

CASE REPORT

A second autopsy revealed the silent killer: A case of fatal carbon monoxide poisoning from gas geyser

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Abstract

Carbon Monoxide (CO) is one of the important causes of accidental death in bathroom that occurs frequently due to installation of gas geyser. CO is emitted from a gas geyser due to defect or poor maintenance. Blockage of the exit or 'flue' pipe is a common fault, sometimes from bad installation or because it becomes blocked by soot or by birds' nests. Here, we present the case of 30-year-old female found dead in her bathroom, whose second autopsy unveils the actual cause of death. Liquefied petroleum gas (LPG) or piped natural gas (PNG) are used frequently in gas geyser for heating water in developing countries such as India. CO produces anemic anoxia as well as tissue hypoxia by competing with oxygen for binding sites on oxygen carrying heme proteins like hemoglobin, myoglobin, cytochrome-c oxidase and cytochrome p-450. This case highlights the importance of the second autopsy and role of forensic medicine expert in determining the cause and manner of death so as to guiding police in proper investigation and preventing the harassment of innocent people.

Keywords

Second autopsy; Silent killer; Carbon monoxide; Gas geyser

Introduction

Apart from the extra hazards of electricity, a bathtub for drowning, wet surfaces for slipping, tablets in the cabinet and sharp instruments such as razor blades, the small-sized room and the frequent installation of a gas water heater or 'geyser' makes the bathroom a frequent locus for unnatural deaths.¹ Liquefied petroleum gas (LPG) or piped natural gas (PNG) geysers are used frequently for heating water in developing countries such as India. These geysers are simple, economical in the form of faster heating of water and are used in bathrooms for bathing purpose due to erratic electric supply in many parts of India.² CO is emitted from a gas geyser due to defect and poor maintenance. Blockage of the exit or 'flue' pipe is a common fault, sometimes from bad installation or because it becomes blocked by soot or by birds' nests.^{1,3}

We present a case of accidental death of a married woman due to exposure to carbon monoxide gas in the confines of a bathroom. The importance of establishing the cause of death in this case is clear as further deaths would have occurred if this dangerous environment had not been identified by the forensic medicine expert.³ This case highlights the importance of taking detailed history regarding the circumstances surrounding death

as well as correlating scene of death examination with autopsy findings and laboratory investigations.

Case History

Dead body of a 30-year-old married woman was brought to the Forensic Medicine Department, B.J. Medical College, Ahmedabad for second post-mortem examination. History reveals that she went to the bathroom to take bath at her in-law's house. After long time when she did not come out of the bathroom and did not respond to the call, the door was broken by in laws. She was found lying naked in prone position, was unconscious and bleeding from forehead. She was immediately taken to the nearest private hospital where she was declared dead.

The first postmortem was done by panel of two medical officers of General Hospital, where they preserved viscera for chemical analysis and tissues for histopathological examination and cause of death was kept pending. They were suspecting head injury due to fall as a cause of death. In police papers also head injury was given as an apparent cause of death. Parents and a sister of the deceased made an allegation of murder and demanded second postmortem at Forensic Medicine Department, B.J. Medical College, Ahmedabad. Detailed history regarding the circumstances surrounding the death was taken.

On examination, procedural artifacts of first autopsy were present. Bright red color postmortem lividity was present on back aspect of the dead body except over pressure areas and was fixed as shown in Figure 1. Nails of both hands showed bluish discoloration. Dried fecal stains were present over inner aspects of both thighs. One reddish lacerated wound of size 3.5cm x 0.5cm was transversely present over middle of the

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forehead. Underlying scalp layers were ecchymosed. It was found deep up to the underlying frontal bone but without any fracture and intra-cranial damage. Two reddish abraded contusions of size 1cm x 0.5cm and 1.5cm x 1cm each were present over the chin.

On internal examination, all available organs are found congested and without any significant gross pathology and injury. Internal examination of neck was unremarkable. However, bright red discoloration of musculature, visceral organs and blood was found. No sample for COHb detection was preserved during first autopsy. In second autopsy, along with the routine viscera for chemical analysis, blood sample was preserved in the fluoride bulb and another blood sample preserved covered with liquid paraffin for qualitative and quantitative analysis of Carboxyhemoglobin. Organ samples were also preserved for histopathology. Organ were preserved in 10% formalin for histopathology remain pink and do not decolourize (Compare with normal tissue) as shown in Figure 2.



Figure 1: Bright (Cherry) red post-mortem lividity on back



Figure 2: Tissues preserved in 10% formalin for histopathology remain pink and do not decolourize i.e in left side container (compared with normal tissue in right side container).

Bedside tests performed during second autopsy like dilution, 10% NaOH and Hoppe-Seyler's test (heating) were found positive suggestive of presence of COHb in the blood as shown in Figure 3. However these crude tests are not recommended as

an alternative to proper laboratory analysis.¹ Examination of scene of death was also conducted. Size of the bath room was approximately 8x3.6x6 ft. Door of the bath room was found opened forcefully from outside. Door handle on inside was found separated. One white colored gas geyser was installed inside the bath room. Geyser was found in working condition with PNG connection. Bath room was poorly ventilated. One small bath stool made up of stain less steel was found in the bath room having reddish stains over it. Reddish blood stains and fecal material were present on the floor. From primary tests, it was found positive for blood. Subsequently in serological examinations, it was confirmed to be blood of the deceased. Chemical analysis revealed no common poison in the viscera; blood preserved during second autopsy revealed presence of COHb by UV spectrophotometry method. However, no quantitative analysis was done due to lack of facility. Histo-pathological examination was unremarkable.

Discussion

CO is colorless, odourless, tasteless and non-irritating gas in its pure form. The specific gravity of CO is 0.97 relative to air, and thus it disperses easily and does not stratify. The gas is produced whenever incomplete oxidation of a carbon containing compound occur. In its pure form (i.e without smoke) CO remains undetectable and it spreads rapidly in the surroundings. Due to above mentioned physical properties, CO has been described as a "Silent Killer".^{4,5} CO produces anemic anoxia as well as tissue hypoxia by competing with oxygen for binding sites on oxygen carrying heme proteins like hemoglobin, myoglobin, cytochrome-c oxidase and cytochrome p-450.⁴ Circumstances of our case are very much similar to the case reported by Kumar et al⁶ which indicates similar pattern in such deaths. If such pattern is found, it will help the autopsy surgeon in diagnosis of cause of death. Injuries found in our case were not sufficient to cause death and caused due to sudden unconsciousness and fall.

After the detailed study of history, circumstances surrounding death, scene of death examination, autopsy findings, reports of chemical and histopathology examination as well as excluding other causes, cause of death was opined as "Died due to asphyxia as a result of inhalation of carbon monoxide gas emanating from gas geyser in the bathroom." Cherry red livor mortis suggests the diagnosis even before autopsying the individual. However, this colour can be simulated by prolonged exposure of the body to a cold environment (either at the scene of death or in a morgue cold boxes) or cyanide poisoning. Cherry red colour is not invariable and was not found in an individual with COHb level of 45 % when autopsied by DiMaio. This colouration of viscera will persist even if tissue is removed and placed in formaldehyde. In our case also, unusual

pink discolouration of organ samples preserved in formalin was observed by histopathology experts. COHb saturation in blood is not altered during post-mortem decomposition.⁴ CO poisoning from gas water heaters are infrequent but can be fatal. 17 cases of non-fatal and 2 cases of fatal CO poisoning in bathrooms were reported in the Cameron highlands hospital from 1988 to 1995 by Chong CK et al. A study in Denmark showed increased production of CO from gas water heaters when installation maintenance checks were not done.⁷

Conclusion

CO poisoning should always be suspected and tested for by the examining medical officer or Forensic Medicine Expert when an unexpected death occurs in a confined space where there is a heating unit. This case reveals the importance of second autopsy and vigilance of Forensic Medicine Experts making it possible to determine the cause and manner of death in such unique cases. It will help in putting end to rumors or suspicions. It also helps investigating officer in precise investigation, preventing harassment of innocent people and may also help in settling the issues of insurance claims and property disposition.

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Conflict of interest: None to declare

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