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Brief Report

Opium - an Unusual Cause of Lead Poisoning: A Case Series

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ABSTRACT

Background:
Lead is a widely distributed metal in the environment and can be toxic to the human body. Lead poisoning has different clinical features. Recently, there have been increasing reports about lead poisoning following oral opium use. We report on a series of patients presented with abdominal pain attributable to lead-contaminated opium.

Materials and Methods:
We recruited all patients presented with abdominal pain and opium addiction, referring to the emergency room of a university-affiliated hospital. Demographic, clinical, and laboratory data, as well as abdominal imaging and blood lead level, were collected for all patients.

Results:
Of 208 patients enrolled, 183 were male (88%), and the mean age was 51.2 ± 14.1 years. They all had a minimum of one-year history of oral opium consumption. 112 (53.8%) patients had a blood lead level of more than 20 µg/dL, and 22 patients (10.5%) had a blood lead level of more than 100 µg/dL. Half of the patients had a history of several hospital admissions for abdominal pain. Among patients with a lead level of more than 20 µg/dL, 87 (78%) had anemia with a hemoglobin level of less than 13 g/dL (mean hemoglobin 11.1 ± 2.5 g/dL).

Conclusion:
Our case series highlights the role of opium administration as a possible emerging cause of acute abdominal pain of unknown cause.

Keywords: Addiction, Lead poisoning, Opium

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INTRODUCTION

Human being has acknowledged lead poisoning since ancient times. The very first description dates back to more than 2000 years ago (1). During the previous century, the industrial revolution extended lead applications to different types of industries and as a result, occupational and household exposures are considered the main sources of lead poisoning (2,3).

Lead poisoning may happen through ingestion, inhalation, and cutaneous contact with lead compounds. The main site of lead absorption is the respiratory tract through which more than 95% of lead content will be absorbed (4,5). Lead poisoning or plumbism has various

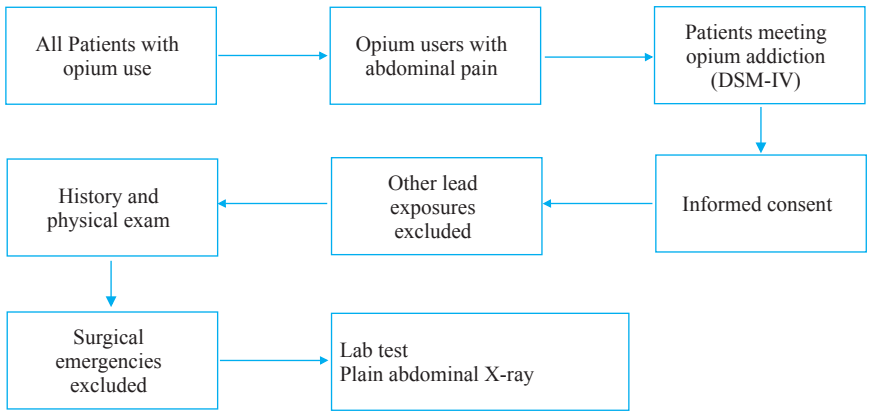

Fig.1: Patient selection and diagnostic workup

clinical features; many of them are non-specific, including anemia, abdominal pain, constipation, myalgia, headache, and neurological problems (6-9). Timely diagnosis of this condition is therefore intriguing, and for some common symptoms like recurrent abdominal pain may lead to preventable broad assessments such as laparotomy (10,11).

More recently, there have been reports of such presenting symptoms in opium addict populations (7,12,13). Some studies have pointed to lead toxicity in heroin users (14-16), and increasing reports are now being published about lead poisoning following oral opium intake, especially in Iran. On the other hand, some studies confirmed the presence of a high amount of lead contamination in opium samples in this country (6,7).

Lead poisoning due to opium abuse was mostly reported as case reports or small case series.

MATERIALS AND METHODS

Herein, we report on laboratory data of a case series of Iranian opium addicts presenting to the emergency room (ER) with severe abdominal pain.

In this cross-sectional study, we evaluated all opium-addicted patients presenting with acute severe abdominal pain to the ER of a university-affiliated hospital, Tehran, Iran, over a period of 23 months from March 2016 to Feb 2018. Patients with at least 1-year history of addiction (according to the Diagnostic and Statistical Manual of Mental Disorders-fourth edition [DSM-IV] criteria) were identified. All patients were interviewed. Patients with known risk factors of lead poisoning and known previous history of lead poisoning were excluded. A thorough medical, drug, and habitual history were taken, and a complete physical examination was performed for each patient. Serum lead level was measured in the Atomic Energy Organization laboratory using absorption spectrophotometry. Figure 1 shows the used diagnostic workup protocol.

Standard plain abdominal radiography (in supine and upright position) was performed in all patients. We acquired electromyogram (EMG) and nerve conduction velocity (NCV) study for patients with prominent focal neurological deficits. All opium users were advised to quit opium consumption, and treatment with a suitable chelator was started in lead level greater than 100 µg/dL or in the presence of encephalopathy or serious neurological symptoms. For better clarification, we classified blood lead level (BLL) as "low" and "high" using 20 µg/dL as a cut-off value.

RESULTS

Of the 208 patients recruited, 183 were men (88%) with a mean age of 51.2 ± 14.1 (range: 18-92) years. Table 1 shows different complaints of patients other than abdominal pain.

Laboratory data demonstrated microcytic anemia (MCV<80 fL) in 32 patients (15.4%).

Mean BLL was 43.6 ± 50.9 µg/dL (range: 2-316 µg/dL). Median BLL was 24.1 µg/dL, and data were right-skewed (IQR = 7.1-61.9). BLL lower than 20 µg/dL were observed in 96 patients (46%) with a mean of 7.5 ± 4.8 µg/dL (Table 2). Mean corpuscular volume (MCV) was the only other variable with a significant

Table 1: Frequency of presenting complaint in participants

Complaint	Number	Frequency (%)
Constipation	208	100
Fever	35	17
Gastrointestinal bleeding	18	9
Limb weakness	12	6
Nausea/vomiting	10	5

Table 2: Blood lead level in patients

BLL (mcg/dL)	Patients number (%)
20 >	96 (46.1)
20-39	26 (12.5)
40-49	15 (7.2)
50-79	36 (17.3)
80-100	13 (6.6)
100 <	22 (10.6)

BLL: Blood Lead Level

difference among patients with high or low BLL (84.8 vs. 87.8 fL; $p = 0.02$). Table 3 shows the biochemical profile and BLL in the participants.

Spearman's r revealed an association between BLL and MCV (r = 0.15; $p = 0.03$). However, no significant association was seen between BLL and hemoglobin (r = -0.02; $p = 0.74$).

We started intravenous dimercaprol as a chelating agent due to encephalopathy for three patients (2.5%) from whom only one person with BLL = 76 µg/dL died. All other patients were discharged and referred to a trained psychiatrist for quitting opium. The mortality rate was not statistically different between patients with high BLL and low BLL ($p = 0.5$). Similarly, no significant difference was observed regarding Aspartate Aminotransferase (AST), Alanine Aminotransferase (ALT), bilirubin, and hemoglobin levels, although all of them were slightly higher in patients with higher BLL (Figure 2).

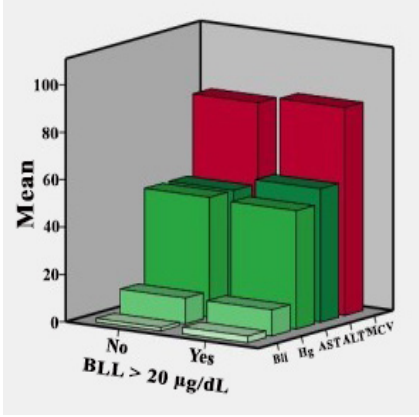

Fig.2: Mean value of biochemical profile between two blood lead level groups

DISCUSSION

Occupational exposure is the main source of lead toxicity in humans. Lead poisoning has various and mostly non-specific clinical features, including anemia, abdominal pain, constipation and/or neurological signs (17,18). Lead can readily be absorbed in gastrointestinal and respiratory systems, which results in tissue lead accumulation (2).

Since BLL in most of the patients involved in this study was above 10 µg/dL, our result shows that oral opium intake is a new non-occupational source of lead toxicity.

The main cause of lead contamination in opium are dealers who can access lead easily and with minimal price, then add it to opium samples to make it heavier. BLL greater than 5 µg/dL is considered high. Lead levels of more than 10 µg/dL have resulted in symptoms and signs of lead poisoning, particularly in children. BLL above 45 µg/dL almost needs medical considerations (18).

Abdominal pain and discomfort observed in opium addicts might be due to lead accumulation in bowels, which might be severe enough to cause unnecessary laparotomy as seen in one of our patients (9-11). Nearly 10% of our patients experienced neurological problems, which is also in concordance with previous studies (6,14).

The imaging findings of lead poisoning have been described in the literature by a focus on the neurological or osseous manifestations. Lead related encephalopathy may cause a constellation of abnormalities in computed tomography (CT) scan or magnetic resonance imaging (MRI) including intracranial calcifications, subcortical white matter demyelination, cerebellar edema or symmetric involvement of thalami and lateral putamen (19-22). Dense metaphyseal bands or tooth lead lines are typical skeletal findings of lead poisoning in young children caused by inhibition of osteoclastic activity (23). However, published data about the imaging findings of lead poisoning in the gastrointestinal tract are lacking.

Table 3: Mean serum biochemistry and lead level in participants

Variable	Mean blood level ± SD			*p* value
	Total	Low BLL*	High BLL*	
Number (n)	208	96	112	
Alanine aminotransferase (IU/L)	53.7 ± 88.0	50.6 ± 98.4	56.4 ± 78.4	0.64
Aspartate aminotransferase (IU/L)	50.2 ± 76.4	50.6 ± 98.6	50.0 ± 50.6	0.95
Alkaline phosphatase (IU/L)	311.9 ± 98.2	330.4 ± 450	296.2 ± 255.8	0.49
Bilirubin (mg/dL)	2.1 ± 9.9	1.4 ± 2.8	2.8 ± 13.3	0.32
Hemoglobin (g/dL)	10.9 ± 2.8	10.9 ± 2.9	11.0 ± 2.8	0.77
MCV (fL)	86.4 ± 9.8	84.8 ± 9.9	87.8 ± 9.5	0.02
Blood lead level (µg/dL)	43.6 ± 50.9	7.5 ± 4.8	74.6 ± 52.3	0.00

*The cut-off for discriminating high and low BLL was 20 µg/dL
BLL: blood lead level; MCV: mean corpuscular volume; SD: standard deviation

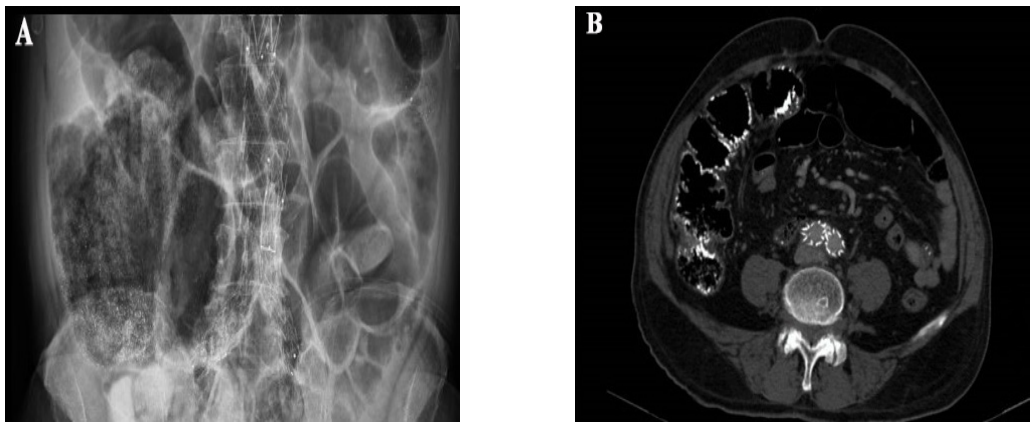

Fig.3: Plain abdominal radiograph (A) and computed tomography (CT) scan (B) of a 64-year-old male patient with a blood lead level of 89 µg/dL. Several tiny metallic densities can be seen in the colon and ileal loops.

Imaging assessment of patients in this case series included plain abdominal radiographs and abdominopelvic CT scans if indicated. Lead particles were visualized as multiple tiny hyperdense foci in the colon with metallic appearing density. The presence of lead particles in ileal loops other than colon was depicted in those subjects with higher BLL (Figure 3). The most sensitive imaging modality for visualization of lead particles in the bowel is abdominopelvic CT without oral contrast agent because lead particles can be overlooked by using positive oral contrast in CT. However, plain abdominal radiography could also be helpful in making the correct diagnosis in emergency settings. This is caused by the significantly higher density of lead in radiographs in comparison with the fecal material or even previously used iodine-based oral contrast materials.

Image findings should be interpreted appropriately, especially in oral opium users who may not have convincing surgical or non-surgical causes for abdominal pain based on clinical and para-clinical data. Recently there have been reports of lead toxicity arising from drug use, including heroin or methamphetamine (14,24). There are also studies pointing to opium as a possible source (12,13). Different ways of lead contamination are suggested, such as lead adulteration to increase weight and even soil contamination (7,25). Our research, as a large case series put emphasis on opium abuse as an emerging cause of lead toxicity.

In conclusion, measuring blood lead concentration might be appropriate in oral opium addicts, particularly those who have abdominal pain. Lead poisoning should be considered in differential diagnosis of such

patients. As well, our case series highlights the role of imaging in diagnosing possible lead poisoning among opium users presented with acute abdominal pain of unknown cause.

CONFLICT OF INTEREST

None of the authors declare any conflict of interest.

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