ARTYKUŁ ORYGINALNY / ORIGINAL PAPER
Otrzymano/Submitted: 29.11.2017 • Zaakceptowano/Accepted: 01.03.2018

An analysis of emergency medical teams' dispatches to carbon monoxide poisoning cases in the years 2014-2016 on the example of the Voivodeship Rescue Service in Katowice

Analiza wyjazdów Zespołów Ratownictwa Medycznego do zatrucia tlenkiem węgla w latach 2014-2016 na podstawie danych Wojewódzkiego Pogotowia Ratunkowego w Katowicach

Michał Kucap[1,2], Klaudiusz Nadolny[1,3], Artur Borowicz[1], Łukasz Szarpak[4], Daniel Ślęzak[5], Robert Gałązkowski[6]
[1] Voivodeship Rescue Service, Katowice, Poland
[2] College of Strategic Planning, Dabrowa Gornicza, Poland
[3] Department of Emergency Medicine and Disasters, Medical University of Bialystok, Poland
[4] Department of Emergency Medicine, Medical University of Warsaw, Poland
[5] Department of Emergency Medicine, Faculty of Health, Medical University of Gdansk, Poland
[6] Department of Emergency Medical Service, Medical University of Warsaw, Poland

Abstract

Background. Carbon monoxide is a colorless and odorless gas, which makes it difficult to diagnose carbon monoxide poisoning. Unfortunately, the number of medical rescue teams' dispatches to cases of exposure to carbon monoxide has been increasing every year in periods of lower outdoor temperatures. ***Aim.*** The aim of this study is a retrospective analysis of emergency medical teams' dispatches to carbon monoxide poisoning. The analysis involves the characteristics of the population under research, carbon monoxide exposure time, medical rescue actions performed in the particular situations, and the procedures closing the specific medical rescue actions. ***Material and methods.*** A retrospective analysis of dispatch order forms and emergency medical procedure forms of the Voivodeship Rescue Service in Katowice in the years 2014-2016 (n = approx. 750000). The analysis covered all diagnosed and presumed cases of carbon monoxide poisoning. With regard to these criteria, there were 1326 dispatch order forms selected out of emergency medical team (EMT) dispatch orders. ***Results.*** There were 1326 dispatch order forms and emergency medical procedure forms involved in the analysis. The selected forms included the following information provided by the leader of the team: "presumed carbon monoxide poisoning" or "exposure to carbon monoxide", and X08, X09 or X47according to the ICD10 classification of diseases. The total number of analyzed forms involved cases of 734 male patients and 592 female patients. There were 273 patients under the age of 18 years within the group of analyzed cases. In most cases the emergency medical dispatcher decided to dispatch a basic emergency medical team i.e. a unit without doctor. The emergency medical teams were definitely dispatched under the highest emergency priority code c-1. The highest number of carbon monoxide poisoning cases was recorded in the evenings (06:00 p.m.-12:00 *midnight*). Additionally, in n = 512 (38.61%) cases, patients were injured in various regions of the body. Finally, the analysis focused on emergency medical procedures performed by the teams in the case of patients transported to hospital n = 856 (64.56%). There were 3 most frequent medical procedures found: oxygen therapy n = 778 (90.89%), venipuncture n = 684 (79.90%) and monitoring n = 398 (46.49%). ***Conclusions.*** Situations of carbon monoxide poisoning very frequently involve more than one person. In most cases, patients are transported to hospital for further diagnosis confirming carbon monoxide poisoning.

There is only a carbon monoxide detector available to emergency medical teams in order for them to measure carbon monoxide levels in the air. *Anestezjologia i Ratownictwo 2018; 12: 31-37.*

Keywords: emergency medical team (emt), carbon monoxide, carboxyhemoglobin

Streszczenie

Wstęp. Tlenek węgla jest gazem bezbarwnym i bezwonnym, co utrudnia rozpoznanie zatrucia tym gazem. Niestety liczba wyjazdów zespołów ratownictwa medycznego do narażenia na tlenek węgla z roku na rok wzrasta w okresie ochłodzenia temperatury zewnętrznej. ***Cel pracy.*** Celem pracy jest analiza retrospektywna wyjazdów zespołów ratownictwa medycznego do zatrucia tlenkiem węgla. Analiza obejmuje charakterystykę badanej populacji, godzin narażenia na tlenek węgla, zastosowanych medycznych czynności ratunkowych oraz sposobu zakończenia działań zespołów ratownictwa medycznego. ***Materiał i metody.*** Analizie retrospektywnej poddano Karty Zlecenia Wyjazdu wraz z Kartami Medycznych Czynności Ratunkowych Wojewódzkiego Pogotowia Ratunkowego w Katowicach za lata 2014-2016 (n = ok. 750000). Do badania retrospektywnego włączono te, które kończyły się przypadkiem rozpoznanego lub podejrzanego zatrucia tlenkiem węgla. Ze zleceń wyjazdów zespołów ratownictwa medycznego z uwzględnieniem powyższych kryteriów pozostało 1326 kart zlecenia wyjazdu. ***Wyniki.*** Przeanalizowano 1326 Kart Zlecenia Wyjazdu i Kart Medycznych Czynności Ratunkowych, w których kierownik zespołu jako rozpoznanie słowne wpisywał: „podejrzenie zatrucia tlenkiem węgla" lub „narażenie na tlenek węgla", a jako rozpoznanie zgodnie z kodyfikacją ICD10 stawiał: X08, X09 lub X47. Wśród tej liczby było: 734 – mężczyzn, 592 – kobiety, w tym 273 – pacjentów poniżej 18 r.ż., Najczęściej decyzją dyspozytora medycznego była dyspozycja zespołu podstawowego, czyli zespołu bez lekarza. Zdecydowanie Zespół Ratownictwa Medycznego był dysponowany w kodzie K-1. Największa liczba zatruć tlenkiem węgla występowała w godzinach wieczornych (18-24). Dodatkowo n = 512 (38,61%) pacjentów posiadało urazy w różnych okolicach ciała. Na koniec skupiono uwagę na procedurach medycznych wykonywanych przez ZRM wśród pacjentów transportowanych do szpitala n = 856 (64,56%). Wyłoniono trzy najczęściej wykonywane procedury medyczne: tlenoterapia n = 778 (90,89%), założenie kaniuli dożylnej n = 684 (79,90%) i monitoring n = 398 (46,49%). ***Wnioski.*** Bardzo często zatrucie tlenkiem węgla jest zdarzeniem o charakterze mnogim. W większości przypadków poszkodowani trafiają do szpitala w celu dalszej diagnostyki potwierdzającej zatrucie tlenkiem węgla – w zespołach ratownictwa medycznego do dyspozycji jest tylko czujnik tlenku węgla wykonujący pomiar z powietrza. *Anestezjologia i Ratownictwo 2018; 12: 31-37.*

Słowa kluczowe: zespół ratownictwa medycznego, tlenek węgla, karboksyhemoglobina

Introduction

Carbon monoxide (CO) is a very common issue every fall and winter. In spite of extensive media coverage regarding carbon monoxide hazards and cases of poisoning, the number of medical rescue teams' dispatches to cases of exposure to carbon monoxide has been increasing every year in periods of lower outdoor temperatures [1]. Carbon monoxide is the third most common type of poisoning in individuals, overtaken only by drug and ethanol poisonings, and the most frequent type of poisonings by exposure to inhaled substances [2,3].

First mention of the harmful effects of carbon monoxide comes from Aristotle, who noticed that coal fumes lead to "heavy head and death". In 1857, the physiologist, Claude Bernard, described the influence of carbon monoxide minimizing the ability to transfer oxygen in the blood and thus leading to hypoxia [4]. It can be stated that, nowadays, carbon monoxide is no longer a secret. The kinetics, metabolism, toxicity, clinical picture, diagnostics, treatment, and complications related to carbon monoxide are known. However, the most problematic issue is that carbon monoxide is colorless and odorless, which makes it difficult to diagnose CO poisoning [2,5]. Therefore, the effects of carbon monoxide poisoning may be recognized very late, which may lead to an injury of the central nervous system or even to death [6]. This gas is formed as a result of incomplete combustion of natural gas, coal, wood,

Table I. Symptoms of carbon monoxide poisoning depending on carboxyhemoglobin levels in blood

% COHb in the blood	Intoxication symptoms	Intoxication severity
0-10%	Asymptomatic or with non-specific symptoms	Mild intoxication
10-20%	headaches, a feeling of pressure around the temples and the forehead, pulsating in the temples, widening of cutaneous blood vessels, weakness, nausea	Moderate intoxication
20-30%		
30-40%	as above, vomiting, dizziness, visual disturbance, fainting collapse, redness of skin	Severe intoxication/ death
40-50%	as above, deepening of consciousness disorders, acceleration of heart rate and breath, possible death	
50-60%	tachycardia, tachypnoe, Cheyne–Stokes respiration, coma, convulsions, possible death	
60-80%	coma, convulsions, respiratory failure (bradypnoe) and circulatory failure (bradycardia), possible death	
>80%	severe depression of the circulatory-respiratory system, death after a few breaths	

and other substances if there is insufficient amount of oxygen available [3,7].

The symptoms of carbon monoxide poisoning vary depending on the level of carboxyhemoglobin in the blood, and the time of exposure [8]. The level of CO poisoning depends on CO levels in the room where the patient was staying, the time of exposure, and the patient's physical activity that influences minute ventilation (table I).

The first symptoms of carbon monoxide poisoning are: headaches, dyspnea, nausea, vomiting, tachycardia, tachypnea, increasing fatigue, balance disorders, stupor, and coma. In severe cases of poisoning, clonic-tonic seizures may occur. The skin is usually pale or blue colored. As far as the clinical course is concerned, acute carbon monoxide poisoning can be divided into two stages. The first stage results from the amount of hemoglobin that bonded to carbon monoxide. The symptoms directly result from oxygen deficiency and correlate with the amount of carboxyhemoglobin. They disappear when there is no more exposure to carbon monoxide and after the application of passive oxygen therapy. The second stage is not related with the current level of carboxyhemoglobin in blood. The dominating symptoms results from the consequences of brain damage, heart injury or injuries of other organs. Non-specific symptoms of carbon monoxide poisoning are not homogenous and can be related with symptoms of other diseases such as brain stroke, hypoglycemia, acute psychosis, alcohol poisoning or flu, the last one having its incidence peak in fall and winter similarly to carbon monoxide poisoning [10]. Proper diagnosis may be difficult especially in cases when there is no information about potential exposure to CO provided in the history. Carbon monoxide poisoning should be suspected especially in cases of similar symptoms occurring simultaneously in a few individuals staying in one room, or in the case of a patient who has stayed lately in a room with a potential source of carbon monoxide [8].

Aim of the study

The aim of this study is a retrospective analysis of emergency medical teams' dispatches to carbon monoxide poisoning. The analysis involves the characteristics of the population under research, carbon monoxide exposure time, medical rescue actions performed in the particular situations, and the procedures closing the specific medical rescue actions.

Material and methods

A retrospective analysis of dispatch order forms and emergency medical procedure forms of the Voivodeship Rescue Service in Katowice (WPR) in the years 2014-2016. WPR is one of four most important dispatch centers in the Silesian voivodeship (province), not taking into account subcontractors. There are 88 emergency medical teams (29 specialized and 59 basic) securing about 2 700 000 individuals. In the years 2014-2016, dispatchers of the two integrated medical dispatch centers (ZDM), i.e. in ZDM Katowice and

ZDM Gliwice, answered 1,800,000 phone calls and dispatched emergency medical teams 750,000 times. Both mentioned dispatch centers function within the structures of WPR. The analysis covered all diagnosed and presumed cases of carbon monoxide poisoning. With regard to these criteria, there were 1326 dispatch order forms selected out of emergency medical team dispatch orders.

Results

There were 1326 dispatch order forms and emergency medical procedure forms involved in the analysis. The selected forms included the following information provided by the leader of the team (originally in Polish): "presumed carbon monoxide poisoning" or "exposure to carbon monoxide", and X08, X09 or X47 as diagnosis according to the ICD10 classification of diseases. According to the International Statistical Classification of Diseases and Related Health Problems ICD-10, the code X08 refers to "exposure to other specified smoke, fire and flames" and was noted in n = 315 cases. The code X09 means: "exposure to unspecified smoke, fire and flames" and was recorded in n = 617 cases. Finally, the code X47 refers to: "accidental poisoning by and exposure to other gases and vapors" and was recorded by EMT leaders in n = 394 cases (figure 1). Out of the 1326 selected dispatch order forms, there were n = 231 (17.42%) with additional diagnosis noted by the leader of the EMT. The types of diagnosis mentioned in the forms included: Y91: "Evidence of alcohol involvement determined by level of intoxication", T51: "Toxic effect of alcohol", R55: "Syncope and collapse", I10: "Essential (primary) hypertension"", I46: "Cardiac arrest" and other types of injuries related to various parts of the body within the S00 and S99 codes.

As far as patients' gender is concerned, a majority of individuals who suffered from carbon monoxide poisoning were male patients (n = 734; 55.35%). Female patients constituted 44.65% (n = 592) of the group (figure 2). Among all cases of CO poisoning within the period under research, a special focus was on juvenile individuals (i.e. under the age of 18). The number of patients in this group amounted to n = 273 (20.59%) patients. A conclusion can be drawn here that CO poisoning involves all age groups. The youngest patient was almost one month old, whereas the oldest individual under involved was 92 years old.

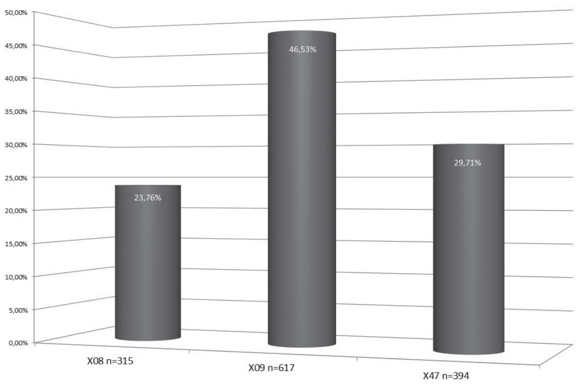

Figure 1. ICD-10 diagnosis

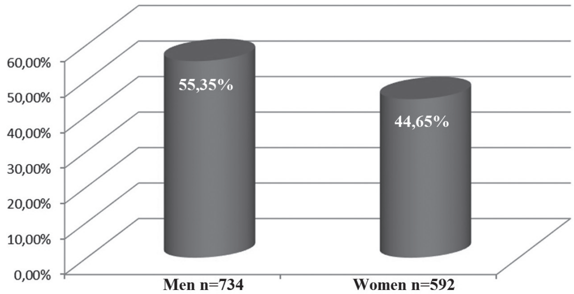

Figure 2. Classification according to age

According to the regulation of Minister of Health dated January 10th 2014 concerning procedures of accepting incident calls by medical dispatchers and dispatching medical emergency teams, the EMT dispatch order is based on two emergency priority codes: c-1 and c-2. Code c-1 is the highest priority code referring to most urgent dispatch orders that should involve a very short travel time to the place of incident. It is always related with the use of light – and sound signals, and the ambulance driver is expected to select the shortest way to the place of incident.(15) Concerning the dispatch orders of this study, c-1 code was selected in 82.95% (n = 1100) of the cases, and c-2 code was related to 17.05% (n = 226) of all cases. Apart from the decision on the urgency of the dispatch order, medical dispatchers also need to decide on the type of the EMT to be dispatched. The act of 8th September 2006 on the National Medical Emergency defines two types of emergency medical teams: P-units (basic units) including a minimum of two individuals with medical education (paramedics and/or medical emergency nurses), and S-units (specialized units) with at least 3 individuals with medical education including at least one doctor of the system [16]. The most frequently dispatched type of unit was the basic unit (figure 3). Among all 1326 dispatch order forms, there were n = 536 (40.42%) individual cases involving only one patient and the ETM did not require additional support or any additional dispatch order form. Other cases were related to more than one patient as ETMs asked for additional supporting unit and further dispatch order forms. In n = 242 (18.25%) cases of carbon monoxide poisoning, the medical dispatcher already had the information about the multiple number of patients before dispatching the team.

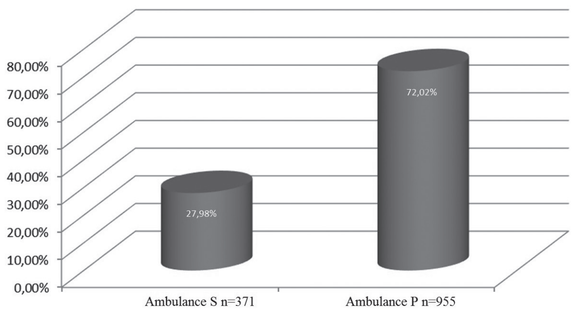

Figure 3. Emergency medical teams dispatch order

The next point of focus was the time of poisoning. Day and night were divided into 4 following periods in order to classify the number of emergency calls according to these periods: 6:00 am - 11:59 am (n = 226; 17.04%), 12:00 (noon) - 5:59 pm (n = 333; 25.11%), 6:00 pm - 11:59 pm (n = 514; 38.76%), and 12:00 (midnight) - 5:59 am (n = 253;19.08%).

The last point of focus was related to the procedures closing the specific medical rescue actions. Most patients were transported to hospital emergency wards or emergency departments (n = 856; 64.56% individuals). There was no hospitalization consent in n = 234 (17.65%) cases, n = 213 (16.06%) did not require hospitalization, n = 9 (0.68%) patients went to detoxification units, and in n = 14 (1.06%) cases medical treatment was withdrawn or the doctor confirmed death.

After evaluating dispatch order forms, emergency medical procedure forms were analyzed. The first element of the analysis involved the assessment of the nervous system according to the Glasgow scale. Conscious patients being able to think logically, properly referring to time and space, and reacting to requests score 15 point according to this scale. A vast majority of patients exposed to CO scored this maximum amount of points (n = 1112; 83.86%). The next element of the analysis was the assessment of the patient's respiratory efficiency. n = 202 (15.23%) patients required active oxygen therapy or artificial ventilation due to respiratory inefficiency. Finally, the last evaluated element of basic life parameters was the assessment of circulatory failure. Such failure involved n = 356 (26.84%) individuals. Some patients presented respiratory-circulatory failure with disorders of the nervous system. The number of patients with injuries of any part of the body was also calculated and amounted to n = 512 (38.61%).

The final point of focus were medical procedures performed by EMTs in patients transported to hospital (n = 856; 64.56%). There were three most frequently performed medical procedures: oxygen therapy n = 778 (90.89%), venipuncture n = 684 (79.90%) and limb leads monitoring (I, II, III) n = 398 (46.49%). The procedure involving pulse was eventually the point of interest. Pulse oximeters were used in n = 331 (38.67%) cases. EMTs of the Voivodeship Rescue Service in Katowice are equipped with simple pulse oximeters that do not detect if the O2 particle is free or bonded with the carbon particle.

Discussion

Carbon monoxide bonds with hemoglobin 250 easier than oxygen. CO transforms hemoglobin to carboxyhemoglobin (HbCO) and causes tissue hypoxia. Moreover, CO bonds with cytochrome oxidase in cells causing the creation of free radicals and cell membrane structures damage [2,3].

Carbon monoxide is absorbed and removed by lungs. Average biological half-life of carboxyhemoglobin amount to 4-6 hours and is not determined by the time of exposure or the number of exposure situations. Half-life of carboxyhemoglobin in the application of oxygen mask (100% oxygen) amounts to 40-90 minutes, whereas in the application of a hyperbaric chamber (oxygen at 3 Atmospheres Absolute [ATA]), half-life of carboxyhemoglobin lasts about 30 minutes [1]. In n = 778 (90.89%) patients, EMTs aimed at minimizing half-life of carboxyhemoglobin by means of oxygen therapy. In deterioration of patients' health conditions during transportation to hospital, EMTs administered drug to have immediate access to the circulatory system (n = 684; 79.901%).

The most important element in cases of carbon monoxide poisoning is the security of rescuers. It is because of the fact that short exposure of rescuer to carbon monoxide may result in an increase of the number of casualties. It is already during the emergency call that the medical dispatcher presuming carbon monoxide poisoning should instruct the person reporting the incident that they should open doors and windows to allow fresh air to enter the room, and that they ought to leave the place of poisoning. Upon reaching destination, rescuers should begin their medical procedures with urgent evacuation of casualty/casualties from the room with a high level of carbon monoxide in the air. It is also important to remember about evacuating and monitoring other individuals staying in the place of poisoning. The next step after evacuation is the monitoring of the following vital signs: A – patency of respiratory tract, B - respiration, C - circulation, D – consciousness [11,12]. Oxygen therapy is the basic method of carbon monoxide poisoning treatment. 100% oxygen should be administered through a tightly fit face mask with reservoir [2,3,5,8,11]. In cases of confirmed respiratory inefficiency, patency of respiratory tract should be restored by means of the application of advanced methods (intubation or alternative methods) and ventilated with positive final pressure. Symptomatic treatment should be implemented along with oxygen therapy to prevent or treat pulmonary edema and cerebral edema by means of administration of steroid drugs e.g. hydrocortisone or, in some cases, Manitol. Fluid therapy should be applied in cases of hypotension caused by venous bed extension. Special care should be taken to avoid patient's fluid overload that may lead to left ventricular insufficiency. In case of seizures, anticonvulsants (e.g. Relanium) should be administered [8,11,13].

Below are procedures performed in acute carbon monoxide poisoning cases according to the recommendations of the Section of Clinical Toxicology of the Polish Medical Association [14].

1. Security of the rescuer
2. Measurement of carbon monoxide level in the room
3. Evacuation of the casualty
4. Measurement of carboxyhemoglobin level (SpCO, carboxyhemoglobin saturation)
5. Confirmation or suspicion of carbon monoxide poisoning
6. Passive oxygen therapy with 100% O_2 with the use of a face mask with reservoir (oxygen flow: 8-12 l/min)
7. Anamnesis and physical examination
8. Measurement of blood pressure, 12-lead ECG
9. Ensuring intravenous and intraosseous access
10. Starting symptomatic treatment according to recommendations: a. hypotension – fluid therapy (crystalloids) b. seizures– anticonvulsants (Relanium – 10-20 mg by means of intravenous or intramuscular injections; the dose can be repeated after 30-60 minutes)
11. Considering transportation to a unit that provides treatment by means of hyperbaric therapy:
    a. pregnant patient with > 25% COHb level
    b. pregnant patient with > 15% COHb level and additional neurological disorders and/or cardiological disorders and/or metabolic acidosis in spite of normobaric oxygen therapy
    c. patients with prolonged coma, neurological disorders and/or cardiological disorders and/or metabolic acidosis in spite of normobaric oxygen therapy

Results

Carbon monoxide exposure is very frequently a direct threat to life. If medical dispatchers presume carbon monoxide poisoning while answering emergency calls, they decide to dispatch emergency medical team in the highest priority code. This has been confirmed by this analysis. Carbon monoxide poisoning is very often an incident involving more than one person, usually whole families. Therefore, CO poisoning affects all age groups. The youngest patient was almost one month old, whereas the oldest individual under involved was 92 years old. The group of patients under the age of 18 constituted 1/5 of all casualties. Male patients were more frequently exposed to carbon monoxide. A large number of incidents was reported in the evening hours rather than at night or in the morning.

In most cases, casualties were transported to hospital for further diagnosis confirming carbon monoxide poisoning. Unfortunately, there was a numerous group of casualties who did not consent to transportation for further diagnostics. This phenomenon is very frequent in fires involving damages of patient's belongings.

Currently, EMTs of the Voivodeship Rescue Service in Katowice are equipped with CO detectors to measure CO levels in air. However, there is no effective possibility of assessing the patient's condition as far as carbon monoxide is concerned. Therefore, efforts should be made to make proper equipment available to EMTs in order for them to be able to measure carbon monoxide level in exhaled air. The aim of these efforts is to minimize access time to hyperbaric chamber, where carbon monoxide will be removed from hemoglobin within 30 minutes.

Konflikt interesów / Conflict of interest
Brak/None

Correspondence address:
Michał Kucap
Voivodeship Rescue Service in Katowice
52, Powstańców Str.; 40-024 Katowice, Poland
☎ (+48 32) 609 31 40
mkucap@wpr.pl

References

1. Nieścior M, Jackowska T. Zatrucie tlenkiem węgla Post Nauk Med. 103;XXVI(7):519-22.
2. Kokot F. Ostre stany zagrożenia życia w chorobach wewnętrznych. Warszawa: PZWL; 2000.
3. Szczeklik A. Interna 2016. Kraków: Medycyna Praktyczna; 2016.
4. Pach J. Zarys toksykologii klinicznej. Kraków: Wydawnictwo Uniwersytetu Jagiellońskiego; 2009.
5. Nadolny N. Rekomendacje postepowania w ratownictwie medycznym. Katowice: Elamed; 2015.
6. Traczyk WZ. Fizjologia człowieka w zarysie. Warszawa: PZWL; 2005.
7. Nowak M, Kawecki M, Skotnicka, Knefel G, Ryszkiel I. Zatrucia toksycznymi produktami spalania (CO) – medyczne i psychologiczne następstwa zatruć. W: Czerwona księga pożarów. Centrum Naukowo-Badawcze Ochrony Przeciwpożarowej im. Józefa Tuliszkowskiego, Państwowy Instytut Badawczy, Józefów 2014. str. 329-363.
8. Zawadzki A. Medycyna Ratunkowa i Katastrof. Warszawa: PZWL; 2016.
9. Seńczuk W. Toksykologia. Podręcznik dla studentów lekarzy i farmaceutów. Warszawa: Wydawnictwo Lekarskie PZWL; 2002.
10. Nieścior M, Jackowska T. Zatrucie tlenkiem węgla. Post N Med. 2013;7:519-22.
11. Breen PH. Zatrucie tlenkiem węgla. W: Fleisher LA, Roizen ME. Anestezjologia w praktyce klinicznej. Jednostki chorobowe od A do Z. Wrocław: Elsevier Urban & Partner; 2014.
12. Szponar E, Szponar J, Kulik-Rechberger B, Polkowska G, Kościesza A, Billewicz-Kraczkowska A, et al. Narażenie na toksyczne działanie tlenku węgla jako przyczyna hospitalizacji pacjentów w Dziecięcym Szpitalu Klinicznym w Lublinie w latach 2006-2012. Prz Lek. 2012;8:420-3.
13. Gałązkowski R, Wejnarski A, Baumberg I, Świeżewski S, Timler D. Wpływ przedszpitalnego zastosowania nieinwazyjnego pomiaru karboksyhemoglobiny na działanie ratunkowe w zdarzeniach mnogich i masowych – opis przypadku. Med Pracy. 2014;65(2):289-95.
14. Burda P, Kołaciński Z, Głębocka-Łukasik M, et al. Postępowanie w ostrych zatruciach tlenkiem węgla – stanowisko Sekcji Toksykologii Klinicznej Polskiego Towarzystwa Lekarskiego. Przegl Lek. 2012;69:463-5.
15. Rozporządzenie Ministra Zdrowia z dnia 10 stycznia 2014 roku „w sprawie ramowych procedur przyjmowania wezwań przez dyspozytora medycznego i dysponowania zespołami ratownictwa medycznego".
16. Ustawa z dnia 8 września 2006 r. o Państwowym Ratownictwie Medycznym (Dz.U. Nr 191 poz. 1410, z późn. zm.).