Accidental Death due to Carbon Monoxide: Case Report

Chand-Meena M[1]*

[1] Department of Forensic Medicine and Toxicology, Lady Hardinge Medical College, New Delhi, India

A R T I C L E I N F O

Article Type:
Case Report

Article History:
Received: 9 April 2014
Revised: -
Accepted: 2 June 2014

Keywords:
Carbon Monoxide
Garage
Vehicle
Ventilation
Haemoglobin

A B S T R A C T

Background: Carbon monoxide (CO) is a colorless, odorless gas produced as a by-product of incomplete combustion of hydrocarbons. CO binds rapidly to Haemoglobin (Hb), leading to the formation of carboxyhemoglobin (COHb), so the oxygen carrying capacity of the blood will be decreased and causing tissue hypoxia.

Case Report: A 35-years-old male mechanic was found unconscious at automobile garage and he was dead after hospitalization on same day after one hour. On external examination, Rigor mortis had occurred all over the body. Cherry red postmortem lividity was present over back. Hypostasis, sub-scalpel tissue, muscles of chest and abdominal wall were cherry red in color suggestive of carbon monoxide toxicity. The chemical analysis report of blood and viscera confirmed toxicity due to carbon monoxide poisoning.

Conclusion: Accidental carbon monoxide poisoning in vehicles can occur due to leaking exhausts and inadequate ventilation, but some cases in fatal concentration of CO was found even with garage door had opened or in the absence of defective exhaust systems. Each of the CO poisoning hazard scenarios reflects either product malfunction resulting in high CO emissions and/or some failure to adequately remove CO from the living or recreational environment. Use of catalytic converters in vehicles has reduced carbon monoxide emission considerably. The sudden death of a mechanic due to excessive inhalation of the carbon monoxide gas due to defective exhaust systems and poorly ventilated in automobile garage.

Copyright©2014 *Forensic Medicine and Toxicology Department.* All rights reserved.

►*Implication for health policy/practice/research/medical education:* Accidental Death due to Carbon Monoxide

► *Please cite this paper as:* Chand-Meena M. *Accidental Death due to Carbon Monoxide: Case Report. International Journal of Medical Toxicology and Forensic Medicine*. 2014;4(4):158-61.

1. Introduction:

Carbon monoxide (CO) is a colourless, tasteless, odourless, non-irritating but highly toxic gas. CO is a by-product of the incomplete combustion of hydrocarbons. Faulty domestic heating appliances have resulted in many accidental poisoning (1). Deliberate self exposure to car exhaust fumes in enclosed space, which can contains up to 10% of carbon monoxide is a very effective form of suicide (2). CO is difficult to detect and can mimic other common disorders. Therefore, the true incidence of CO poisoning is unknown and many cases probably go unrecognized. CO has been termed "the unnoticed poison of the 21st century" (3).

Other causes of CO exposure include propane-fueled forklifts, gas-powered concrete saws, and indoor tractor pulls, as well as inhaling spray paint and swimming behind a motorboat. Industrial workers at pulp mills, steel foundries, and plants producing formaldehyde or coke are at risk for exposure, as are personnel at fire scenes and individuals working indoors with combustion engines or combustible gases. CO intoxication also occurs by inhalation of methylene chloride vapors, a volatile liquid found in degreasers, solvents, and paint removers. A significant percentage of methylene chloride is stored in the tissues and its continued release results in elevated CO levels for at least twice as much as with direct CO inhalation. Children riding in the back of enclosed pickup trucks seem to be particularly at a high risk (4, 5).

A common non fire CO death scene involves motor vehicle exhaust gases in a poorly ventilated garage or in areas in close proximity to garages; combustion appliances, e.g. heating units, in which partial combustion of oils, coal, wood, kerosene and other fuels generate CO (6). Use of catalytic converters in vehicles has reduced carbon monoxide emission considerably. However prolong exposure can lead to death due to hypoxia.

Corresponding author: Chand-Meena M, MD. Senior Resident, Department of Forensic Medicine and Toxicology, Lady Hardinge Medical College, New Delhi, India.
E-mail: drmahe2012@gmail.com

Fig. 1. Cherry red postmortem lividity was present on the back.

2. Case Report:

A 35-years-old male mechanic was found unconscious at automobile garage during working hours in central Delhi on 2013 and he was dead one hour after hospitalization on same day. On external examination, Rigor mortis had occurred all over the body. Cherry red postmortem lividity had occurred on the back and dependent parts of the body in supine position (fig 1). There was generalized cyanosis of the bodies with sub-conjunctival hemorrhages. In the facial was seen multiple discrete petechial hemorrhages. There were marked laryngotracheal edema with severe hyperaemia and frothy fluid discharges. Hypostasis, sub-scalpel tissue, muscles of chest and abdominal wall were cherry red in color suggestive of carbon monoxide toxicity. The lungs were wet, shining with multiple discrete anthracitic patches and moderate to severe edematous. Petechial hemorrhages as hallmark of asphyxia were also seen over the epicardial tissue and brain. The chemical analysis of blood and viscera confirmed toxicity with carbon monoxide.

3. Discussion:

Carbon monoxide is an odourless, colourless, non-irritating gas produced by the incomplete combustion of carbon-

based fuels (7). CO binds rapidly to Hb, leading to the formation of carboxyhemoglobin (COHb), so the oxygen carrying capacity of the Hb will be decreases and causing tissue hypoxia. The colour of COHb is red which explains as "cherry-like" in victims. Carbon monoxide has very high affinity to haemoglobin, which is about 210 times more that the oxygen. There is also evidence of a synergistic effect of alcohol and carbon monoxide leading to death at lower COHb saturation levels when the blood alcohol concentration is high (8).

Emissions of carbon monoxide (CO) from motor vehicles cause several hundred accidental fatal poisonings. Accidental carbon monoxide poisoning in vehicles can occur due to leaking exhausts and inadequate ventilation (9). In a study Susan P. *et al* showed that fatal concentration of CO was found even in garage with open door and also in the absence of defective exhaust systems (10). May be entry of fumes can be through holes in the floor of the passenger compartment, fender panels, holes in the spare tire well that were originally plugged with rubber at the time of manufacture. About two-thirds of all consumer product-related non-fire CO poisoning deaths and injuries were associated with some type of heating system. Each of the CO poisoning hazard scenarios reflects either product malfunction resulting in high CO emissions and/or some failure to adequately remove CO from the living or recreational environment. Most of the deaths and injuries likely resulted from one of the following hazard scenarios: unvented products operated in closed spaces without adequate ventilation, faulty installations, long-term use accompanied by neglected maintenance, or inappropriate use of products for heating purposes.

Accidental CO poisonings can occur in a variety of circumstances. In a study of unintentional deaths from CO poisonings in California, death certificates and coroners' reports from 1979 to 1988 were evaluated to determine location and cause of poisoning (11). Among 128 evaluations and reports of accidental CO poisonings due to vehicle exhaust, 80 incidents took place in a garage or house, 38 involved a vehicle parked outside, 4 occurred while driving, and the circumstances of the remaining deaths were unspecified. In cases where the circumstances of death were known, the most common cause of poisoning was driving into the garage (the driver was often under the influence of alcohol or other drugs) and leaving the car running (42% of deaths). Starting the car to perform vehicle maintenance (25%) or to provide heat (23%) were the next most frequent causes of death (12). Martin *et al* reported a case of sudden death of the four occupants was due to excessive inhalation of the carbon monoxide gas from the exhaust fumes leaking into the cabin of the car (13). In colder climates, it may be more common for people to start a vehicle in an attached garage in the morning to warm it up. If they return to the house and forget that the vehicle is running, accidental poisoning may occur.

Griffin SM *et al* had reported a case of CO poisoning which was initially thought to be a case of ischemic heart disease (IHD), but later toxicological analysis revealed a lethal blood COHbg, due to inhalation of vehicular exhaust fumes (14). In the case presented here inadequate ventilation inside the garage must led to the accumulation of CO inside the garage.

4. Conclusions:

This case stresses the public awareness of the dangers of possible exposure to toxic doses of CO due to inadequate ventilation inside the garage. Use of catalytic converters in vehicles has reduced carbon monoxide emission considerably. Public health education on the sources and dangers of CO can also help them to decrease reports of CO poisoning in India.

References

1. Crawford R, Campbell DGD, Ross J. Carbon monoxide poisoning in the home:

recognition and treatment. BMJ. 1990;301:977-9.
2. Busuttil A, Obafunwa JO, Ahmed A. Suicidal inhalation of vehicular exhaust in the Lothian and Borders region of Scotland. Hum exp toxicol. 1994;13:545-50.
3. Proceedings Satellite Meeting IUTOX VIIIth Internationazl Congress of Toxicology. "Carbon monoxide: the unnoticed poison of the 21st Century" 1998. Université de Bourgogne, France.
4. Prockop LD, Chichkova RI. Carbon monoxide intoxication: an updated review. Journal of the neurological sciences. 2007;262(1):122-30.
5. Nnoli MA. Family death-carbon monoxide poisoning from Generator exhaust. J Medicine in the Tropics. 2009;11(1):123-8.
6. Abelsohn A, Sanborn MD, Jessiman BJ, Weir E. Identifying and managing adverse environmental health effects: 6. Carbon monoxide poisoning. CMAJ 2002;166(13):1685–90.
7. Wheeler R, Covington MA. Koponen AB, Meehan PJ, Lance-Parker SE, Powell K. Carbon monoxide poisoning deaths associated with camping—Georgia. JAMA 1999;282:13-26.
8. VeveIstad M, Morild I. Lethal methaemoglobinaemia and automobile exhaust inhalation. Forensic Sci int. 2009;187(1-3):l-5.
9. Zumwalt RE, Wake MC, Hoffman R. Deaths from motor vehicle related unintentional carbon monoxide poisoning-Colorado 1980-1995 and United States, 1979-1992. Morb Mortal Wkly Rep. 1996;45:1029-32.
10. Susan P, Baker MPH, Russel S Fisher, William C Masemore and Irvin M Sopher. Fatal Unintentional Carbon Monoxide poisoning in Motor Vehicles. AJPH. 1972;62(11):1463-7.
11. Girman JR, Chang Y, Hayward SB, Liu K. "Causes of Unintentional Deaths from Carbon Monoxide Poisonings in California"; Final Report; California Indoor Air Quality Program, California Department of Health Services: Berkeley, CA, undated; *West. J. Med.* 1998;168:158-65.
12. Liu KS. California Indoor Air Quality Program, California Department of Health Services, personal communication, 1997.
13. Nnoli M, Lebgbosi N, Chukwuonye I, Nwabuko O. Toxicological Investigation of Acute Carbon Monoxide Poisoning in Four Occupants of a Fuming Sport Utility Vehicle. Iranian Journal of Toxicology. 2014;7(23):973-6.
14. Griffin M, Ward M, Terrell A, Stewart D. Diesel fumes do kill: a case of fatal carbon monoxide poisoning directly attributed to diesel fuel exhaust with a 10-year retrospective case and literature review. Journal of Forensic Sci. 2008;53(5):1206-11.