

Research Article

# Accidental Hydrogen Sulfide Intoxication: About Two Autopsy Observations

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## Abstract

Hydrogen sulfide is a colorless gas, heavier than air and characterized by its rotten egg odor at low concentrations. Its toxicity remains an important problem because of its high rate of mortality. The diagnosis is challenging because symptoms are variable and non-specific. Furthermore, biological confirmation is usually difficult.

We report two autopsy cases of domestic accidental intoxication by Hydrogen Sulfide in two men who were found dead in a septic tank. Investigation of the accident site detected the hydrogen sulfide gaz. Dosage of blood sulfide and thiosulfate was negative. Urinary dosage of thiosulfate was not performed because bladders were empty for the two deceased. The death was attributed to Hydrogen Sulfide intoxication based on memorials, investigation of the accident site, the irritating and fetid odor emitted by the body and the marked asphyxia syndrome.

**Keywords:** Hydrogen sulfid; Intoxication; Autopsy; Prevention

## Introduction

Hydrogen sulfide is a colorless gas, heavier than air and characterized by its rotten egg odor at low concentrations. Its toxicity has been known for several hundred years and remains an important problem because of its high rate of mortality [1]. The symptoms are variable, non-specific and are related to the duration and concentration of exposure [2]. Furthermore, biological confirmation is usually difficult. Thus, the diagnosis is often challenging.

Hydrogen sulfide intoxication has been described mainly in industrial environments (petroleum industry, synthetic textiles, rubber ...) [3,4]. However, domestic lethal intoxication remains rare.

We report two autopsy cases of domestic accidental intoxication by Hydrogen Sulfide and we discuss the mechanism of death.

## Reported Cases

Mr. A, a 20-year-old and Mr. B a 27 year-old men were found dead in a septic tank. According to the memorials, Mr. A was gone down into the septic tank to recover his sheep that accidentally fell there and has rapidly lost consciousness. His cousin, Mr. B climbed down to rescue him, but also lost consciousness and did not recover.

On investigation of the accident site, we found a septic tank whose depth was of four meters and its width was of two meters (Figure 1). The bottom contained water whose height was estimated at 50cm. Dosage of the concentration of hydrogen sulfide within the tank was performed by civil protection officers using a gaz detector and returned positive (Figure 2).

A forensic autopsy was carried out 20 hours after the accident at the department of Forensic Medicine of Mahdia (Tunisia). In the autopsy room, there was an irritant and fetid odor emitted by both bodies.



Figure 1: The sheep being down in the septic tank (white color).

The external examination of Mr. A revealed frontal bruises and a marked facial congestion with conjunctival petechial (Figure 3). No putrefactive changes were noticed. At dissection, an irritant odor spread in the autopsy room. Internal examination did not reveal any injury. All organs were very congested. The lungs were oedematous associated to a diffuse sub pleural bleeding. An important hyperemia of trachea and bronchus was noted. The rest of the autopsy did not show any abnormalities.

On external examination of Mr. B, there was a marked facial congestion. No traumatic injuries were noted on the body. On making the main incision, an irritant odor spread in the autopsy room. The autopsy revealed a congestion of the organs and a massive pulmonary hemorrhagic oedema. An important hyperemia of trachea and bronchus was also noted. No pathological findings were detected in the other organs.

Histological examination revealed, in both cases, an evident passive congestion and oedema in lungs. None others remarkable abnormalities were noted.

Blood and gastric samples of both victims were taken for



Figure 2: H<sub>2</sub>S gas detector.



Figure 3: Asphyxia syndrome with a foamy foam.

toxicological analysis in both cases. Standard analyses were negative. Indeed, dosage of blood sulfide and thiosulfate was negative. Urinary dosage of thiosulfate was not performed because bladders were empty for the two deceased.

The death was attributed to Hydrogen Sulfide intoxication based on memorials, investigation of the accident site, the irritating and fetid odor emitted by the body and the marked asphyxia syndrome.

## Discussion

Hydrogen Sulfide is a colorless and flammable gas with a characteristic odor of rotten egg. It is naturally produced when three conditions coincide: the presence of sulfates and sulfate-reducing bacteria, anaerobic conditions and temperatures higher than 20 °C. These conditions are common in septic tanks [5].

H<sub>2</sub>S intoxication occurs almost exclusively by inhalational exposure. The cutaneous or digestive exposure is uncommon [6]. Hydrogen sulfide acts on different body systems. It can cause local irritative effects mainly on the mucous membranes of the upper airways, lungs, digestive organs and eyes [7,8].

In the reported cases, both victims had a marked hyperemia of trachea and bronchus. These signs may be related to direct toxicity.

H<sub>2</sub>S has also a systemic action. It acts preferentially on the brain, pancreas, kidneys, liver and small intestines as an inhibitor of cellular respiration by blocking the cytochrome a33 [3,9,10]. This will lead to cell asphyxia and metabolic acidosis by accumulation of lactic acid.

The symptoms of H<sub>2</sub>S poisoning are variable, non-specific and related to the duration and concentration of exposure [2]. H<sub>2</sub>S is characterized by the olfactory stunning from a threshold of 150ppm [11]. Intoxication may occur even through a dead body, which had been recovered from a septic tank. Thus, intoxication of would-be rescuers is frequent and has been reported by several authors [12]. Additionally, forensic doctors should take protective measures including airway protection to avoid being affected while performing autopsy.

Concentrations greater than 700-800ppm are often rapidly fatal. This can be explained by the direct damage to the central nervous system, particularly in the brain stem [11]. This direct neurotoxicity was explained by hyper-polarization of sodium-potassium channels leading to inhibition of neuronal cell function [12,13].

Fatal outcome due to cardio-toxicity has recently been reported in the literature. H<sub>2</sub>S intoxication rapidly decreases cardiac contractility and cardiac output, responsible for a cardiac arrest within minutes [14]. This may be explained by the blockage of L-type Calcium channels in cardiomyocytes [15]. In addition, H<sub>2</sub>S blocks cellular respiration, leading to myocardial cell necrosis [16].

The diagnosis of fatal H<sub>2</sub>S intoxication is confirmed by analysis of sulfide and thiosulfate in body fluids. However, biological confirmation is usually difficult because sulfide is rapidly metabolized and affected by the conditions of storage and the time between onset of exposure and autopsy [17]. Thiosulfate which is one of the major metabolites of sulfide is stable in blood, thus, it has been proposed as a more reliable indicator to confirm a death due to H<sub>2</sub>S exposure [18]. However, the lack of an elevated blood thiosulfate level had been reported in several cases of fatal H<sub>2</sub>S poisoning. In this situation, the diagnosis of H<sub>2</sub>S exposure should not be ruled out. The authors opined that immediate death prevented metabolism of H<sub>2</sub>S to thiosulfate [19,20].

Thiosulfate concentrations has been measured by Several authors in other biological tissues besides blood and urine such as brain, lung and muscle , but this is not totally reliable because of the H<sub>2</sub>S post mortem production due to putrefaction [20].

## Conclusion

H<sub>2</sub>S intoxication can be rapidly fatal. The diagnosis is based essentially on memorials, on investigation of the sources of H<sub>2</sub>S and data of autopsy (asphyxia syndrome). Biological confirmation is contributive but is usually misleading. Providing proper protective gear is the mainstay of preventing intoxication of would be rescuers.

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