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Blood Lead Level in Opiate Addicts Hospitalized in the Intensive Care Unit of a Trauma Referral Center in Kerman, Iran

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Original Article

Abstract

Background: Opium is the most commonly-used narcotic in Iran and some Asian countries. There are many reports of lead poisoning in opium users. Lead poisoning encompasses a wide range of symptoms the incidence and severity of which depend on the concentration and duration of contact with lead. The present study compares blood levels of lead in two groups of non-addicted patients and opiate addicts admitted to the intensive care unit (ICU) of a trauma referral hospital in Kerman, Iran.

Methods: Two groups of about 30 patients were compared. The first group was the patients who were known as opium addict according to the Diagnostic and Statistical Manual of Mental Disorders-4th Edition (DSM-IV) and the second group was the patients who had no history of opium abuse. Patients' data were collected through a questionnaire. After determining the blood lead concentration by atomic absorption spectrophotometry (AAS) with graphite furnace, the data were analyzed by statistical tests.

Findings: Blood lead levels (BLLs) in both addicted and non-addicted groups showed a significant difference ($P < 0.050$), but there was no meaningful relationship between blood lead concentration and other factors such as age, gender, type of opium, method of consumption, amount of use, and duration of dependence.

Conclusion: Many of opium-addicted ICU patients in Kerman had a high BLL due to opium pollution that can be harmful for these patients.

Keywords: Opium; Lead poisoning; Intensive care unit

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Introduction

Water, air, soil, colors, seafood, some contaminated plants, etc. are environmental sources of lead poisoning, and some jobs such as battery technician, soldering, jewelry making, painting, working at the petrol station, etc. are sources of occupational lead poisoning. Lead is a silvery white and odorless metal that is insoluble in water.[1] Lead poisoning has been known by scientists and physicians since thousands of years ago and the signs of lead poisoning are found in medical books of that era.[2] The main ways of lead poisoning are ingestion or inhalation of lead compounds although the absorption of inhaled lead is significantly more than oral method.[3]

Three quarters of lead is removed from the blood by the kidneys; the remainder is excreted by the gastrointestinal (GI) tract, sweating, or is accumulated in the nails and hair.[4]

Clinical manifestations of lead poisoning are non-specific and include non-specific abdominal pain, constipation, irritability, muscle pain, weakness and myoclonus, headache, anorexia, decreased libido, disturbance in concentration, anemia, and so on. Lead poisoning can also cause liver damage and increased liver enzymes, jaundice, and even liver failure.[5,6] Heart problems are also possible in chronic exposure to lead. Contact with non-organic lead can cause cancer in the long term.[7] Many of these side effects are related to interaction of lead with crucial components like calcium, enzymes, and other proteins.[8]

Nowadays, a new form of lead poisoning has been observed in drug addicts, which is due to the addition of lead to opiates with the intention of increasing their weight.[9] Opium is obtained from the juice of a plant known as Papaver somniferum. Frequent use of opium and other opiates results in endurance and, at the same time, dependence on these substances.[10]

Substances abuse, especially opium, is common among intensive care unit (ICU) patients[11] and the incidence of withdrawal syndrome symptoms as a result of drug discontinuation in the hospital complicates the treatment process.[12] One of the main difficulties of opium and its derivatives is its impurity and its being contaminated with materials like lead.[13] Adding lead to opiates often occurs at the time of opium production.[14]

Some Iranian researches have analytically confirmed the presence of lead in opium.[15]

There are several reports of lead poisoning in opium users[16,17] and lead toxicity outbreaks in Iranian opium addicts.[18,19]

Based on the observations, a significant proportion of patients hospitalized in the ICUs of hospitals of Kerman City, Iran, were drug abuser, especially opium addict.[11] ICU patients are susceptible to many complications such as anemia, myopathy and neuropathy, organ failure, and etc. Lead poisoning can induce many of these complications in ICU patients that results in increased mortality and morbidity of patients.

Regarding this point and considering that the measurement and comparison of the blood lead level (BLL) in addicted and non-addicted patients admitted to the ICU has not been carried out elsewhere, the main goal of this study was to measure and determine the concentration of lead in total blood in two groups of non-addicts and opiate addicts admitted to the ICU of a trauma referral center in Kerman.

Methods

After obtaining approval from the Ethics Committee of Kerman University of Medical Sciences, Kerman (No. 90/144/K) and collecting written informed consents from the patients' legal guardians (they were assured of the confidentiality of data), this cross-sectional study was conducted from May 2016 to November 2016 (for 6 months).

Inclusion criteria: patients admitted to the ICU of Shahid Bahonar Hospital in Kerman with 15-80 years old.

Exclusion criteria: simultaneous other substances abuse (due to the possibility of contamination of other narcotic drugs such as heroin, glass, and amphetamines with lead),[11] occupational risk factors for lead poisoning such as petrol station workers, working with lead batteries, printing workers, paint workers, car radiator repairmen, and jewelry makers.

In this way, 5cc of the venous blood sample was collected in a non-lead gelatinized heparin tube and stored until the preparation and analysis at a temperature of -70 °C. Demographic information about the patients participating in the study was collected through a one-page questionnaire.

Patients were divided into two groups of

opiate addicts and non-addicted patients based on patients' legal guardian's history. Non-addicted group included the patients who did not have any history of addiction to any substances, and in the addicted group, those patients were classified who were known to be addicted to opium according to the Diagnostic and Statistical Manual of Mental Disorders-4th Edition-Text Revision (DSM-IV-TR) scale. The dependence on opioids [opium, opium residue (shireh)] was proved on the basis of the criteria of this scale. Patients with different methods of using opium (oral, opium pipe, etc.) were included in this study.

Due to the possibility of contamination of other narcotic drugs such as heroin and crystal methamphetamine with lead,[16] the patients who were addicted to other drugs were excluded and those patients were participated in the study who only had opium addiction.

Due to the sensitivity of the instrument used in the lead analysis, the smallest contamination in the containers could have considerable effects in the result of the analysis. Therefore, all stages of the process, from blood sampling to laboratory and analysis, were carried out with the sufficient accuracy and control for the absence of contamination with lead. All the containers were washed before use with acetone and chloroform and then placed in a 2 molar sulfuric acid solution for 24 hours. They were rinsed with distilled water and deionized water and finally dried in oven.

A diluent solution is a mixture of Triton X-100 [as a surfactant and red blood cell (RBC) agent] and Antifoam B (as an anti-foaming agent to prevent foaming error during analysis) with a ratio of 2.5cc of Triton X-100 and 5cc of Antifoam B in one liter of deionized water. To avoid errors, the diluent solution was prepared and used daily and with a necessary amount.

Blood sample, taken from patients and kept at a temperature of -70 °C, was melted at room temperature before starting the preparation. Then the sample was mixed with vortex for about 30 seconds. After that blood sample was uniform, 1cc of the blood sample was combined with 5cc of the diluent solution in 15cc Falcon plastic tubes and again was mixed with vortex for 30 seconds. After complete RBC lysis, 5cc of 1.6 molar nitric acid solution was added to the previous mixture and again mixed with vortex for 30 seconds. The samples were then transferred to the centrifuge and centrifuged for 4 minutes at a speed of 10000 revolutions per minute (rpm) [relative centrifugal force (RCF) ~ 12300xg]. The outer solution was separated and transferred to non-leaded plastic tubes that had previously been washed with acid and, until analysis, was kept in the temperature of -70 °C. The method of preparing blanks was exactly the same as the method of preparing blood samples, except that 1cc of deionized water was used instead of 1cc of blood.

The instrument used in this study was an atomic absorption instrument (Varian SpectAA 220 graphite furnace, made in Australia). The purge gas used in the argon system was 99.99% pure. Direct calibration was used to calibrate the instrument. In this method, the solutions were first prepared with concentrations of 0, 10, 25, 50, and 100 µg/l (deionized water) using an initial standard solution of 1000 parts per million (ppm), and then their absorption was measured by the instrument and the calibration curve obtained by it was drawn. Regarding the obtained regression, the obtained diagram had acceptable linearity ($r = 0.995$). After calibration of the instrument, the absorbance of the samples under study was measured by the instrument and the concentration of samples was calculated using the line equation of the calibration curve. In this study, after calculating the limit of detection (LOD), all data that were less than LOD and therefore outside the scope of the instrument, were eliminated and the statistical analysis was performed on the remaining samples. Data were analyzed by SPSS statistical software (version 22, IBM Corporation, Armonk, NY, USA) and analyzed.

Results

After analyzing the data, it was found that out of 32 addicted patients, 28 people (87.5%) were men and 4 people (12.5%) were women. Out of 31 non-addicts, 21 people (67.7%) were men and 10 people (32.3%) were women.

As shown in table 1, 78.1% of the addict group used opium, 15.6% of them used shireh, and 6.3% of them consumed both shireh and opium. The frequency of the type of substance used has been also presented, according to gender, in table 1.

We saw that 38.7% of the patients used the narcotic in way of inhalation-stick, 19.4% of the patients by opium pipe, 32.3% by oral way, and 7.9% of the patients by both ways (oral and inhaled).

Table 1. Frequency of type of used substance and method of substance consumption in terms of gender

Variable		Gender of patients	
		Men [n (%)]	Women [n (%)]
Type of used substance	Opium	22 (78.6)	3 (75.0)
	Shireh	5 (17.9)	-
	Mixture of opium and shireh	1 (6.3)	1 (25.0)
Method of use	Inhalation-stick	12 (42.5)	-
	Opium pipe	3 (10.7)	4 (100)
	Oral	10 (35.5)	-
	Combination of methods	3 (10.7)	-

The results of the number and frequency of the individuals under study in three age groups of under 20, 20-40, and older than 40 years showed that in the addict group, 37.5% of the individuals were in the age group of 20-40 years, 3.1% of them were in the age group less than 20 years, and 59.4% were over 40 years old. While the non-addict group had the highest number in the age range of 20 to 40 years, including 61.3% of the cases, 25.8% of them were in the age group of over 40 years, and 12.9% in the age group of under 20 years old.

Standard lead solutions were prepared with the concentrations provided in table 2 and their absorption was registered by the instrument.

Table 2. Standard lead solutions

Absorbance	Standard concentration (µg/l)	Standard number
0.0151	10	10
0.0729	25	25
0.1502	50	50
0.2711	100	100

In table 3, the results have been presented after analysis of blood samples, such as mean BLLs, standard deviation (SD), etc. in addict and non-addict groups. Distribution of BLL in addicted patients was significantly higher than non-addicted group.

Table 4 shows the data on BLLs based on the type of substance used, the method of consumption, daily intake, duration of dependence, and age group.

Kruskal-Wallis test was used to compare the BLLs of addicts in different age groups. Comparison of BLLs in two groups of women and men was done using t-test. One-way analysis of variance (ANOVA) was used to compare other variables.

Discussion

The present study showed that in ICU patients, the mean BLL in the opium-addicted group was significantly higher than the non-opium-addicted group (37.15 ± 22.75 µg/dl and 3.58 ± 6.09 µg/dl, respectively) ($P < 0.050$). However, no significant relationship was found between the concentration of lead in the total blood and the type of substance and the method of consumption. According to the results of our study, there was not any relationship between duration of opium consumption and BLL.

Opium as a narcotic drug is more prevalent in Iran[17,20] and many of ICU patients in Kerman Province are opium-addicted.[11] The analysis of some opium samples has confirmed their remarkable lead levels.[14] Recently, there were many reports of lead poisoning and its severe adverse effects due to opium consumption in different parts of Iran.[3,21]

Some factors are known as risk factors for ICU patients' mortality and morbidity,[22] but the opium addiction and particularly lead poisoning due to opium abuse was not considered as a risk factor, although the lead poisoning can cause many problems such as anemia, organ failure, GI problems, and etc.[4] Thus through the present study, we compared the BLL in opium-addicted and non-opium-addicted patients who were admitted in ICU.

Table 3. Blood lead levels (BLLs) in two addict and non-addict groups

Groups under study	Mean ± SD	Frequency	Minimum	Maximum
Addict	37.15 ± 22.75	30	11.28	110.66
Non-addict	3.58 ± 6.09	31	0	8.63

SD: Standard deviation

Table 4. Blood lead levels (BLLs) of addicted patients according to type of substance, method of consumption, daily intake, duration of dependence, and age

Variable		Frequency	Mean ± SD	P
Type of used substance	Opium	21	38.46 ± 26.82	0.992
	Shireh	8	34.53 ± 9.92	
	Mixture	2	31.92 ± 4.98	
	Total	30	37.15 ± 22.75	
Method of consumption	Inhalation-stick	9	38.00 ± 24.62	0.164
	Opium pipe	3	75.43 ± 49.83	
	Oral	13	32.34 ± 8.63	
	Combination of methods	5	24.36 ± 6.56	
	Total	30	37.15 ± 22.75	
Daily intake (g/day)	< 2	18	41.78 ± 26.50	0.515
	> 2	12	29.70 ± 21.29	
Duration of dependence (year)	< 10	19	41.59 ± 26.32	0.478
	10-20	8	30.00 ± 13.14	
	> 20	3	26.11 ± 8.39	
Age (year)	< 20	1	60.24 ± 4.32	0.297
	20-40	15	28.99 ± 6.09	
	> 20	14	43.65 ± 31.46	

SD: Standard deviation

Khatibi-Moghadam et al. reported a significant relationship between opium addiction and BLL, but there was not any relationship with urine lead level. Also in contrast to our results, they showed a positive relation between duration of opium consumption and BLL.[22]

Similar to our findings, Salehi et al. reported a significant higher level of BLL in opium-addicted patients rather than non-addicted patients.[23]

In the study of Hayatbakhsh Abbasi et al., the serum level of lead in the inhaled opium-addict group was compared with the control group, and although the serum level of lead in the addicted group was higher than the control group, unlike to our results, this difference was not statistically significant.[8]

Similar to the results of present study, Meybodi et al. did not conclude any association between the duration of addiction and levels of lead in blood.[16]

We did not find any significant relationship between BLL and method of opium consumption, as Hayatbakhsh Abbasi et al.;[8] it may be due to small sample size.

Limitation of the present study is that some ICU patients have low consciousness and therefore, there is a risk of unreliable information obtained from the patient and sometimes patient attendants (information such as drug abuse or duration of dependence).

Conclusion

Although we did not find any significant relation between method of opium consumption and BLL, BLL in opium addicts was significantly higher than non-opium-addict ICU patients. Therefore, screening of blood lead concentration is helpful for opium-addicted ICU patients in areas with high prevalence of opium consumption.

Conflict of Interests

The Authors have no conflict of interest.

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مقایسه سطح خونی سرب در بیماران وابسته و غیر وابسته به مواد مخدر بستری در بخش مراقبت‌های ویژه بیمارستان شهید باهنر کرمان

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مقاله پژوهشی

چکیده

مقدمه: بیشترین ماده مخدر مورد مصرف در ایران، تریاک است. گزارش‌های زیادی در مورد مسمومیت با سرب در مصرف‌کنندگان تریاک وجود دارد. مسمومیت سرب طیف وسیعی از علایم را در برمی‌گیرد که بروز و شدت آن به غلظت و مدت تماس با سرب بستگی دارد. پژوهش حاضر با هدف بررسی و مقایسه مقادیر سرمی سرب در دو گروه بیماران وابسته و غیر وابسته به مواد مخدر بستری شده در بخش مراقبت‌های ویژه بیمارستان شهید باهنر کرمان انجام شد.

روش‌ها: در این مطالعه، دو گروه ۳۰ نفره از بیماران مورد مقایسه قرار گرفتند. گروه اول بر اساس تعریف Diagnostic and Statistical Manual of Mental Disorders-4th Edition (DSM-IV)، بیماران وابسته به تریاک و گروه دوم بیماران بدون سابقه سوء مصرف مواد مخدر بودند. داده‌های بیماران با استفاده از پرسش‌نامه جمع‌آوری شد. پس از تعیین غلظت خونی سرب با کمک اسپکتروفتومتری جذب اتمی با کوره گرافیت، داده‌ها با استفاده از آزمون‌های آماری مورد تجزیه و تحلیل قرار گرفت.

یافته‌ها: اختلاف معنی‌داری بین گروه‌های وابسته و غیر وابسته در سطح سرمی سرب وجود داشت ($P > ۰/۰۵۰$)، اما بین غلظت سرب خون و عوامل دیگر مانند سن، جنسیت، نوع تریاک، روش مصرف، میزان استفاده و مدت وابستگی ارتباط معنی‌داری مشاهده نشد ($P < ۰/۰۵۰$).

نتیجه‌گیری: بسیاری از بیماران وابسته به تریاک بستری در ICU کرمان سطح خونی سرب بالایی به علت آلودگی مواد مخدر به سرب داشتند که می‌تواند برای این بیماران مضر باشد.

واژگان کلیدی: تریاک، مسمومیت با سرب، واحد مراقبت‌های ویژه

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