Are Iranians Aware of Carbon Monoxide Poisoning: Symptoms and Its Prevention Strategies?

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Received: 20 Aug. 2013; Received in revised form: 17 Jan. 2014; Accepted: 21 Jan. 2014

Abstract- Carbon monoxide (CO) poisoning is still a health problem all over the world. Informing users about symptoms and suggesting annual inspection of CO producing devices will result in CO poisoning reduction. The goal of this study was to evaluate awareness about CO poisoning symptoms and its prevention ways in Iranian population. In this study, a total of 700 patients' family members attended Imam Khomeni hospital were asked to enroll in the study. A structured questionnaire was used including demographic characteristics, devices which were used at home, awareness of CO poisoning symptoms, awareness of CO detectors, the last time that tubal patency of devices are checked, if it is helpful to open the window to fix gas leak and if surveying devices by an expert at the beginning of the cold season is recommended. A total of 635 participants completed questionnaires. The most used device was gas water heater followed by gas heater. Five hundred and nine reported that they are aware of CO poisoning symptoms (80.1%), 398 (62.6%) stated that it is possible to detect CO leak and 566 (89.1%) told CO detectors would be helpful for reduction of mortality from CO poisoning. Fifty percent of participants had not checked their devices since they have bought their devices. Five hundred and thirty-six (84.4%) reported that opening window could help CO leak, and 596 (93.8%) agreed that an expert checked their fuel-burning devices at the beginning of the winter. Iranian people are not aware of all CO poisoning symptoms. Developing a national strategy for CO surveillance and people education will be helpful.

Acta Medica Iranica, 2014;52(12):931-934.

Keywords: Carbon monoxide; Poisoning; Prevention; Iran

Introduction

Carbon monoxide (CO) is a colorless, odorless and toxic gas which is produced by the incomplete combustion of fossil fuels that is used in household applicants such as furnaces, gas stoves, water heaters, fireplaces, gas heaters and primus (1).

CO poisoning is still a health problem all over the world as natural gas is used for domestic energy supply. It has been suggested that every year near 20,000 emergency department visits in USA are due to CO poisoning (2). In a previous study, in the city in Iran, two-year incidence of CO poisoning is reported as 37 per 100,000 inhabitants (3,4). In Iran, CO poisoning counts for 3.1% and 11.6% of all poisonings (5-8) and CO poisoning death has been increased to an annual rate of 20% (9). Natural gas is the primary source for energy supply and gas heater is the main heat supply device, and annual reparation is not performed properly. On the other hand, most users are not aware of CO detectors, and these devices are not used in all devices that are prone to produce CO.

As symptoms of CO poisoning are not specific, a definite diagnosis is not easy in most of the patients.

Early symptoms include headache, dizziness, weakness, nausea, confusion, disorientation, and visual disturbances while unconsciousness, coma, convulsions and death could occur in severe cases (8,10).

One strategy to reduce CO poisoning is educating applicants about better use of fuel-burning devices, maintenance and reparation of used devices (5,6).

Informing users about symptoms and suggesting annual inspection of devices will result in CO poisoning reduction.

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On the other hand, application of CO alarms will reduce the incidence of poisoning (11). In USA, heath organizations stated public service announcements and emphasized on installation of CO detectors (12) but these facilities are not present in Iran. To organize public attitudes toward CO poisoning, the Centers for Disease Control and Prevention (CDC) applied a questionnaire to assess safety-related attitudes about gasoline-powered generators, fuel-burning appliances, and CO detectors. The theory behind this questionnaire was based on the key role of attitude in behavior. The findings were used for popular and social messaging through media to aware about CO poisoning.

As there is no public study about awareness about CO poisoning, we designed this population-based study evaluating awareness about CO poisoning symptoms and its prevention ways in Iranian population.

Materials and Methods

In this study which conducted between January and May 2013, by means of simple sampling, 700 patients' family members attended Imam Hospital (Affiliated hospital of Tehran University of Medical Sciences) were asked to enroll in the study. A structured questionnaire was used including demographic characteristics (age, sex), occupation, years of education, province of residence, if the house was owned or rented, devices which were used at home, awareness of CO poisoning symptoms, awareness of Co detectors, the last time tubal patency of devices are checked, if it is helpful to open the window to fix gas leak and if surveying devices by an expert at the beginning of the cold season is recommended.

Collected data were analyzed by SPPS software version 18. Data are presented as mean ± SDs, frequencies, and percentages.

Results

A total of 635 participants completed the questionnaires. Mean age and years of education were 31.2 ± 11.2 and 14.8 ± 3 years. Three hundred and fifty-eight were male (56.4%). Five hundred and forty-five were unemployed (85.8%).

A total of 526 participants were living in Tehran (Capital of Iran). The most used device was gas water heater followed by gas heater (Table1).

Five hundred and nine reported that they are aware of CO poisoning symptoms (80.1%), 398 (62.6%) stated that it is possible to detect CO leak and 566 (89.1%) told that a device which could detect CO leak in early stages, would be helpful for reduction of mortality from CO poisoning. Participants were not aware of all symptoms of CO poisoning. The most reported symptom which they were aware of was vertigo followed by headache and nausea (Table 2).

Three hundred and twenty (50%) participants had not checked their devices since they have bought their devices.

Five hundred and thirty-six (84.4%) reported that opening window could help CO leak, and 596 (93.8%) agreed that an expert checked their fuel-burning devices at the beginning of the winter.

Table 1. The devices that were used by participants

	Number (%)
Gas water heater	392
Kerosene heater	3
Gas heater	291
Oil heater	10
Radiator	271
Boiler	7
Oil primus	4
Gas primus	61
Fireplace	38

Table 2. Number of participants who were aware of symptoms

Headache	412
Fatigue	251
Nausea	346
Vertigo	452
Dizziness	241
Disorientation to time and location	84
Visual disturbance	101
Coma	53
Convulsions	28
Chest pain	155
Death	172

Discussion

The results of the current study showed that although 80% of participants stated that they were aware of CO poisoning symptoms, they were not aware of all symptoms.

Near 60% of participants reported that it is possible to detect CO leak and near 90% reported that CO detector device would be helpful for reduction of mortality from CO poisoning.

In a previous study, King and Damon conducted a survey to evaluate attitudes of Americans toward CO

poisoning (12). In their study, 70% agreed with CO detector application with gas-powered generator and only 8% agreed with no need for CO detector with furnaces.

Dianat and Nazari interviewed with 328 households with CO poisoning diagnosis. They found that only 62 households (19%) were aware of CO hazards, and most of them received their information from relatives or friends (4). In their study, the most used appliances were water heaters followed by heating devices that are compatible with our findings.

In current study, 93% agreed that the annual check of fuel burning devices is necessary which is higher than the rate reported in King *et al*., study (12). Sixty-three percent of their participants agreed that annual appliance inspection is important.

CO is one of the most causes of unintentional poisoning deaths in many countries such as Iran. In Tehran (Capital of Iran), the overall rate of CO poisoning was 7.5 per 100,000, with an annual rate of 1.5 per 100,000 (9).

In USA, it causes approximately 20,000 emergency department visits and 450 deaths annually (2).

It mostly is produced by incomplete burning of fossil fuels, and since CO is a colorless, odorless gas, it would cause silent death.

When CO combines with hemoglobin, carboxyhemoglobin will be produced which could decrease total oxygen capacity of the blood. Along with decreasing blood capacity, CO shifts the curve of oxyhemoglobin to the left that implies more harm to tissues than only carboxyhemoglobin formation. This anoxia will impair cellular respiration and causes cellular damage (9,13).

Different factors such as model of exposure, age, lung diffusion capacity, barometric pressure, and alveolar ventilation rate are among factors affecting severity of CO poisoning (9,14).

One of the strategies to reduce CO poisoning is public education and messages about CO hazards. It is important to make people aware of CO poisoning symptoms, proper use of fuel burning devices, and installation of CO detector in all fuel burning devices. As present results showed, all participants were not aware of all CO poisoning symptoms and advantages of detectors in preventing CO poisoning.

In USA, public announcements are performed annually by health agencies to aware people about CO dangers and benefits of installing CO detectors (11).

Unfortunately, in Iran there are not organized programs for alerting people about CO poisoning. Programs on media such as TV or brochures and pamphlets will be helpful to educate people.

The other strategy to reduce CO related death is to force sellers of fuel burning devices to install CO detectors and inform people to buy devices that are equipped with detectors.

Previous studies showed that fewer and less severe episodes of CO poisoning reported for inhabitants who had CO detectors (15,16).

CO detectors are considered to reduce CO related death to near one-half of all poisonings (17).

Unfortunately, in Iran all people are not familiar with detectors, and all sold devices are not equipped with detectors. Community interventions for installation of detectors will be useful.

The other strategy is to motivate residents to have their devices inspected by an expert every year especially before cold weather. As CO is the result of incomplete burning of fuels, annual inspection will result in detecting problems with the devices and repair them before failure. Only 50% of participants had checked their devices since they have bought their devices.

In conclusion, Iranian people are not aware of all CO poisoning symptoms, and they are not aware of the ways to prevent corelated poisoning. Developing a national strategy for CO surveillance and education of people will be helpful.

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