

# An unusual case of suicide due to carbon monoxide poisoning from a barbecue

Stawomir Majdanik<sup>1, A</sup>✉, Barbara Potocka-Banaś<sup>2, B</sup>, Sebastian Głowiński<sup>3, C</sup>, Krzysztof Borowiak<sup>4, D</sup>

<sup>1</sup>Pomeranian Medical University in Szczecin, Faculty of Medicine and Dentistry, Rybacka 1, 70-204 Szczecin, Poland

<sup>2</sup>Pomeranian Medical University in Szczecin, Department of Clinical and Forensic Toxicology, Powstańców Wlkp. 72, 70-111 Szczecin, Poland

<sup>3</sup>Koszalin University of Technology, Department of Mechanical Engineering, Śniadeckich 2, 75-453 Koszalin, Poland

<sup>4</sup>Pomeranian Medical University in Szczecin, Department of Clinical and Forensic Toxicology, Powstańców Wlkp. 72, 70-111 Szczecin, Poland

<sup>A</sup>ORCID: 0000-0003-0472-1924; <sup>B</sup>ORCID: 0000-0003-0259-2006; <sup>C</sup>ORCID: 0000-0003-3140-6313; <sup>D</sup>ORCID: 0000-0002-2526-2686

✉ majdanik@pum.edu.pl

## ABSTRACT

In recent years, fatal cases of carbon monoxide poisoning have only rarely been encountered in clinical and forensic practice compared to other xenobiotics. These are most often accidents, but cases of suicide by carbon monoxide poisoning have also been reported. In cases of suicidal poisoning, carbon monoxide has most often been obtained from car exhaust fumes supplied into a car cabin with rubber hoses. This paper presents an unusual case of suicide by poisoning with carbon monoxide from

a charcoal garden grill. A 19-year-old male lit a charcoal garden grill in a closed room where all gaps around the door were sealed with adhesive tape. An investigation revealed that the deceased had obtained information on the technical aspects of suicide from a person of unknown identity who he had met on the Internet. The analysis of this case indicates that the Internet is a significant source of information on the toxicity of various substances and how to use them, including for suicidal purposes. **Keywords:** suicide; carbon monoxide poisoning; charcoal grill.

## INTRODUCTION

Carbon monoxide (CO) is one of the most common toxic substances causing acute and fatal poisoning reported in clinical and forensic practice in Poland. The main sources of CO, and odourless and colourless gas, are defective appliances for central heating, defective gas appliances for heating water, industrial processes and vehicle exhaust fumes [1, 2, 3]. Carbon monoxide has particularly toxic effects on children, the elderly, and people suffering from anaemia and cardiovascular diseases. Carbon monoxide can diffuse to some extent through intact skin [4]. However, acute poisoning most often results from breathing in air containing more than 0.2% (2 g/dm<sup>3</sup>) of CO, because of blocked oxygen transport and competitive binding of CO to the iron atom of the heme group in haemoglobin molecules, which results in the formation of carboxyhaemoglobin (COHb). Impaired transport of oxygen leads to progressing hypoxia in the tissues and organs [5]. The most common symptoms of CO poisoning depend on the concentration of COHb in the exposed subject:

- 10–20% – slight headache, fatigue, dyspnoea,
- 20–30% – dizziness, confusion, muscle weakness, paresis,
- 30–40% – loss of consciousness, hypopnoea and tachypnoea, symptoms of shock,
- 40–60% – deep unconsciousness, respiratory arrest, Cheyne–Stokes respiration due to metabolic acidosis developing in tissues. Death due to respiratory arrest occurs within 30–40 min,
- 60–70% – death occurs within several to 20 min [6].

It should be emphasized that the symptoms and clinical status of the person exposed to CO depends on many factors. The most important of them are CO concentration in the ambient air, exposure time, physical activity and respiratory minute volume, age, potential comorbidities, and body position during exposure [7].

Cases of fatal CO poisoning are quite common in studies and forensic reports [8]. These are most often accidents associated with indoor exposure to increased levels of CO in the air. Such accidents are associated with fires, leaks from gas appliances or systems, and exposure to vehicle exhaust fumes in closed rooms. Cases of deliberate CO poisoning, usually with fumes from motor vehicles introduced into the car cabin via rubber hoses, are also known in forensic practice [9]. This paper presents an unusual case of suicide by poisoning with CO from a charcoal grill. The presented case is interesting because of the circumstances and events which consequently led to a tragic loss of life.

## CASE DESCRIPTION

One evening in western Poland, a family member found the body of a 19-year-old male lying in the hallway of a detached house. Next to him, there was a metal portable garden grill with the remains of burnt charcoal and ashes (Fig. 1). All gaps around the entrance door and the door leading to the interior of the house were sealed with adhesive tape, which was removed before the arrival of rescue services and police. By

questioning family members, the police found that for about 2 weeks before the incident, the deceased man had been planning suicide by inhaling an unspecified mixture of toxic gases. Therefore, suicide by CO poisoning was suspected.



FIGURE 1. A garden barbecue indoors

Forensic inspection of the mobile phone that belonged to the deceased revealed that, before his death, he had used a popular communication app to chat with a person from outside Poland to obtain information on committing suicide.

Quote: „(...) CO method is very tricky. Do you know another method? (...) How are you handling the smoke?”.

Answers: „This is how it's supposed to be done; you should let it burn outside for an hour, then bring it inside and let it burn for another hour. While outside, the charcoal turns white and ashy, and doesn't produce smoke. Allegedly. The only problem could be temperature, but that's why winter is actually a perfect season to try it in. Sadly, as we know, hardly any plan goes off perfectly (...)”.

Because of the suspected crime (encouraging suicide, Article 151 of the Polish Criminal Code), an investigation was opened and a decision was made to perform a forensic autopsy of the dead man's body. Forensic macroscopic inspection revealed the presence of pink to vivid red livor mortis patches, and the autopsy revealed pink to vivid red discoloration of serous membranes and internal organs. There were also signs of congestion in internal organs, including cerebral and pulmonary oedema, confirmed by further histopathological examination. Toxicology tests were negative for ethyl alcohol and narcotic substances, but tests on blood samples from the cavities of the heart confirmed the presence of COHb in a concentration of 41.7%. In the conclusion of the forensic report, the direct cause of the death of the young man was poisoning with CO from burning a charcoal grill in a closed room.

The investigation into soliciting the suicide of the young man was eventually terminated because it was impossible to identify the person from abroad with whom the deceased had communicated.

## DISCUSSION

Charcoal grills heat slowly and produce a large amount of smoke and CO. These appliances do not create any hazard when used outdoors. The situation changes dramatically when the charcoal grill is used in a small, tightly sealed room. Carbon monoxide and other gases are potential sources of poisoning for occupants in such a room. The available literature reports cases of suicide by CO poisoning from a charcoal grill [10, 11]. This method of suicide is prevalent in Asian countries [12, 13, 14]. However, only 1 such case has been reported in Poland. This shows that generating CO with a grill to commit suicide is rare in Poland [15]. Literature data attribute a significant role in the popularization of this new method of suicide to mass media which, by publicizing these cases, gives inspiration to further victims. In the modern world, the Internet has become another important source of information. Its users can find details on the toxicity of substances and instructions on how to commit suicide. This is what happened in the reported case, where the victim obtained the information necessary to commit suicide via a popular communication app [16].

## REFERENCES

1. Chen KS, Wang WC, Chen HM, Lin CF, Hsu HC, Kao JH, et al. Motorcycle emissions and fuel consumption in urban and rural driving conditions. *Sci Total Environ* 2003;312(1-3):113-22.
2. Donnay A. Carbon monoxide exposure and carboxyhemoglobin. *Environ Health Perspect* 2003;111(10):A511-2.
3. Kozinc J, Zupančič-Kralj L, Zapušek A. Evaluation of gas emissions from coal stockpile. *Chemosphere* 2004;55(8):1121-6.
4. Guzman JA. Carbon monoxide poisoning. *Crit Care Clin* 2012;28(4):537-48.
5. Byard RW. Carbon monoxide – the silent killer. *Forensic Sci Med Pathol* 2019;15(1):1-2.
6. Borowski K, Machoy-Mokrzyńska A, editors. *Wybrane zagadnienia z toksykologii ogólnej i ostrych zatrucí*. Szczecin: Wydawnictwo Pomorskiej Akademii Medycznej; 2003. p. 93-6.
7. Ndisang JF, Tabien HEN, Wang R. Carbon monoxide and hypertension. *J Hypertens* 2004;22(6):1057-74.
8. Choi YR, Cha ES, Chang SS, Khang YH, Lee WJ. Suicide from carbon monoxide poisoning in South Korea: 2006-2012. *J Affect Disord* 2014;167:322-5.
9. Potocka-Banaś B, Borowski K, Janus T, Majdanik S. Eksperyment procesowy jako istotny element w opiniowaniu zatrucia tlenkiem węgla. *Ann Acad Med Stetin* 2007;53(2):129-31.
10. Lyness JR, Crane J. Carbon monoxide poisoning from disposable charcoal barbecues. *Am J Forensic Med Pathol* 2011;32(3):251-4.
11. Brooks-Lim EWL, Sadler DW. Suicide by burning barbecue charcoal: three case reports. *Med Sci Law* 2009;49(4):301-6.
12. Chung WS, Leung CM. Carbon monoxide poisoning as a new method of suicide in Hong Kong. *Psychiatr Serv* 2001;52(6):836-7.
13. Leung CM, Chung WSD, So EPM. Burning charcoal: an indigenous method of committing suicide in Hong Kong. *J Clin Psychiatry* 2002;63(5):447-50.
14. Huh GY, Jo GR, Kim KW, Ahn YW, Lee SY. Imitative suicide by burning charcoal in the southeastern region of Korea: the influence of mass media reporting. *Leg Med (Tokyo)* 2009;11 Suppl 1:S563-4.
15. Bolechała F, Strona M. Niecodzienny przypadek samobójczego zatrucia tlenkiem węgla przy użyciu przenośnego grilla ogrodowego. *Arch Med Sąd Kryminol* 2013;63(1):15-20.
16. Potocka-Banaś B, Majdanik S, Dutkiewicz G, Borowski K, Janus T. Death caused by addictive inhalation of nitrous oxide. *Hum Exp Toxicol* 2011;30(11):1875-7.