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Accidental Carbon Monoxide Poisoning – The Invisible Killer

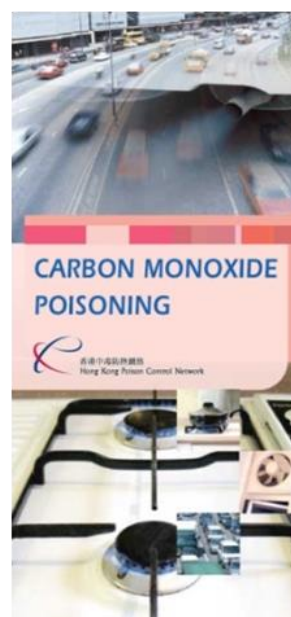
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Introduction

Carbon monoxide (CO) is a colourless, odourless and tasteless gas which is a by-product from incomplete combustion of any fuel which contains carbon, such as gasoline, wood and natural gas.

You cannot smell, see or taste CO, but CO can be lethal. As little as 0.4% concentration of CO in the air can result in unconsciousness and death in a few minutes. CO is absorbed through the lungs and transported by bloodstream to be taken up by every cell in the body. Its presence impairs the oxygen carrying capacity of blood and, more importantly, once inside a cell CO can prohibit the cell from utilizing oxygen to generate energy. This results in hypoxic damage to body organs, particularly the brain and the heart.

In general, CO poisoning can be classified as intentional or accidental. Intentional CO poisoning, including suicidal cases, accounts for the majority of deaths related to CO poisoning worldwide. On the other hand, although accidental CO poisoning accounts for a lesser burden on mortality, it is mostly preventable through public education.



Health education pamphlet on CO poisoning published by the Hong Kong Poison Control Network



Local situation

In Hong Kong, CO poisoning accounts for dozens of emergency department visits and hospitalisations each year.

According to records of Accident & Emergency Departments (AED) of the Hospital Authority, there were 381 patients recorded as CO poisoning cases, including 43 accidental and 338 intentional cases from January 2012 to December 2016 (Table 1). Of the 43 accidental CO poisoning cases, 53% were female and 56% belonged to the age groups of 31-40 and 51-60 years. None of these accidental cases ended up being fatal.

Table 1: Number of AED attendance in public hospitals related to CO poisoning (2012-2016)

Year	Total number of cases	Number of cases related to accidental causes	Number of cases related to intentional causes
2012	97	2	95
2013	72	5	67
2014	51	11	40
2015	77	71	71
2016	84	19	65
Total	381	43	338

According to mortality statistics of the Department of Health (DH), in the same period of time, there were a total of 654 CO poisoning deaths in Hong Kong, including 17 accidental and 635 intentional cases (Table 2). In fact, many deaths due to CO poisoning occur before the victims reaching hospital and are thus not captured in AED statistics.





Table 2: Number of registered death related to CO poisoning based on mortality statistics (2012-2016)

Year	Total number of death	Number of death related to accidental causes	Number of death related to intentional causes	Number of death related to causes of undetermined intent
2012	115	4	111	0
2013	141	10	131	0
2014	134	0	133	1
2015	143	1	141	1
2016	121	2	119	0
Total	654	17	635	2

Susceptible groups of CO poisoning

All people are at risk of CO poisoning, but the following groups are more susceptible to its toxic effects:

- young children;
- pregnant women;
- elderly;
- people with heart or respiratory diseases;
- people with blood diseases that affect oxygen uptake or transport, such as anaemia; and
- those who already have elevated CO blood levels, such as smokers.



Places potentially having high levels of CO

Common sources of CO exposure may exist outdoors or indoors, which may result in poisoning.



Outdoor areas:

- near street intersections or congested traffic; and
- near exhaust gas outlets from industrial sources.



Indoors/enclosed areas:

- in poorly ventilated workplaces, food premises or at home while using faulty or poorly vented fuel-burning appliances, such as gas water heater and gas stove; and
- in poorly ventilated enclosed areas, such as parking garages and tunnels.

CO poisoning associated with food premises

In the past one year, DH received notifications of and carried out epidemiological investigations for 10 cases of accidental CO poisoning. While two cases were domestic related to possible leakage of fuel gas, the other eight cases occurred in two local food premises. The cases associated with food premises involved eight persons with age ranged from 22 to 53 years. They presented with symptoms such as dizziness, headache, vomiting, shortness of breath and unconsciousness. All eight persons required hospitalisation. Two patients required hyperbaric oxygen therapy and one of them was admitted to the intensive care unit. All of them were later discharged from hospital after treatment. Investigations showed that all of them had been exposed to CO while using charcoal as cooking fuel



Charcoal as cooking fuel for hot pot

for hot pot in poorly ventilated venue. The Food and Environmental Hygiene Department (FEHD) was informed of these cases and although storage and use of charcoal as fuel on the premises was not observed during inspection, the operators of these food premises were warned to refrain from using unapproved fuels.#

Using charcoal as fuel in the customer seating area of a food premises is not allowed. Besides, food premises using fuel other than charcoal for hot pot or barbecue business shall comply with specific sets of fire safety and ventilation requirements imposed by the Fire Services Department (FSD) and FEHD respectively to ensure safe operation.



Signs and symptoms of CO poisoning

The severity of CO poisoning depends on factors such as duration of exposure and concentration of CO inhaled.

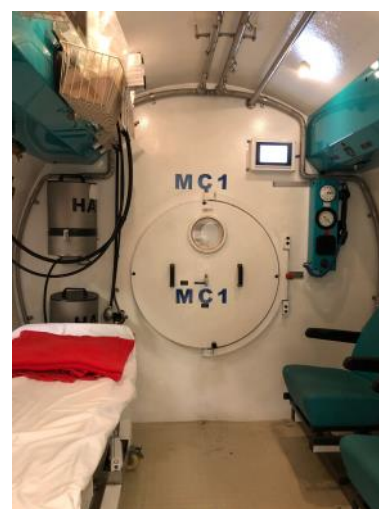
Exposure to low concentration of CO can lead to a range of symptoms such as dizziness, headache, tiredness and nausea. Doctors should remain alert to the possibility of CO poisoning if more than one patient turn up complaining of similar symptoms and a history of suspected common exposure to CO, or if the symptoms improve after the exposure is stopped e.g. after leaving the area with potential source of CO. Exposure to high concentration of CO can lead to impaired vision, disturbed coordination, unconsciousness, brain damage or even death.

Management of CO poisoning

In hospitals, victims of CO poisoning will receive tests on their blood, neurological, heart and lung functions. Mild cases will be treated by supportive care with normobaric oxygen therapy. Severe cases may be referred for hyperbaric oxygen therapy, where patients receive greater amounts of oxygen to their entire body, by breathing oxygen under pressure in a hyperbaric chamber. It may enhance the removal of CO from brain cells and may improve the neurological outcome in some patients.



Facility for hyperbaric oxygen therapy
on Stonecutters Island (outside)
(Photograph courtesy of FSD)



Facility for hyperbaric oxygen therapy
on Stonecutters Island (inside)
(Photograph courtesy of FSD)



Prevention

Prevention of accidental CO poisoning begins with raising knowledge and awareness about the dangers of CO poisoning and taking measures to reduce potential exposure in everyday life.

Practical tips:

- Have your fuel burning appliances installed and regularly maintained by qualified technicians;
- Use vented fuel-burning appliances in a well ventilated area;
- Have regular maintenance of vehicles including the exhaust system;
- Do not stay in an idling car with the engine running and windows shut; and
- Be alert to the symptoms of CO poisoning. Seek medical advice immediately if in doubt.



If CO poisoning is suspected:

- Keep calm;
- Leave the affected area for fresh air;
- Seek medical advice immediately; and
- Call emergency hotline 999 immediately if the victim's condition is serious, un-arousable or not breathing.





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