain were reported. Gradually, improvement occurred and the patient was released on the 22nd day of hospitalization.

Discussion

We presented 3 subjects with an acute severe intoxication typical of H₂S poisoning. Hydrogen sulfide (H₂S) is a colorless gas, with a particular ‘rotten egg’ odor, resulting from many industrial processes, such as oil refining and in the manufacturing of dyes, paper, rubber, leather and other materials.¹ It is also a product of the breakdown of organic material in sewers.²

The mechanism of H₂S is related primarily to its cytotoxic effects secondary to in vitro inhibition of cytochrome oxidase enzymes and other enzymes and metabolic processes, resulting in a disruption of the respiratory chain and a decrease in ATP synthesis. The phosphorylation process is affected, putting the cell under reductive stress.³

The clinical manifestations of H₂S toxicity are dose dependent. Mild mucous membrane irritation occurs at 50–100 ppm and may produce nausea, vomiting, keratoconjunctivitis, corneal ulceration and even irreversible corneal scarring. Olfactory nerve endings become rapidly fatigued or paralyzed at concentrations between 100 and 150 ppm. At levels approaching 200–300 ppm, rhinitis, bronchitis and pulmonary edema may result. Cardiopulmonary arrest usually results at concentrations

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>700 ppm. Acute exposure to H$_2$S concentrations $>$1000 ppm usually cause unconsciousness and death.$^3$

Despite the toxicity of this material and the description of H$_2$S poisoning and dangers by Dr Alice Hamilton in her book more than 90 years ago, prevention measures have not been successful and sporadic reports have been reported at different places.$^4$

There are still clusters of deaths and injuries from workers trying to rescue other workers without proper life support equipment.

Implementation of H$_2$S detection equipment, air-supplied respirators in toxic or oxygen-deficient atmospheres and confined space safety training could help to prevent most H$_2$S-related fatalities.$^5$

Conflict of interest: None declared.

References