

Trends of carbon monoxide fatalities in Jordan

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Carbon monoxide poisoning (COP) is a common occurrence in today's society, one of the most common poisonings worldwide, and is responsible for more fatalities than other toxic agent.¹ Carbon monoxide has been termed the "silent killer" due its physical characters as well as its mechanism of action. It is generally accepted that, unintentional COP may be partially preventable through public education and/or safety regulations. Numerous publications are available in the literature reviewing COP and fatalities in different parts of the world. The objective of this work was to evaluate and analyze the trends of COP fatalities in Jordan according to varying associated factors to extrapolate suitable preventive measures.

This study was a joint project among toxicologists and pathologists from the Faculties of Medicine of the University of Jordan, Jordan University of Science and Technology and National Institute of Forensic Medicine (NIFM) conducted during 2006-2008. To fulfill the objective, postmortem forensic pathology reports for all autopsies examined at the NIFM were reviewed over a 5-year period (2000-2004). All reports, where the cause of death was attributed to COP were analyzed, and data pertinent to the work objective were compiled. Mass poisoning was considered if 2 or more victims died at the same place and circumstances. Statistical analysis was conducted using SPSS program version 13.0. The Scientific Research Committee at the Faculty of Medicine in the University of Jordan approved the project.

A total of 5789 autopsies were conducted over the 5 years. Autopsied cases, where the cause of death was attributed to toxic substances accounted for 3.2%, (n=184). The COP fatalities constituted for most deaths due to poisoning (58.1%, n=107), while drug abuse associated fatalities constituted 0.8% (n=44).² These COP fatalities accounted for 1.8% of the causes of deaths over the 5 years, and corresponded to 3.56 deaths per million persons per year. This rate was lower than other reported rates in other countries. Mott et al³ reported a decline in COP related mortality rates in USA from 20.2 to 8.8 deaths per million person years during the period 1968 to 1998. All COP fatalities were accidental during the night, and the majority (77.6%, n=83) occurred during the period between December and March, which are the coldest months of the year,

and they peaked during January (29.9%, n=32). The ages of COP fatalities ranged from 1-76 years with a mean age of 27.6±16.7 years. Most of these fatalities were below the age of 40 years (76.6%, n=82), and 28.9% were between the ages of 20-29 years. Jordanian COP fatalities constituted 75.7% (n=81), where in a previous study,⁴ Jordanians accounted for 50% of COP fatalities. Other nationalities including Iraqis, Egyptians and others were few, but their numbers were consistent with their general distribution in Jordan. Among COP fatalities, Jordanian females were more than male, while fatalities among other nationalities, males were more than females. Mass fatalities accounted for 36.4% (n=39), where most of them were Jordanian. A kerosene heater and fire were the main causes of multiple fatalities. However, kerosene heaters as source of COP accounted around 43% (n=46) of cases, and fire was the second most common source (Figure 1). Site of death was mainly in bedrooms (73.8%, n=79) followed by bathrooms (11.2%, n=11). The accidental circumstances of these COP fatalities were explained by negligence, where people tend to ignore the danger of the toxic gases that are released from the open flame sources in a closed environment, and might forget to keep a means of ventilation to refresh the surrounding air, which soon becomes toxic. This becomes obvious when the source of heating is dependent on propane gas or kerosene, particularly if there is no smell. Some people have a false feeling of safety regarding the toxic

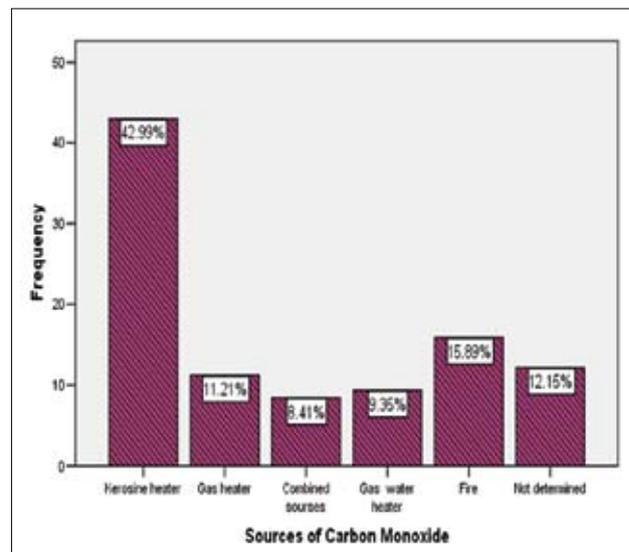


Figure 1 - Sources of CO that predisposed to COP fatalities and their percentage and frequencies. (Combined sources mean that more than one source was available at the scene of death, this category includes also central heating). COP - carbon monoxide poisoning, CO - carbon monoxide.

gases as long as they do not recognize a particular odor. Fatalities of COP were confirmed by carboxy hemoglobin saturation (COHb%) determination in postmortem blood in just 53 cases. The average saturation of COHb% was $73.5 \pm 12.5\%$ and ranged from 46-95%. Levels above 80% were observed in 20.7% (n=11). Pink discoloration of postmortem hypostasis is usually evident if the saturation of the blood exceeds 30%, and it is a common and highly suggestive sign in COP fatalities. Adequate history of the circumstances surrounding death, supported by pinkish discoloration was suggestive of these COP fatalities.

Risk factors for COP such as drugs or alcohol, preexisting cardiovascular diseases or injuries were also evaluated. Cardiovascular pathology was found in 10.3% (n=11) and alcohol was positive in a non-lethal concentration in just 3 cases (2.8%). Associated injuries were present in 19 cases (17.8%), and these injuries ranged from simple abrasions to third degree burns but in all these cases COP was the leading cause of death. Ethanol was not a risk factor in fire fatalities compared to other societies.⁵

In conclusion, CO still constitutes a serious risk in Jordan, where it accounted for more than 50% of toxicologically related deaths. Fatalities resulted from COP were mainly accidental, and the majority of them could be prevented if proper attention were taken to avoid the potential danger of CO sources that people were exposed to without utilizing any safety consideration. Effective means to educate people on

the risks of exposure to different sources of CO and how to avoid being harmed by it are required to be implemented. Such campaigns should be always applied prior to and within the cold months. In addition, a device to detect CO is highly recommended to avoid COP in the presence of a potential toxic source.

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