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Research Article
Epidemiological and Clinical Aspects of Carbon Monoxide Poisoning in Fez City (Case of Ibn Alkhatib Hospital)

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Abstract

Background and Objective: Poisoning by carbon monoxide (CO) is the leading cause of poisoning deaths in the world. In Morocco, it remains a common, serious and often unrecognized and constitutes a public health problem. The present study aimed to describe the main epidemiological and clinical characteristics of occurred cases and to determine factors that may have influenced the evolution of these cases. **Materials and Methods:** This is a prospective study on CO poisoning cases occurred in Fez city between January, 2009 and December, 2016. Data were retrieved from medical records of patients who were received at the emergency department at Ibn Alkhatib hospital. The data were analyzed using Statistical Package for Social Sciences. **Results:** About 2163 cases of intoxication were recruited. Of which 1806 cases are intoxicated by CO (83.5%). The mean age was 25.4±16.1 years, the sex ratio = 0.44 in favor of the female sex (69.44%). Poisoning was accidental in 100% of cases. The oxycarbon poisoning was seasonal. The main cause is the malfunctioning of gas-fired water heaters and the use of braziers. According to the source of the cases, poisoning mainly affects disadvantaged areas (76.94%), poisonings were of urban origin in 99.1%. The group of adults was the most exposed (52.49%) cases, followed by the adolescent group (15-19 years) (25.75%). The age of children (5-14 years) have accounted for 21.1% of all cases, which requires awareness of parents to the dangers of carbon monoxide poisoning (42.47% of cases are collective). It was essentially isolated poisoning (57.53%) that occurred at place of residence in 97.95% of cases. Clinical manifestations are dominated by neurological signs (42.36%), followed by digestive signs (34%), respiratory signs (22.82%) and cardiovascular manifestations (0.35%). Poisoning was relatively benign (98.78%). Treatment based mainly on oxygen therapy normobar. **Conclusion:** Oxycarbon poisoning remains underestimated. Therefore it was concluded that prevention is an indispensable element.

Key words: Carbon monoxide poisoning, epidemiological, clinical characteristics, public health, malfunctioning of gas-fired

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Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Carbon monoxide (CO) is known as the silent killer. It is a toxic gas but being colorless, odorless, tasteless and initially non-irritating, it is very difficult for people to detect. Carbon monoxide involves a bastard table and remains of this fact often under-diagnosed[1,2]. Carbon monoxide poisoning occur after enough inhalation of CO. It is a product of incomplete combustion of organic matter due to insufficient oxygen[3,4]. Symptoms of mild acute poisoning will include lightheadedness, confusion, headaches, vertigo and flu-like effects, larger exposures can lead to significant toxicity of the central nervous system and heart and death[5,6]. Treatment of poisoning largely consists of administering 100% oxygen or providing hyperbaric oxygen therapy, although the optimum treatment remains controversial[7]. Oxygen works as an antidote, it increases the removal of carbon monoxide from hemoglobin, in turn providing the body with normal levels of oxygen. Carbon monoxide poisoning is the most common type of fatal poisoning[8]. International studies have shown that carbon monoxide is a public health problem in several countries. However, the actual incidence is certainly underestimated.

The involuntary inhalation of carbon monoxide (CO) constitutes one of the first causes of deaths by accidental poisoning. In Belgium, in 2002, the poison control center listed 613 incidents at the origin of carbon monoxide poisoning of 1302 persons[9]. In France, about 6,000 people are hospitalized for poisoning with CO each year and 300 of them die. In 2010, 1509 episodes of CO poisoning were notified in Alsace-Lorraine region, which involved 5,195 people[10]. In the United States, approximately 200 people die each year from carbon monoxide poisoning associated with home fuel burning heating equipment[3]. In South Korea, 1,950 people had been poisoned by carbon monoxide with 254 deaths from 2001 through 2003[11,12]. In Hubei, China, 218 deaths from poisoning were reported over a 10 years period with 16.5% being from carbon monoxide exposure[13]. In Morocco, only 18379 cases of carbon monoxide poisoning were recorded during 1980-2011[14,15]. This figure does not reflect the reality. According to data from the Moroccan Poison Control and Pharmacovigilance Center (CAPM), the geographic distribution shows that all regions of Morocco were affected[15]. Including the region of Fez-Boulemane. In this region, 2332 cases were recruited between January, 2009 and December, 2012 with 1.3% mortality, Fez city presented the highest number of intoxication with 66.2% of the cases and Ibn AlKhatib Hospital reported the majority of cases of intoxication with 916 cases (39.3 %)[16].

Hence, the objective of this present study, which focused on carbon monoxide poisoning, describes the epidemiological and clinical profile of this type of poisoning and identifies factors that may influence evolution of the cases in Fez city (capital of the FES-BOULEMANE region) formally case of the hospital Ibn Alkhatib.

MATERIALS AND METHODS

Study site: Fez is a town in central Morocco, located at 180 km East of Rabat between the Rif's massif and the Middle Atlas. Fez is the second largest city in Morocco with a population of 1,112,072 inhabitants according to the 2014 census and one of the twelve new regions of Morocco instituted by the territorial division of 2015 (Fig. 1). According to the General Census of Population and Housing (RGPH) 2014, the Region of Fez-Meknes (Fez remains the capital) has 4,236,892 inhabitants. The urban population in this region is of the order of 2,564,220 representing 60.5% of total population.

Data collection: This is a prospective study of cases of CO poisoning in the city of Fez between January, 2009 and December, 2016. The data were extracted from the medical records of patients who were received at the emergency department at Ibn Alkhatib hospital under the Regional Health Directorate for Health in the region.

Statistical analysis: The case was entered on Excel and the descriptive analysis of the data was carried out in terms of number and percentage. The data were analyzed using Statistical Package for Social Sciences (SPSS Inc, Chicago, IL, USA) and also with the Geographic Information System Tools (MapInfo, ArcGIS, QGIS and Global Mapper). The age groups that have been adopted are those of the International Program on Chemical Safety (IPCS) of WHO. The severity assessment was made by the Poisoning Severity Score (PSS)[17]. Based on this scale, poisoned patients can be classified as minor or grade 1 (mild, transient and spontaneously resolving symptoms), moderate or grade 2 (marked or prolonged symptoms), severe or grade 3 (severe or life-threatening symptoms) and fatal or grade 4. By comparing critical (grade 3 or 4) and non-critical (grade 1 or 2) cases, univariate analysis was performed to identify factors that may influence the severity of patients.

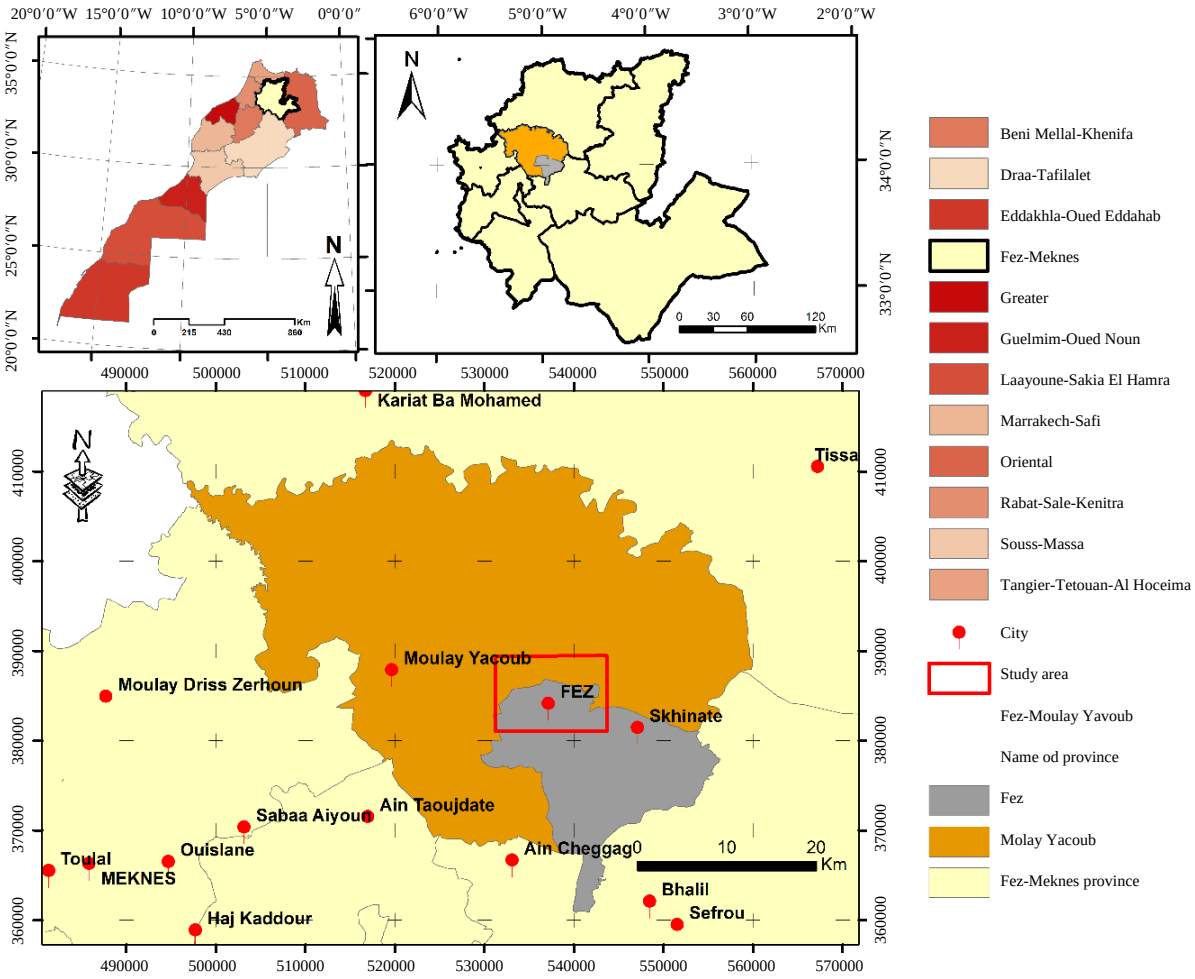

Fig. 1: Geographical position of Fez city, Morocco (province and prefectures of the region)

RESULTS

Epidemiological and clinical characteristics of CO poisoning in Fez

Epidemiological characteristics: Between January, 2009 and December, 2016, all patients admitted for acute intoxication were recruited (2163 cases), 1806 cases were intoxicate by CO accounted for 83.5% of all poisonings hospitalized during the same period, followed by food poisoning by 115 cases and animal intoxication by 52 cases (envenomation by scorpion and snakes) (Fig. 2).

The average age of intoxicants by CO was 25.4±16.1 years, the sex ratio was 0.44 in favor of the female. A female predominance was noted in 69.44% of cases (Table 1). This potentially lethal intoxication may be voluntary as part of an autolysis attempt, it is nevertheless, in our series accidental in 100% of cases. The average annual of CO intoxication was 270 cases. The frequency of cases appearance

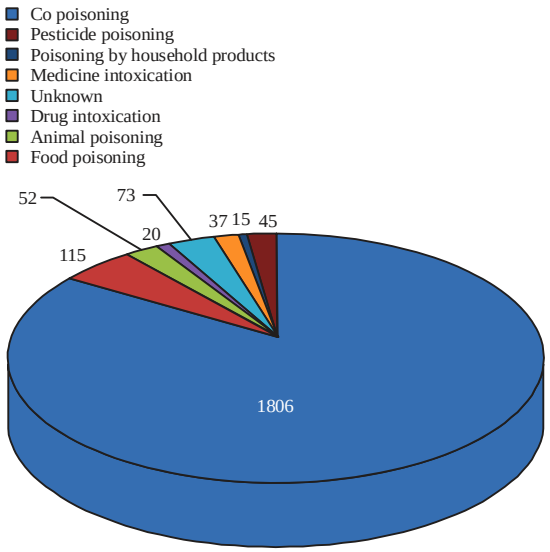

Fig. 2: Distribution of cases of intoxication in the hospital Ibn Alkhatib Fez (2009-2016)

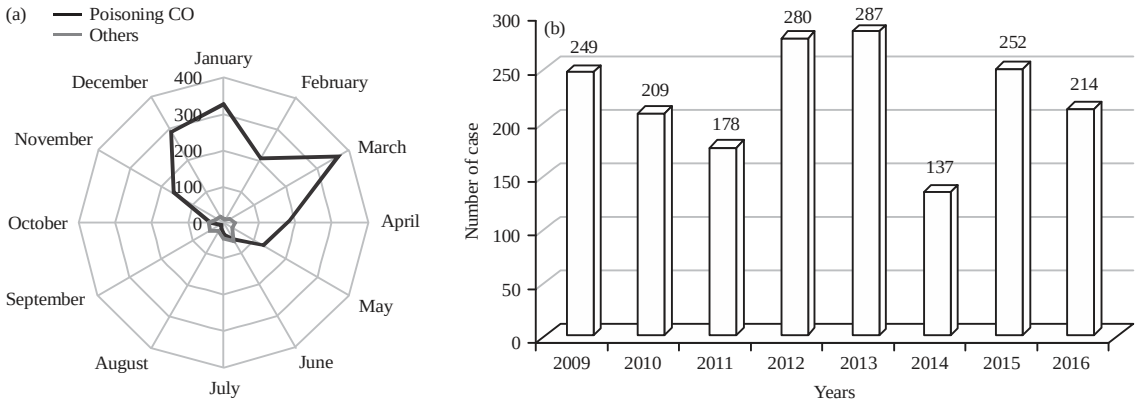

Fig. 3(a-b): Distribution of poisoning cases by (a) Months and (b) Years

Table 1: Epidemiological characteristics of the study population

Variables	Mean or frequency (%) (N = 1806)	Cured cases (N = 1784)	Died cases (N = 22)	LS (%)
Mean age (years)	25.4±16.1			
Sex				
Male	552 (30.56)	543	9	1.63
Female	1254 (69.44)	1241	13	1.03
Age group (years)				
<1	1 (0.05)	1	0	-
1-4	0	0	0	-
5-14	381 (21.10)	375	6	1.57
15-19	465 (25.75)	452	13	2.79
20-74	948 (52.49)	945	3	0.31
>75	11 (0.61)	11	0	-
Season				
Autumn	418 (23.14)	418	0	-
Summer	73 (4.04)	73	0	-
Winter	919 (50.89)	901	18	1.96
Springs	396 (21.93)	392	4	1.01
Hour of poisoning				
Day	478 (26.47)	472	6	1.25
Night	1328 (73.53)	1312	16	1.20
Poisoning type				
Collective	767 (42.47)	755	12	1.56
Isolated	1039 (57.53)	1029	10	0.96
Poisoning place				
Place of residence	1769 (97.95)	1751	18	1.02
Public	37 (2.05)	33	4	10.81
Gradation				
Grade 1 (Minor)	499 (27.63)	499	0	-
Grade 2 (Moderate)	1132 (62.68)	1132	0	-
Grade 3 (Severe)	153 (8.47)	153	0	-
Grade 4 (Fatal)	22 (1.22)	0	22	100

<1: Infant, 1-4: Baby Walker, 5-14: Children, 15-19: Adolescents, 20-74: Adult, >75: Aged

had known a progressive increase until 2013, to reach its maximum with 287 cases. During 2014, the number of poisoning had a remarkable fall going from 287-137 cases. This regression could be explained by the efforts provided by the Moroccan Poison Control and Pharmacovigilance Center and the realization of many open days to raise awareness about various dangers of carbon monoxide. The carbon monoxide poisoning occurred during the year. However, it knew a big rise during the coldest months. The phenomenon of CO poisoning was seasonal (Table 1) and often related to meteorological phenomena (91% of poisonings between October and May). A peak was observed during the month of January and March (Fig. 3), poisoning occurs at night (73.53%) more than the day (Table 1) and almost homogeneously during all days of the week except on Sunday or there is an increase.

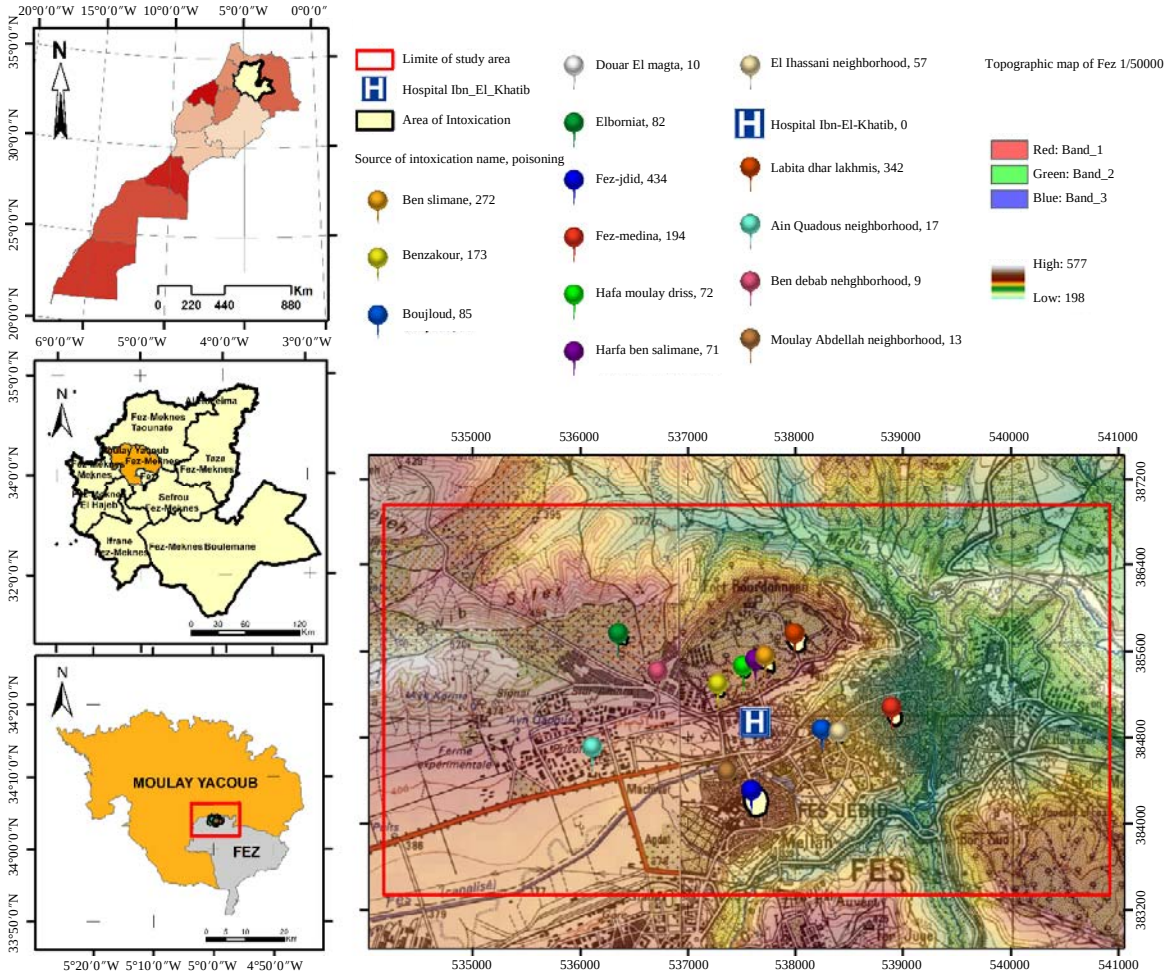

Fig. 4: Distribution of case by source

These poisonings originate mainly from the malfunctioning of heaters and the production of hot water using all organic fuels. The most commonly implicated device is the gas water heater. Another common cause is the use of make shift heaters such as braziers.

According to the source of the cases and the location of Ibn Alkhatib Hospital, CO poisoning mainly affects disadvantaged areas (76.94%) (Fig. 4).

Socially and economically fragile families are at greater risk of CO poisoning. The intoxication is often familial, the group of adults, whose aged between 20 and 74 years, was the most exposed 52.49% of cases, followed by the adolescent group (15-19 years) by 25.75% of cases, 21.1% of the victims being children under 14 years, which requires awareness of parents to the dangers of carbon monoxide poisoning. It was collective poisoning in 42.47% of cases that occurred at residence place in 97.95% of cases (Table 1). The difference in incidence is evidently marked between the predominantly rural and the highly urbanized regions. The urban origin was predominant in 99.1%.The distribution of patients according to the severity showed that 62.68% of patients had moderate symptomatology (grade 2). The fatal state (grade 4) was observed in 1.22% of cases. The intoxications were relatively benign, 1784 cases had favorably evolved and 22 patients had died (Table 1).

Clinical characteristics: The clinical status of patients was symptomatic in majority (100%). Poisoned patients presented one or more clinical signs (number of symptoms more than the total number of poisoning). Clinical manifestations of CO poisoning dominated by neurological signs (headache, dizziness etc.) (42.36%), followed by digestive signs (nausea, vomiting etc.) (34%), respiratory signs (dyspnea, respiratory distress etc.) (22.82%) and cardiovascular manifestations can be seen but are rare. The complications was essentially neurological and cardiorespiratory can be life-threatening in

the short term and require urgent treatment of which oxygen is the cornerstone, normobaric oxygen therapy was the only treatment given to intoxicated patients (Table 2).

The total number of the clinical signs exceeds the total number of case of poisoning because certain patients had expressed several signs.

The univariate study comparing groups of serious and non-serious poisoning demonstrated that age (p = 0.000), seasons (p = 0.001), type of poisoning (p = 0.001) and time of intoxication (p = 0.000) influence significantly the severity of intoxicated patients, whereas sex (p = 0.24) does not influence it (Table 3).

Toxicological analysis: Asymptomatic status may be more likely to evolve to death, which is explained by the nature of carbon monoxide, which is an odorless gas and irritant properties, allowing it to be inhaled at high and potentially lethal concentrations without symptoms alert for the victim. No clinical pathognomonic signs of CO poisoning. The diagnosis is based mainly on the circumstances of discovery and is often suspected by first aid (firemen, Samu). The only notion of exposure to the risk must evoke the diagnosis of carbon monoxide poisoning in an emergency situation. Under these circumstances, the history, clinical examination and dosage of carboxyhemoglobin may assist in diagnosis. In the absence of specific symptoms of carbon monoxide poisoning, toxicological analysis (determination of COHb) plays an important role in the affirmation of the diagnosis and the orientation of the doctor's in the management of cases. This assay allows tracking of patient outcomes and the evaluation of treatment (oxygen) introduced to the patient, the carboxyhemoglobin is assayed in whole blood taken from an anticoagulant (lithium heparin or EDTA), flush-filled, stored at 4°C without exceeding a period of 3 h.

Table 2: Distribution of poisoned patients according to clinical status (symptomatic, asymptomatic) and clinical signs

Clinical status and signs	Effective	Percentage
Clinical status		
Symptomatic	1806	100.00
Clinical signs		
Headache	1384	21.81
Dyspnea	1364	21.49
Vertigo	1247	19.65
Nausea	1189	18.73
Vomiting	865	13.63
Respiratory distress	56	0.88
Discomfort	47	0.74
Digestive Pain	46	0.73
Secheresse buccale	44	0.69
Muscle weakness	30	0.47
Thoracic pain	29	0.45
Diarrhea	14	0.22
Bradycardia / Tachycardia	12	0.19
Rhythm disorder	10	0.16
Conflict of conscience	5	0.08
Coma	5	0.08
Total	6347	100.00

Between January, 2008 and June, 2017, all the requests for toxicological analysis especially research applications of COHb occurred at the laboratories of the Anti Poison Center and Pharmacovigilance of Morocco were collected. Data were collected from the CAPM-LAB archives.

During this period, all applications for toxicological analysis admitted to CAPM-LAB were recruited (5804 cases), of which 316 cases of COHb assay request to confirm CO intoxication represented 5.44 % of all analyses received during the same period (Fig. 5). The mean age of patients was 13.02±8.75. The sex ratio (M/F) (145/169) was 0.86 in favor of females (53.48% of cases). The 70.57% of the victims being children under 14 years. The collective nature was observed in 32.91% of the cases. The circumstances of intoxication were accidental in 100%.

Toxicological analysis was carried out in the blood, the COHb molecules responsible for CO intoxication were identified and assayed in 269 cases, the COHb level is normally less than 2% in 117 cases and considered abnormal for 48% of cases (152 cases), the COHb level was reached in some cases 41% (Fig. 6). Whereas, in 45 cases the analysis was not made (Coagulated blood for 22 cases, non-compliant sample for 23 cases).

In the absence and lack of data concerning the clinical signs of the cases during their hospitalization (only 10 cases that presented information about the symptoms) (Table 4), It was noted that there is a poor correlation between blood levels of COHb and clinical manifestations.

Table 3: Association analysis between the evolution and epidemiological, clinical parameters

Variable	Evolution (Critical* vs. Non-critical**)	OR (95% IC)	X2	p-value***
Sex	175 vs. 1631	-	1.26	0.24
Age groups	175 vs. 1631	2.00 (1.42-2.57)	52.30	0.000
Season	175 vs. 1631	1.85 (1.82-1.88)	17.37	0.001
Hour of poisoning (Night vs. Day)	175 vs. 1631	1.92 (1.91-1.94)	39.97	0.000
Poisoning type (Collective vs. Isolated)	175 vs. 1631	2.32 (2.24-3.67)	46.13	0.001

*Patients with grade 3 or 4 of poisoning severity, **Patients with grade 1 or 2 of poisoning severity, ***Analyzed with Chi-square test

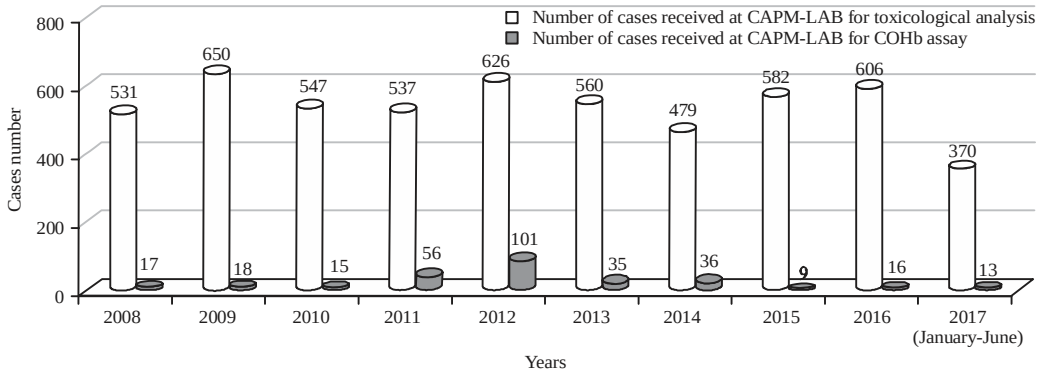

Fig. 5: Annual distribution of toxicological analysis received at CAPM-LAB, 2008 to June, 2017

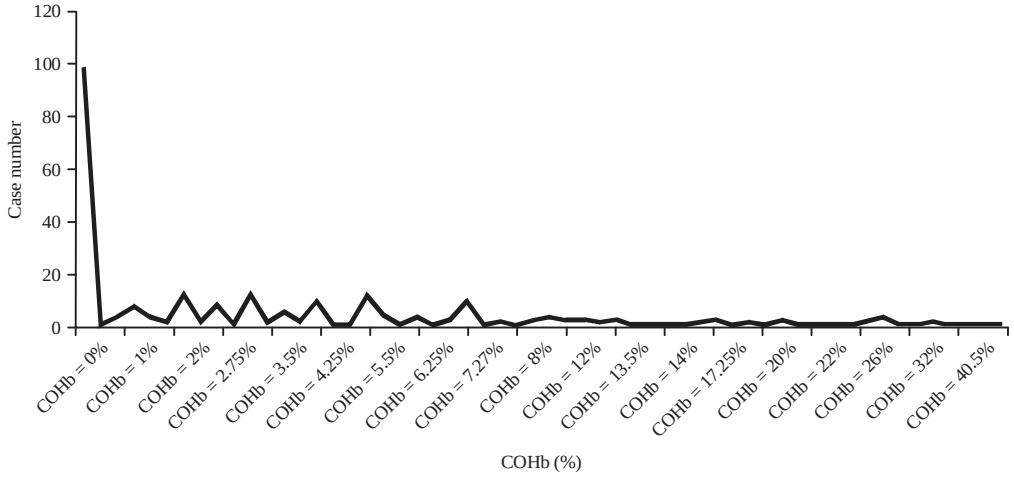

Fig. 6: Distribution of CO poisoning cases received at CAPM-LAB, depending on the COHb rate, 2008 to June, 2017

Table 4: Distribution of cases of CO poisoning received at CAPM-LAB, According to the clinical signs and rates of COHb, 2008 to June, 2017

Clinical signs	Effective	COHb (%)
Coma	3	2, 3 and 7
Deep coma	1	5
Convulsion, headache	2	0
Prolonged loss of consciousness	1	23
Loss of consciousness, vomiting	1	29
Constipation disorder, rhabdomyolysis	1	4
Eating disorders	1	5

DISCUSSION

The involuntary inhalation of carbon monoxide (CO) constitutes one of the first causes of deaths by accidental poisoning. The Anti Poison Center and Pharmacovigilance of Morocco (CAPM) reported 18379 cases of CO poisoning during 1980-2011[15]. In the region of Fez-Boulemane, 2332 cases between January 2009 and December 2012 with 1.3% mortality[16].

The true number of incidents of carbon monoxide poisoning is unknown, since many non-lethal exposures go undetected. In Morocco, this could be related to several reasons: Under notification of cases by professionals in public health structures, absence notification of university hospital and military sector, existence of cases which die at home or in road before the victim has been hospitalized, presence of asymptomatic cases not having the recourse to the consultation, minor symptoms or absence of warning signs as a consequence of an underestimation of exposure and a non hospitalization and consequently non declaration. From the available data, carbon monoxide poisoning is the most common cause of injury and death due to poisoning worldwide[5].

The CO poisoning is especially serious, responsible for the third cause of poisoning in Morocco (15%) after the medicine and foods[14]. In spite of our series, CO poisoning takes the first place by 1806 cases against 115 cases of food poisoning and

52 cases poisoning by envenomation. These figures are probably poorly estimated due to under-reporting due to a lack of knowledge of the pathology. Studies conducted by the National Public Health Network show a stable number of oxycarbon poisonings, despite repeated public awareness campaigns.

Poisoning is typically more common during the winter months. This is due to increased domestic use of gas furnaces, gas or kerosene space heaters and kitchen stoves during the winter months, which if faulty and/or used without adequate ventilation, may produce excessive carbon monoxide[18]. The presence of an atmosphere saturated with steam (bathrooms) is a factor favoring incomplete combustion and therefore the production of CO. It is mainly maintenance defects and malfunctions of the appliances but also installations (Chimney in poor condition, obstructed, inadequate) that are implicated[19].

The frequency of home accidents by CO poisoning begins to grow in autumn with a peak in winter in the month of March and then decreases in the spring. Periods of fog or of wind absence promote CO poisoning default ventilation of houses. The large colds cause an elevation in risk of intoxication by intensive use of heaters[4]. In summer, we are not safe from CO poisoning since we have recorded 73 cases. This even low rate suggests the involvement of other sources of carbon monoxide poisoning such as fires, exhaust fumes and smoke escapes in public baths[4,5].

The CO poisoning mainly affects disadvantaged areas, financially disadvantaged families are at greater risk for CO poisoning (dilapidated device of heating, use of wood and coal as the main source of heating, lack of maintenance by worry to economy) but all social strata of the population may be affected[20]. Intoxication is often familial, collective poisoning had represented in 42.47% of cases this phenomenon could be due to the use of gas water heaters in non-ventilated area in the residence place, which can cause a collective poisoning of several members of the family. During CO poisoning, there is rarely a single victim but more often a whole family, parents and children. The group of adults was the most exposed 52.49% of cases, followed by the adolescent group 25.75% of cases[21], the age of children less than 14 years have accounted for 21.1% of all cases, which requires awareness of parents to the dangers of carbon monoxide poisoning. The predominance of young patients, which may be partially explained by the "Moroccan population pyramid" that mostly includes people at young ages and also by the fact that this age group is the active population which is often the victim of occupational toxic exposures[21].

Females are predominant, this could be explained by the fact that the majority of Moroccan women at home are not aware of the risks related to certain risky practices. Awareness campaigns should be organized in this way. This result agrees with a study that was nationally carried out where females are most affected by carbon monoxide poisoning.

The main manifestations of carbon monoxide poisoning develop in the organ and systems most dependent on oxygen, the central nervous system and the heart. The initial symptoms of acute carbon monoxide poisoning include headache (cephalic), nausea, malaise and fatigue[8,4]. These symptoms are often mistaken for a virus such as influenza or other illnesses such as food poisoning or gastroenteritis. Headache is the most common symptom of acute carbon monoxide poisoning, it is often described as dull, frontal and continuous[22]. If CO concentration is high, the poisoning cause's nausea, vomiting, vertigo, or more serious, fainting and death. Chronic exposure to relatively low levels of carbon monoxide may cause persistent headaches, lightheadedness, depression, confusion, memory loss, nausea and vomiting[23].

Indeed, this study showed a predominance trouble of central and peripheral nervous system (Cephalalgia 21.81% and vertigo 19.65%) and affections of the respiratory apparatus (dyspnea 21.49%). Thus, it is necessary to systematically evoke CO poisoning before the appearance of any of these signs without obvious cause. This result is in perfect agreement with that of the national study on CO poisoning which showed a predominance of the following signs: Cephalalgia, vertigo and dyspnea[14].

The gradation is in perfect agreement with the symptomatology. The predominance of grade 2 is the result of troubles of the central and peripheral nervous system (cephalic, vertigo). The fatal state (grade 4) was observed in 1.22% of cases. Intoxications due to CO were relatively benign, 1784 cases had favorably evolved and 22 patients had died. In the vast majority of cases, deaths are caused by the failure of the installation of heaters and the lack of aeration in the bathrooms. The CO poisoning remains a worrying phenomen on causing many deaths. Moreover, in our case, it is estimated that there are deaths that are beyond the reporting systems. Asymptomatic status may be more likely to evolve to death, which is explained by the nature of carbon monoxide, which is an odorless gas and irritant properties, allowing it to be inhaled at high concentrations without symptoms alert for the victim.

The poisoning period is generally short which allowing immediate taking of charge. Nevertheless, this period has sometimes reached 32 days, this is related to the appearance

of post-intervallic syndrome which generally occurs 7-21 days after the initial exposure to CO. This imposes second medical consultation after 3-4 weeks.

Initial treatment for carbon monoxide poisoning is to immediately remove the person from the exposure without endangering further people. Administering oxygen via non-rebreather mask shortens the half-life of carbon monoxide from 320-80 min on normal air[24]. Oxygen hastens the dissociation of carbon monoxide from carboxyhemoglobin, thus turning it back into hemoglobin[25]. Hyperbaric oxygen therapy was not recommended, this advice often impinges to the rareness and remoteness of hyperbaric medicine centers. In the absence of hyperbaric therapy in most parts of the kingdom, including the region of Fez-Boulemane, the processing performed in this study was based primarily on the normobaric oxygen[4].

The univariate study comparing severe intoxication (Grade 3 or 4) and non-severe intoxication (Grade 1 or 2) demonstrated the influence of a few parameters such as the age, season of the event, time and type of poisoning. Collective poisoning is more likely to be fatal. This could be due to the use of gas water heaters in an unventilated area in the place of residence, which can cause collective poisoning.

The clinical presentation of acute carbon monoxide poisoning can change rapidly. Health care providers usually first encounter patients after moderate to severe toxicity has developed[8].

The COHb is formed by the union of carbon monoxide and hemoglobin and is a marker of carbon monoxide poisoning. The COHb concentrations of normal healthy individuals are less than 2%. Individuals, who are smokers have COHb levels of upto 9%.

Dangerous levels of carbon monoxide exposure with relation to COHb are levels greater than 25% and levels greater than 50% may result in death[26].

However, there is no direct relationship of clinical effects and responses with COHb levels. Therefore COHb levels are estimates and a guide to help determine exposure levels.

Indeed, the symptoms reflect the dissolved concentration, which may be low in the face of a high level of COHb and the level of COHb in the blood depends on the withdrawal time compared to the poisoning.

The use of certain necessary additional examinations, such as the determination of carboxyhemoglobin, is not yet standardized, there are significant disparities in treatment in our country, particularly in view of the proximity of specialized laboratories. In addition, the biologist is asked to quantify the degree of intoxication but at the level of the laboratory he is confronted with technical constraints in the manipulation of CO and in obtaining carboxyhemoglobin: Coagulated blood, non-compliant sampling and also the treatment instituted can iron the results (especially O2 therapy).

Although supplemental oxygen therapy is the cornerstone of treatment of CO poisoning[27]. The modalities of oxygen therapy, normo or hyperbaric, are dictated according to the clinical gravity. In the absence of hyperbaric therapy in most parts of the Morocco, including the region of Fez-Boulemane, the management performed in this study was based primarily on normobaric oxygen. In the absence of pathognomonic signs of CO poisoning. The dosage of carboxyhemoglobin may assist in diagnosis. The uses of certain necessary additional examinations such as the carboxyhemoglobin dosage are not yet standardized, there are significant disparities in treatment in our country, in particular due to the proximity of specialized laboratories. Moreover, in this study, the data were collected retrospectively with review of medical records. Given that some details may have been missed from being entered into medical records, bias in data collection could be another limitation.

CONCLUSION

In Morocco, including the fez region, acute intoxication with CO is a rather frequent pathology. Despite the statistics provided in some studies and reports on CO poisoning, the actual incidence is certainly underestimated, the management was specific but not standardized. Finally, the implementation of the necessary actions to prevent contacts between the toxicant and the victims, hence the need to reinforce the strategy of fight against this toxic to be developed by the CAPM.

SIGNIFICANCE STATEMENTS

This study found that CO poisoning was common but undoubtedly underestimated due to under-reporting, the management was specific but not standardized. This is a survey carried out for the first time at the level of the Fez-Boulemane region and specifically at the Ibn AlKhatib hospital. The data collected and the results obtained have contributed to enrich and improve the database of the Anti Poison and Pharmacovigilance Center of Morocco (CAPM). New surveys and studies such as this one in the different regions of the kingdom will make it possible to evaluate precisely the magnitude of this problem, which will encourage managers to standardize behavior and train health professionals to take charge of victims and allocate the means to them.

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