

Case Report

Sewer Gas Poisoning: A Report of Two Cases

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Abstract

Death associated with confined and enclosed spaces present problem to the investigating pathologist as there may be few or no diagnostic feature at autopsy. In April of 2013, two manual labourers were engaged to clean a sewerage pipe in Imphal by climbing down a manhole. As soon as they entered the manhole, they collapsed and were declared 'brought dead' in the hospital. These cases are reported here to highlight an unexpected instance of hydrogen sulphide poisoning in the middle of the city here which was heretofore unheard of in this particular part of the country. H₂S is irritant to human tissues causing kerato-conjunctivitis, lacrimation, nasal irritation, dyspnea and coughing at 50-100 ppm.

Hydrogen sulphide is quickly absorbed through the lungs and gastrointestinal tracts. The suddenness of the deaths shocked the general public and has served as an eye-opener to the possibility of similar occurrences in the future. Certain precautions are also suggested here to prevent such mishaps.

Key Words: Manhole, Hydrogen Sulphide, Oxygen Mask, Keratoconjunctivitis

Introduction:

Hydrogen sulphide in combination with CO₂ and methane formed in sewers is known as 'sewer gas'. Sulphureted hydrogen is the chief and dangerous constituent in sewer gas.

It is colourless with a smell of 'rotten eggs', heavier than air and tends to settle at the bottom of pits and cellars or sewers. It is the second leading cause of toxin-related deaths (after carbon monoxide) in the workplace. [1]

It is a by-product generated in several industries and also present in sewer gas, cesspools and wherever putrefaction takes place. In 2007, OSHA (Occupational Safety and Health Administration) recorded 13 work-related asphyxiation deaths' [2]

OSHA General Industry permissible exposure limit is ceiling of 20 ppm with a 50 ppm 10 minutes peak, once during 8-hr shift.

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Case Report:

As per the history given by the police, on 25/04/13 at around 8:00 AM, two workers fell down inside the manhole of sewerage pipe located at North AOC, Imphal while trying to clean the pipe. They were almost immediately evacuated to hospital but were declared 'brought dead'.

Case One:

The 1st case was a 35 yr. old man and was brought to the mortuary of Dept. of Forensic Medicine, RIMS, Imphal for post-mortem examination on the same day at 1:50 PM. On post mortem examination, externally, rigor mortis was developed; post mortem staining was developed on the back, but not yet fixed. Face was congested and cyanosis was present on lips and fingers. No external injuries were seen.

Internal findings showed that all the organs were congested and oedematous with a greenish tinge. Heart was filled with dark fluid blood and petechial haemorrhages were present on the surface.

Case Two:

The 2nd case was a 45 years old man. Post-mortem examination was done at 2:30 PM on the same day. Post mortem findings were similar with the previous case. In this case, traces of froth were also present in larynx and trachea.

Crime Scene Visit:

Air sample analysis was done using lead acetate paper. [1] When lead acetate paper was exposed to the gas/vapor in the hole, few

blackish brown spots were developed on the paper (Indicative of the presence of H₂S). [2] When lime water was exposed to the gas/vapor present in the hole, turning of lime water milky could not be observed which rules out the presence of CO₂. From these, it could be inferred that H₂S gas was present in the hole and CO₂ was absent.

Toxicological Analysis:

Toxicological analysis of the viscera confirmed the presence of Hydrogen sulphide (CFSL Kolkata Report No. 05(04)2013/FSL-Man/CSI Dt. 27-4-14).

From the post-mortem findings and the crime scene and toxicological analysis, the cause of the deaths was **“Asphyxia resulting from Hydrogen sulphide poisoning and Accidental in nature.”**

Discussion:

Death associated with confined and enclosed spaces present problem to the investigating pathologist as there may be few or no diagnostic feature at autopsy. Findings and surrounding circumstances need to be taken into account in determining the cause and manner of death. [3] In the present cases, there are specific features of H₂S poisoning at autopsy i.e. greenish discoloration of tissues, organs and bronchial secretion.

H₂S is irritant to human tissues causing kerato-conjunctivitis called ‘gas eye’; causes lacrimation, nasal irritation, dyspnea and coughing at 50-100 ppm.

Despite its distinctive odor, smell is not a dependable way to detect as it rapidly paralyzes olfactory nerve ending at high concentration. [4] Loss of smell at 100-200 ppm, pulmonary edema at 250-500 ppm, and concentrations greater than 500 ppm often called the “Knockdown concentration”- can cause respiratory arrest, collapse, and death within minutes. [5]

Hydrogen sulphide is quickly absorbed through the lungs and gastrointestinal tracts. Eliminated through the lungs or faeces, and metabolites are passed in urine. Majority of poisonings (approx. 86%) occur in confined spaces and are the direct result of others trying to help co-workers in need. [6]

Treatment is empirical with a combination of nitrite and hyperbaric oxygen. Once the patient is evacuated, first step of treatment should be performed in an airy space. If suspected in patient’s expiration, mouth to mouth resuscitation should be avoided. [7]

When transferring in vehicle, all windows should be opened and well ventilated.

Accurate decontamination in the field and in-transport ventilation is important to keep paramedics safe from secondary injury. [7]

Conclusion:

Death due to H₂S poisoning is almost without exception, accidental in manner. Awareness regarding the safety measures and health hazards of occupational works should be promptly given to the sewage workers. Appropriate preventive steps must be taken to prevent fatalities associated with H₂S poisoning. Workers should use respiratory personal protective equipment while at work and Rescuer should use self-contained breathing apparatus.

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Fig. 1: Manhole



Fig. 2: Closure View of the Manhole



Fig. 3: Dead body of Case One



Fig. 4: Dead body of Case Two



Fig. 5: Lead Acetate Paper Test for Hydrogen Sulphide



Fig. 6: Crime Scene Visit and Test done

