

Accidental Death by Carbon Monoxide Due to Poor Ventilation: A Concern

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Abstract

Carbon monoxide (CO) is a non-irritating, odourless, colourless gas that is somewhat lighter than air. A by-product of incomplete burning of coal, wood, charcoal, natural gas, fuel oil, kerosene, gasoline, fabrics and plastics, it is the leading cause of the accidental poisonings and deaths reported throughout the world each year. CO from these sources can build up in enclosed or semi-enclosed spaces. People and animals in these spaces can be poisoned by breathing it. CO poisoning is associated with a high incidence of severe morbidity and mortality. The history of exposure and Carboxyhaemoglobin (COHb) levels should alert the physician to this diagnosis acutely. In the absence of exposure history, CO poisoning must be considered when 2 or more patients are similarly or simultaneously sick. In such cases Forensic expert plays a vital role in arriving at the cause and manner of death based on the history furnished by the police and post-mortem examination. Here we present a case study with mysterious death of two healthy young individuals who succumbed to death while in sleep. The alleged History, Post-mortem examination, FSL reports and scene of crime visit confirmed the deaths due to carbon monoxide.

Keywords: Carbon monoxide; Silent death; Ill ventilation; Scene of Crime Visit.

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Introduction:

Death due to poisoning is most commonly suicidal, which has been known since time immemorial. Accidental poisoning is the second commonest which happens due to drug over doses and occupational exposure. Carbon monoxide (CO) is a common, potentially fatal, colorless, odorless and tasteless gas that results from the incomplete combustion of hydrocarbons. CO exposure is a cause of fatalities and hospital admissions from accidental poisoning.¹⁻³ Exposure can be both intentional and accidental. Accidental exposure can be from a variety of

sources, including fires and domestic appliances.⁴ Malfunctioning heating systems, improperly ventilated motor vehicles, generators, grills, stoves, and residential fires may be listed in the common sources of CO exposure.^{5,6} One-third of the world's population burn organic material such as wood, dung or charcoal (biomass fuel) for cooking, heating, ironing and lighting. This form of energy usage is associated with high levels of indoor air pollution. Around 2.4 billion people rely on Biomass fuel as their main source of domestic energy for cooking, heating and lighting^{7,8} and a further 0.6 billion people use coal. Inefficient burning of BMF on an open fire or traditional stove generates large amounts of particulate matter as well as carbon monoxide, hydrocarbons, oxygenated organics, free radicals and chlorinated organic.⁹

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Case report:

Two young adult males aged 20-30yrs working in a shop (dry cleaners) using burning coal to iron the clothes were found to be dead next morning. The bodies were brought for post mortem examination. On external examination moderately built and nourished. Rigor mortis has occurred all over the body. Cherry red post-mortem staining present over back and dependent parts of the body including both ear lobes and finger nail beds (Figure 1). the face was seen with multiple discrete petechial haemorrhages with eyes showing sub-conjunctival haemorrhages. No external injuries were present. The sub-scalpel tissue, muscles of chest and abdominal wall including the blood in the cavities were cherry red in colour suggestive of CO toxicity. Lungs were oedematous with c/s exuding cherry red fluid blood. The blood and viscera was sent to forensic science laboratory for chemical analysis. On visit to scene of crime, it was found that, the living room or shop of 7ftx 5ftx10ft = 350 cubic feet which is an enclosed space where the bodies were found without proper ventilation (Figure 2). The charcoal which are used for ironing the clothes were partially burnt found inside the iron box and below the cots where they used to sleep were found to be exposed to smoke overnight (Figure 3). The chemical analysis report confirmed the presence of carbon monoxide about 41.88% and 39.44%/100ml of blood respectively. Cause of death was asphyxia due to carbon monoxide poisoning.

Discussion:

In developing countries one third of the world population still uses wood/charcoal. Carbon monoxide poisoning can kill without warning, as your family sleeps. Because CO gas has no warning properties, even at toxic or life threatening levels, it is considered a silent killer.^[10] In our study, we confirmed by visiting the scene of crime to determine whether CO poisoning and death most likely occurred while the person were sleeping. We found a shop of 8ftx8ft area without proper

ventilation along with the partially burning coal pieces in a bag and around the two beds. When unexplained symptoms persist and affect more than one person in a home or workplace where a source of combustion is present, CO poisoning should be considered. Detection of CO collection is difficult for sleeping person because of its "silent" physical and chemical property.¹⁰ The initial symptoms of CO are similar to the flu (but without the fever). But it can also mimic other ailments like gastric flu or stomach upset, the symptoms include: Dizziness, Fatigue, Headache, Nausea, Irregular breathing. It is critical to note that death from CO poisoning can result with some or all of these symptoms never being experienced, in which case the overexposed victim simply "falls asleep" and never regains consciousness.

Figure 1: Showing cherry red post-mortem staining



CO interferes with the blood's ability to carry oxygen. Blood carries oxygen to body tissues by combining the oxygen with haemoglobin, a substance found in red blood cells. CO, however, combines with haemoglobin with

an affinity 200 - 230 times that of oxygen¹¹ thereby denying body tissues a sufficient supply of oxygen (a condition called hypoxia). Organs with the highest demand for oxygen--the brain and the heart--are most sensitive to CO poisoning.

Figure 2: Showing the place of incident



This study along with other case reports from India and worldwide^{12,14} showed that the main cause of CO poisoning is accidental collection of CO in a non-ventilated room/closed space. People should be alarmed about the danger of CO collection and poisoning in a non-ventilated room while using various room warming mechanisms such as fire pots and room heater by putting warning labels on various CO producing appliances.^{15,16} They should be taught to avoid using these appliances without proper ventilation in the area to avoid collection of dangerous CO^{17,18}

Alternatively, a CO alarm can be put in the house and closed area, even in cars, while using these appliances and it should be promoted as smoke alarms.¹⁹ This prevention is important because it takes toll among economically productive age groups.

Figure 3: Showing partly burnt coal and iron box appliance



Conclusion

Measures to prevent unintentional CO poisoning should include public health messages about the dangers of CO poisoning and about the potential sources of CO in residences and vehicles. The public needs to be advised that properly maintaining all fuel-burning appliances and motor vehicles is necessary to reduce the CO poisoning. It is generally believed that most accidental CO poisoning are preventable through use of public education, warning labels on consumer products and residential CO alarms. Accidental poisoning not caused by exposure to fires is almost entirely preventable through the correct installation and maintenance of CO-emitting devices and the use of CO detectors.

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