

GÜNEY MARMARA BÖLGESİNDE OTOPSİSİ YAPILAN KARBONMONOKSİT ZEHİRLENME OLGULARI

Carbonmonoxide Poisoning Cases Autopsied in South Marmara Region

Filiz EREN¹, Murat S. GÜRSES², M. Numan URAL², Nursel TÜRKMEN İNANIR^{1,2}, Bülent EREN¹, Tomas VOJTISEK³

Eren F, Gürses MS, Ural MN, Türkmen İnanır N, Eren B, Vojtsek T. Güney Marmara bölgesinde otopsi yapılan karbonmonoksit zehirlenme olguları. *Adli Tıp Bülteni* 2014;19(2):96-99.

ABSTRACT

Carbonmonoxide (CO) related deaths, which are generally preventable accidents that include accidents due to the coal stoves and water heaters in bath at home, the mining accidents, and other accidents. CO accept as the most common cause of poisoning cases in many countries and its prominent feature is being a colorless, odorless and nonirritant gas.

The autopsy records between the beginning of 2007 until the end of 2011 of Bursa Morgue Department of Council of Forensic Medicine of Turkey were reviewed. A total of 5782 autopsies had been performed and 218 (3.8%) of these involved CO poisoning. Information regarding age and sex; etiology, month and year of the accident were recorded. Study data were encoded with computer and Statistical analysis was performed using SPSS for windows program.

76 of the cases were (34.9%) female and 142 were (65.1%) male and the male/female case ratio was 1.9. The average age of the cases was 46.8 and ranged between 1 and 90 years. 57.8% of deaths were in winter markedly. The highest carboxyhemoglobin saturation was 92% in the blood.

Poisoning due to CO leaks from coal heaters is an important problem in our country and surrounding regions. The mining accidents should be reduced by increasing safety in the workplace. We must more expend efforts to educate the public and prevent CO poisoning.

Key words: Carbonmonoxide, Poisoning, Autopsy.

ÖZET

Karbonmonoksit (CO) zehirlenmesine bağlı ölümler genelde önlenebilir kazar şeklinde olur. Bu kazalar evde kömür sobaları, banyoda su ısıtıcılarına bağlı kazalar, maden kazaları ve diğer kazaları içerir. Birçok ülkede zehirlenme olgularının en sık nedeni kabul edilen CO gazının en belirgin özellikleri kokusuz, renksiz ve nonirritan olmasıdır.

2007 yılından 2011 yılı dahil olmak üzere Bursa Adli Tıp Kurumu Morg İhtisas Dairesi'ndeki otopsi kayıtları incelendi. 5 yıllık süre toplam 5782 otopsinin 218 tanesi CO zehirlenmesi vakaları olduğu, toplam otopsi vakaların %3,8'ini oluşturmaktadır. Veriler ay ve yıllara göre, yaş, cinsiyetle birlikte çeşitli açılardan incelenmiştir. Araştırma verileri kodlanarak bilgisayarda değerlendirildi ve istatistiksel analizleri SPSS for Windows modülünden elde edildi.

Olguların 76'sı (%34,9) kadın, 142'si (%65,1) erkek, erkek/kadın oranı 1,9'dur. Yaş ortalaması 46,8 olup yaş aralığı 1 ila 90 yıl arasındadır. Ölümlerin %57,8'i belirgin bir şekilde kış aylarında görüldü. En yüksek kan karboksihemoglobin saturasyonu %92'dir.

Ülkemizde ve çevre bölgelerde kömür sobalarından kaynaklanan CO zehirlenmeler önemli bir problemdir. Maden ocağı kazaları iş yeri güvenliğini artırılarak azaltılmalıdır. Biz, CO zehirlenmesi önlemek ve kamuoyunu eğitmek için daha fazla çaba harcamalıyız.

Anahtar kelimeler: Karbonmonoksit, zehirlenme, otopsi.

¹Council of Forensic Medicine, Morgue Department, Bursa, Turkey

²Uludağ University Medical Faculty, Forensic Medicine Department, Council of Forensic Medicine, Morgue Department, Bursa, Turkey

³Masaryk University, Medical Faculty, Forensic Medicine Department, Brno, Czech Republic

INTRODUCTION

Carbon monoxide (CO) is a colourless, odourless, tasteless and non-irritant gas. It is a product of the incomplete combustion of hydrocarbons. CO gas is difficult for those who are exposed to detect it. Because CO lacks sensory warning properties. Carbon monoxide is harmful because it has a higher affinity for hemoglobin than oxygen (230-270 times more avidly than oxygen), thereby producing carboxyhemoglobin (COHb) and displacing oxygen in the blood. The concentration of carbon monoxide is usually less than 0.001 percent in the atmosphere. CO is accepted as the most common cause of poisoning cases in many countries (1-5). Carbon monoxide (CO) related deaths, which are generally preventable accidents (6-13) that include accidents due to the coal stoves and water heaters in bath at home, the mining accidents, and other accidents. The aim of this study was to describe the medico legal characteristics of fatal, autopsied CO poisoning cases in south Marmara (Bursa) and to discuss the topic on the aspects considering the social circumstances.

MATERIAL and METHODS

The autopsy records between the beginning of 2007 until the end of 2011 of Bursa Morgue Department of Council of Forensic Medicine of Turkey were reviewed. A total of 5782 autopsies had been performed and 218 (3.8%) of these involved CO poisoning. Information regarding age and sex; etiology, month and year of the accident were recorded.

Study data were encoded with computer and Statistical analysis was performed using SPSS for windows program. The results were expressed as frequency, mean, and standard deviation (SD), as appropriate. The distribution of cases types of CO sources, seasonal and monthly dispersions have been examined. No statistical test method is applied.

RESULTS

Over a period of 5 years a total of 5782 autopsies were done of which 218 involved CO poisoning, constituting 3.8% of total cases. In the distribution of the cases according to the months and total poisoning cases in these months was showed in Table 1.

Deaths due to CO poisoning were significantly increased in cold months according to warm months. 76 of the cases were (34.9%) female and 142 were (65.1%) male and the male/female case ratio was 1.9. The average age of the cases was 46.8 and ranged between 1 and 90

years. The mean age of female cases was 47.37 years (Standard deviation (SD): 25.95 years) and it was 46.59 years (SD: 23.35 years) for males. The common carbon monoxide source were coal stoves (67%, n=146), fires (14.7%, n=32), water heaters in bath (8.7%, n=19), and gasses of mine explosion (8.3%, n=18), respectively. Other CO sources were arranged as cylinder LPG storage, natural gas, and gas of arise from water engine. The highest CO poisoning deaths are showed in 2009 and the lowest CO poisoning deaths are showed in 2007 (Table 2).

Table 1. CO Poisoning Deaths according to Months.

Month	CO poisoning cases	%
January	48	22.01
February	40	18.34
March	35	16.05
April	11	5.04
May	9	4.12
June	4	1.83
July	2	0.91
August	1	0.45
September	4	1.83
October	16	7.33
November	10	4.58
December	38	17.43

Table 2. CO Poisoning Deaths according to the years.

Years	n	%
2007	35	16.1
2008	36	16.5
2009	64	29.4
2010	50	22.9
2011	33	15.1

Six of the cases had been admitted to hospital and died during treatment. COHb was not detected in the blood of the patients who died while during treatment. However, the highest COHb saturation was 92% in the blood. The most common COHb concentrations were 71-80% and 51-60% with a percentage of 22.93% and 22.47%, respectively. The majority of the CO poisonings (81.19%) occurred at home (Table 3).

Table 3. Scenes according to investigation records.

Scene	n	%
Home	177	81.19
Mine	18	8.25
Place of employment	10	4.58
Hospital	5	2.29
Other places	8	3.66
Total	218	100

DISCUSSION and CONCLUSION

Bursa is one of the most crowded cities of Turkey summing up 2.7 million populations in 2013 (14). Our previous study, the number of CO poisoning case was 305, 10 of them died, and only 1 case suicide from Bursa 1996 to 2006 (15). The authors investigated the frequency of CO poisoning in Turkey in 2010. Total 10,154 CO poisoning cases were detected and only 39 of them died. Bursa has the highest number of cases ending with death 18 cases (16). CO poisoning is a common cause of toxicological morbidity and mortality in the United States (17). In our country, the most common cause of fatal poisoning was CO poisoning (9, 12, 18-19).

In our study the ratio of deaths due to CO poisoning in autopsied deaths in Bursa (South Marmara Region) was detected as 3.8%. Durak (6) reported the rate of CO poisoning in autopsied deaths as 4.74% between years 1995 and 1998. Fedakar et al. (9) was found this ratio as 4.2% in the south Marmara region between 1996 and 2003 years. The decrease in this ratio can be explained by consciousness of the society and sufficient precautions towards to CO poisoning. Azmak et al. (7) was found this ratio as 3% in the study performed in Istanbul. Karaarslan et al. (12) was found this ratio as 4.12% in the study performed in Ankara between years 2007 and 2011. Ait el

Cadi et al. (20) reported the rate of CO poisoning in autopsied deaths as 3.15% in Morocco between years 1999 and 2007. The mean age of the victims in this study was 46,8 while it was 33.39 and 32.60 in the studies of Durak (6) and Azmak et al. (7), respectively. In this study 65.1% of the cases were males, while the ratio was 71.83% and 77.60% in the studies of Durak (6) and Azmak et al. (7), respectively. In recent years, the increasing female ratio can be related to both the alteration of sex population and presumably due to alteration of their roles in social environment.

In this study deaths due to CO poisoning were mostly seen during cold months (December, January and February). In the study of Azmak et al. (7) deaths were more common in December and January. In the study of Karaarslan et al. (12) CO deaths were most common in January. However, in the study of Durak (6) the most of the deaths took place in December and April.

Stefanidou et al. reported the 176 CO poisoning in autopsied deaths in Greece during the period 1987 to 2009. In the study of Stefanidou et al. CO poisoning due to deaths were mostly seen during autumn and winter months (13). Zhou et al. (21) were investigated a total of 2416 deaths in China between years 1999 and 2008. CO poisoning death was determined the second most common cause for death of the cases. However, CO poisoning was the number one cause of accidental poisoning deaths (21). In our study, we were not determined suicide by inhaling the CO. In recent years, suicides by CO inhalation were reported in literature (11, 22).

In our study, the most common setting of accident was at home as in the other reports (6, 7, 10-12, 15). And the most common causes of CO poisoning were coal stoves and fires. Mining accidents are not occurring frequently. However, miners were deceased after gas explosion in Bursa. Because of this the ratio of CO poisoning increased especially in 2009 (Table 2). Therefore, the mining accidents should be reduced by increasing safety in the workplace. The level of education, and legal approaches are very important for the prevention CO poisoning. Poisoning due to CO leaks from coal heaters is an important problem in our country and surrounding regions. We must more expend efforts to educate the public and prevent CO poisoning.

REFERENCES

1. Ernst A, Ziprak JD. Carbon monoxide poisoning. *The New England J of Med.* 1998; 339:1603-1608
2. Ragheb SY Abu-al, Battah AH. Carbon monoxide fatalities in medicolegal autopses. *Med. Sci. Law,* 1999; 39(3):243-246.
3. Liu K, Paz MK, Flessel P, Waldman J, Girman J. Unintentional Carbon monoxide deaths in California from residential and other nonvehicular sources. *Archives of Environmental Health,* 2000; 55(6):375-81.
4. Frode SM, Byers JM, Wolfgang GH et al. An analysis of toxic deaths, 1982 to 1985. *J Forensic Sci.* 1987; 32(6): 1676-93.
5. Theilade P. Carbon monoxide poisoning. five years experience in a defined population. *Am. J. Forens. Med. Pathol.* 1990;11:219-25.
6. Durak D. Karbonmonoksit zehirlenmesine bağlı ölümler. *Bursa Devlet Hastanesi Bülteni,* 1999 :15(2):131-3
7. Azmak D, Çetin G, Kulusayın Ö, Soysal Z. Karbonmonoksit zehirlenmesine bağlı ölümler. *Adli Tıp Dergisi,* 1994;10:73-81
8. Salaçin S. Acute carbonmonoxide intoxications due to simple and preventable fetal accidents. *Am J Forensic Med Pathol,* 1991;12:191-3
9. Fedakar R, Türkmen N, Fatal Poisonings In The South Marmara Region Of Turkey, 1996-2003, *European Journal of General Medicine,* Vol. 5, No. 1, 2008, pp. 1-8
10. Türkmen N, Akgöz S. Deaths due to carbonmonoxide poisonings autopsied in Bursa. *Adli Tıp Dergisi.* 2005; 19(2): 20-25.
11. Cantürk N, Başbulut AZ, Cantürk G, Dağalp R. Ankara'da 2002-2006 yılları arasında Karbonmonoksit zehirlenmeleri otopsi olgularının değerlendirilmesi. *Adli Tıp Dergisi* 2008;22:25-30.
12. Karaarslan B, Karapirli M, Kandemir E, Kucuker H, Gurler M, Ince CH, Akyol O. The fatal poisoning pattern of Ankara (Turkey) and nearby cities from 2007 to June 2011: a retrospective study in forensic autopsies. *J Forensic Sci.* 2013 Nov;58(6):1563-7.
13. Stefanidou ME, Maravelias CP, Dona AA, Pistos CM, Spiliopoulou CA, Athanaselis SA. Carbon monoxide-related deaths in Greece: a 23-year survey. *Am J Forensic Med Pathol.* 2012 Jun;33(2):128-31.
14. <http://www.tuik.gov.tr/UstMenu.do?metod=temelist>.
15. Akköse S, Türkmen N, Bulut M, Akgöz S, Işçimen R, Eren B. An analysis of carbon monoxide poisoning cases in Bursa, Turkey. *East Mediterr Health J.* 2010 Jan;16(1):101-6.
16. Metin S, Metin S, Yıldız S, Çakmak T, Demirbaş S. 2010 Yılında Türkiye'de Karbonmonoksit Zehirlenmesinin Sıklığı. *TAF Prev Med Bull* 2011;10:587-92.
17. Huston B, Froloff V, Mills K, McGee M. Carbon monoxide poisoning and death in a large enclosed ventilated area. *J Forensic Sci.* 2013 Nov;58(6):1651-3.
18. Birincioglu I, Karadeniz H, Teke HY. Fatal poisonings in Trabzon (Turkey). *J Forensic Sci.* 2011 May;56(3):660-3.
19. Battal D, Aktas A, Sungur MA, Bilgin NG, Cekin N. Evaluation of poisoning deaths in Cukurova region, Turkey, between 2007 and 2011. *Toxicol Ind Health.* 2013 Nov 5.
20. Ait El Cadi M, Khabbal Y, Idrissi L. Carbon monoxide poisoning in Morocco during 1999-2007. *J Forensic Leg Med.* 2009 Oct;16(7):385-7.
21. Zhou L, Liu L, Chang L, Li L. Poisoning deaths in Central China (Hubei): A 10-year retrospective study of forensic autopsy cases. *J Forensic Sci.* 2011 Jan;56 Suppl 1:S234-237.
22. Schmitt MW, Williams TL, Woodard KR, Harruff RC. Trends in suicide by carbon monoxide inhalation in King County, Washington: 1996-2009. *J Forensic Sci.* 2011 May;56(3):652-5.

Corresponding author:

Murat S. GÜRSES

Uludağ University Medical Faculty, Forensic

Medicine Department,

Council of Forensic Medicine, Morgue Department,

Bursa, Turkey

E-mail: godbavo@hotmail.com