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

Mehdi Ahmadinejad1&, Maryam Ahmadipour2, Kouros Divsalar3&

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 < 0.05), 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

Citation: Ahmadinejad M, Ahmadipour M, Divsalar K. Blood Lead Level in Opiate Addicts Hospitalized in the Intensive Care Unit of a Trauma Referral Center in Kerman, Iran. Addict Health 2019; 11(1): 11-7.

Received: 22.08.2018

Accepted: 27.10.2018

1- Department of Anesthesiology, School of Medicine, Kerman University of Medical Sciences, Kerman, Iran
2- Department of Pediatric, School of Medicine, Kerman University of Medical Sciences, Kerman, Iran
3- Neuroscience Research Center, Institute of Neuropharmacology, Kerman University of Medical Sciences, Kerman, Iran

Correspondence to: Kouros Divsalar, Email: kourosh_divsalar@yahoo.com
**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),\(^13\) 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, 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 Iran17,20 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.,9 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.

Acknowledgements

This research was supported by Neuroscience Research Center of Kerman University of Medical Sciences. We thank Professor Nozar Nakhee, epidemiologist of Kerman University of Medical Sciences, for comments that greatly improved the manuscript.

References

1. National Toxicology Program. Eleventh report on carcinogens: Lead (CAS no 7439-92-1) and lead compounds. Research Triangle Park, NC: U.S. Department of Health and Human Services, National Toxicology Program; 2004.
2. Azizi MH, Azizi F. Lead poisoning in the world and
Iran. Int J Occup Environ Med 2010; 1(2): 81-7.
3. Karrari P, Mehrpour O, Abdollahi M. A systematic review on status of lead pollution and toxicity in Iran; Guidance for preventive measures. Daru 2012; 20(1): 2.
4. Velez LI, O'Connell EJ. Heavy metals. In: Marx JA, Hockberger RS, Walls RM, Adams J, editors. Rosen's emergency medicine: Concepts and clinical practice. 8th ed. Philadelphia, PA: Elsevier Mosby; 2013.
5. Anderson NR, Gama R, Kapadia S. Herbal remedy poisoning presenting with acute abdomen and raised urine porphyrins. Ann Clin Biochem 2001; 38(Pt 4): 408-10.
6. Ibrahimi AS, Latif AH. Adult lead poisoning from a herbal medicine. Saudi Med J 2002; 23(5): 591-3.
7. Fatemi SR, Jafarzadeh F, Massarat E, Zali MR. A very severe poisoning of lead in inhaled and oral drug addicts. J Med Coun I R Iran 2009; 27(1): 117-20. [In Persian].
8. Hayatbakhsh Abbasi MM, Ansari M, Shahesmaeli A, Qaraie A. Lead serum levels in opium-dependent individuals. Addict Health 2009; 1(2): 106-9.
9. Hassanian-Moghaddam H. An educational and research opportunity for the largest university hospital poison control centers; Tehran and Cairo. Egypt J Forensic Sci 2013; 3(2): 64-5.
10. Katzung B. Basic and clinical pharmacology. Trans. Fatahollahi A, Sobhaniyan K. Tehran, Iran: Nasle Farda Publications; 2010. p. 693-709. [In Persian].
11. Ahmadi-Nejad M, Jaddi F, Dehghani MR, Divsalar K. Studying prevalence and pattern of taking narcotic and ecstasy drugs by patients admitted to special care centers of Shahid Bahonar Hospital, Kerman, Iran. Addict Health 2012; 4(1-2): 57-64.
12. Tetrault JM, O'Connor PG. Substance abuse and withdrawal in the critical care setting. Crit Care Clin 2008; 24(4): 767-88.
13. Aghaez-Afshar M, Khazaeli P, Behnam B, Rezazadeh-Kermani M, Ashraf-Ganjooei N. Presence of lead in opium. Arch Iran Med 2008; 11(5): 553-4.
14. Masoodi M, Zali MR, Ehsani-Ardakani MJ, Mohammad-Alizadeh AH, Aliasoffi K, Aghazadeh R, et al. Abdominal pain due to lead-contaminated opium: A new source of inorganic lead poisoning in Iran. Arch Iran Med 2006; 9(1): 72-5.
15. Khoshgoftar M. Lead poisoning associated with drug use; diagnosis and treatment. Addiction Medicine 2016; 3(12-13): 55-7. [In Persian].
16. Meybodi FA, Eslick GD, Sasani S, Abdolhosseyni M, Saezegar S, Ebrahimi F. Oral opium: An unusual cause of lead poisoning. Singapore Med J 2012; 53(6): 395-7.
17. Radfar SR, Nematollahi P, Farhoudian A, Noroozi A. Lead poisoning among opium users in Iran, a possible new emerging epidemic in the region. Iran J Public Health 2017; 46(8): 1152-3.
18. Sadeghi A, Soleimani H, Nasser-Moghadam S, Radmard A R. Lead contaminated opium as unusual cause of abdominal pain-case series. Iran J Radiol 2017; 14(Spec): e48278.
19. Ghazavi A, Solhi H, Moazzeni SM, Rafiee M, Mosayebi G. Cytokine profiles in long-term smokers of opium (Taryak). J Addict Med 2013; 7(3): 200-3.
20. Nakhaei N, Divsalar K, Meimandi MS, Dabirs S. Estimating the prevalence of opiates use by unlinked anonymous urine drug testing: A pilot study in Iran. Subst Use Misuse 2008; 43(3-4): 513-20.
21. Wolkewitz M, Vonberg RP, Grundmann H, Beyersmann J, Gastmeier P, Barwolff S, et al. Risk factors for the development of nosocomial pneumonia and mortality on intensive care units: Application of competing risks models. Crit Care 2008; 12(2): R44.
22. Khatibi-Moghadam H, Khadem-Rezaian M, Afshari R. Comparison of serum and urine lead levels in opium addicts with healthy control group. Hum Exp Toxicol 2016; 35(8): 861-5.
23. Salehi H, Sayadi AR, Tashakori M, Yazdandoost R, Soltanpoor N, Sadeghi H, et al. Comparison of serum lead level in oral opium addicts with healthy control group. Arch Iran Med 2009; 12(6): 555-8.
مقایسه سطح خونی سرب در بیماران وابسته و غیر وابسته به مواد مخدر بستری در بخش مراقبت‌های ویژه بیمارستان شهید باهنر کرمان

مهدی احمدی نژاد، مریم احمدی پور، گروه بیهوشی، دانشکده پزشکی، دانشگاه علوم پزشکی کرمان، کرمان، ایران
گروه اطفال، دانشکده پزشکی، دانشگاه علوم پزشکی کرمان، کرمان، ایران
مرکز تحقیقات علوم اعصاب، پژوهشکده نوروفارماکولوژی، دانشگاه علوم پزشکی کرمان، کرمان، ایران
نویسنده مسئول: کورس دیوسالار

چکیده

مقدمه: بیشترین ماده مخدر مورد مصرف در ایران، تریاک است. گزارش‌های زیادی در مورد مسمومیت با سرب در کننده‌های بیماران از تریاک وجود دارد. مسمومیت سرب طیف وسیعی از علائم را در بیماران پدید می‌آورد که به شدت از غلظت و مدت تماس با سرب بستگی دارد. پژوهش حاضر با هدف بررسی مقایسه مقدار 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 از بیماران مورد مقایسه قرار گرفتند. گروه اول به اساس تعیین سرب در بیماران مبتلا به تریاک و گروه دوم بیماران بدون سابقه مصرف مواد مخدر بودند. داده‌های بیماران از پرسشنامه‌هایی به‌دست آمده بایستد تا در نظر گرفته شود. پس از تعیین غلظت خونی سرب با کمک اسپکتروفوتومتری جذب اتمی با کوره گرافیت، داده‌ها با استفاده از آزمون‌های آماری مورد تحلیل قرار گرفت.

یافته‌ها: اختلاف معنی‌داری بین گروه‌های وابسته و غیر وابسته در سطح سرب وجود داشت (P < 0.05). 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 > 0.05).

نتیجه‌گیری: برای این بیماران وابسته به تریاک بستری در ICU کوره سرب خونی سرب بالایی به علت الودگی مواد مخدر بستری وابسته می‌باشد.

واژگان کلیدی: تریاک، مسمومیت با سرب، وابستگی به مواد مخدر

ارجاع:
1- احمدی نژاد، مهدی، احمدی پور، مریم، و دیوسالار، کورس. مقایسه سطح خونی سرب در بیماران وابسته و غیر وابسته به مواد مخدر بستری در بخش مراقبت‌های ویژه بیمارستان شهید باهنر کرمان. مجله اعتیاد و سلامت 1397؛ 11(41) 11-17.
2- نام ناگفته خواندگان، نویسنده مسئول: کورس دیوسالار

Email: kouroso_divsalar@yahoo.com

Addict Health, Winter 2019; Vol 11, No 1

http://ahj.kmu.ac.ir, 05 January