

ORIGINAL RESEARCH

Blood lead level and related factors in ADHD patients of Loghman Hakim Hospital in 2016- 2017

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Abstract

Introduction: Lead is a highly neurotoxic metal mainly in early life. In this study we investigate blood lead level (BLL) in children with attention deficit/ hyperactivity disorder (ADHD) and some related factors mainly opium exposure, as a source of lead exposure in recent years in Iran.

Materials and Methods: In this cross-sectional descriptive study children & adolescents aged < 18 years in Child Neurology Clinic of Loghman Hakim hospital with ADHD criteria according to DMS-V in Tehran-Iran were studied. Lead Care II checked BLLs using 0.5-milliliter heparinized venous blood. Demographics characteristic and some related factors such as old housing, parents' job, pica, opium exposure were asked and analyzed.

Results: Fifty-one children and adolescents <18 years, 25.5% female and 74.5% male with mean ages of 71.4 ± 30.3 months entered the study. Mean BLL was 6.34 ± 2.63 $\mu\text{g/dl}$. The mean BLL in 100 normal children in Loghman Hakim hospital was 3.4 $\mu\text{g/dl}$. Mean BLL was $6/57$ $\mu\text{g/dl}$ in boys and $6/60$ $\mu\text{g/dl}$ in girls, ($p=0.973$). Also, the difference in mean BLLs were not significant in terms of living place, sex, age, pica and parents job. Totally, 43 patients (84.3%) of the study samples had $\text{BLL} \geq 5$ $\mu\text{g/dl}$. The highest blood lead level in our patient was 20.1 $\mu\text{g/dl}$. Eighteen (32.7%) of our patients have positive history for opium exposure in their family that BLL in this group was 5.84 $\mu\text{g/dl}$ in comparison 6.95 $\mu\text{g/dl}$ in cases with no opium exposure, that there were not statistically significant. ($p=0.148$)

Conclusion: Based on the results of our study, clinicians are encouraged to take accurately attention about possible lead exposure and to rule out environmental hazards when evaluating for ADHD, particularly in young children and laboratory investigation for this toxin in high-risk cases and further researches recommended.

Keywords: Lead poisoning, ADHD, Opium exposure, Children.

Introduction

Lead is one of the most common environmental invisible neurotoxic poisons mainly for infants and children, with significant irreversible neurologic effects on developing brain like isolated seizures, chronic hyperactive behavior/attention deficit disorder, developmental delay, progressive loss of cortical function simulating degenerative cerebral disease, tremor, hearing loss, peripheral neuropathy, lowered IQ, acute lead encephalopathy and increased ICP (1, 2). The exact prevalence of lead poisoning in children in our country is not clear but it is estimated that this exposure is not descending in recent years in developing countries. Numerous sources of lead exposure exist like environmental, occupational, or additional. Nowadays, lead-contaminated opium has been determined as a route of lead poisoning in our country and inhalational exposure to lead-contaminated parent's opium may be a route of indirect poisoning in children (3). On the other hand, ADHD (attention deficit hyperactivity disorder) is one of the most common psychiatric disorders of children with prevalence of 8-9% (4) and also it is a common disorder in our country. The clinician should consider testing for lead in ADHD children who are exposed to environmental factors that might put them at risk (substandard housing, old paint, proximity to a highway years ago) but opium exposure is not consider as a risk factor in common textbooks (4, 5). Lead as a neurotoxin is reported to cause abnormal behaviors like ADHD but the level of BLL & results of different studies are challenging. This correlation was studied in children but the results were variable and we have not found any study about ADHD, lead poisoning and factors related to parental opium use (6). The aim of our study was the descriptive evaluation of BLL in children with ADHD in Loghman-Hakim Hospital (Child Neurology Clinic) and some related factors like opium exposure. Is it necessary to test for lead poisoning in ADHD child exposed to opium?

Materials and Methods

In this cross-sectional descriptive study children & adolescents aged < 18 years in Child Neurology Clinic of Loghman -Hakim hospital with ADHD criteria according to

DMS-V in Tehran, Iran were studied. Lead Care II checked BLLs using 0.5-milliliter heparinized venous blood and (Figure 1) the tests were done only in 3 minutes. Demographics characteristic, ADHD types and duration, living place and some related factors such as old housing (<or>10 years), father and mother or his/her own job's, history of pica, opium exposure and some other factors were asked and with SPSS software version 16 were statistically analyzed. The ethics committee of Shahid Beheshti University of Medical Sciences approved this study with ethic code: IR.SBMU.RETECH.REC.1396.723.

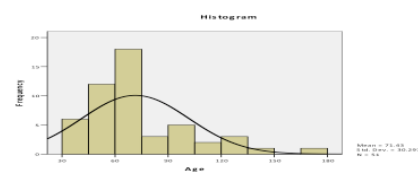


Figure 1 :LeadCare®II Blood Lead Analyzer.

Results

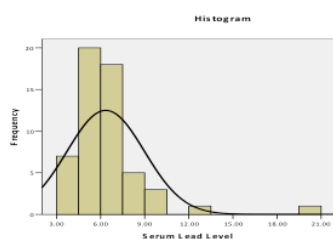
Out of 51 children & adolescent, 13 (25.5%) were female and 38 (74.5%) were male with mean ages of 71.4 ± 30.3 months (min 30 months and max 180months) in our study (Figure 2).

Figure 2: Age distribution in ADHD in Loghman Hakim Hospital, 2016-7



Mean BLL was 6.34 ± 2.63 $\mu\text{g/dl}$. The mean BLL in 100 normal children in Loghman Hakim hospital who referred for growth monitoring was 3.4 $\mu\text{g/dl}$. Mean BLL was 6.57 $\mu\text{g/dl}$ in boys and 6.60 $\mu\text{g/dl}$ in girls, ($p=0.973$). Totally, 43 patients (84.3%) of the study samples had $\text{BLL} \geq 5$ $\mu\text{g/dl}$. The highest blood lead level in our patient was 20.1 $\mu\text{g/dl}$ in one case who lived in an industrial zone ($p=0.148$) (Figure 3).

Figure 3: Mean BLL in ADHD in Loghman|Hakim hospital, 2016-7



BLL was $7.04 \mu\text{g/dl}$ in hyperactive in comparison of $5.48 \mu\text{g/dl}$ in only attention deficit cases, that was statistically significant ($p=0.651$). Also, the difference in mean BLLs were not significant in terms of living place, sex, age, pica, and parents job (Table 1).

Table 1: Mean BLL & some variables in ADHD in Loghman-Hakim hospital, 2016-7

Variable	Mean BLL	p-value
Pica	Yes (n=21): $6.15 \mu\text{g/dl}$	$p=0.321$
	No (n=30): $6.89 \mu\text{g/dl}$	
Living Place	<10 yrs (n=24): $6.76 \mu\text{g/dl}$	$p=0.651$
	>10 yrs (n=26): $6.42 \mu\text{g/dl}$	
Father's Job	Self-employed (n=38): $6.74 \mu\text{g/dl}$	$p=0.536$
	Government-employed (n=13): $6.25 \mu\text{g/dl}$	
Mother's Job	Employed (n=45): $6.21 \mu\text{g/dl}$	$p=0.713$
	Unemployed (n=6): $6.63 \mu\text{g/dl}$	

Eighteen (32.7%) of our patients have positive history for opium exposure in their family that BLL in this group was $5.84 \mu\text{g/dl}$ in comparison with $6.95 \mu\text{g/dl}$ in cases with no opium exposure; that there were not statistically significant ($p=0.148$). Totally, according to the obtained results it may be concluded that over 3/4 of patients with ADHD would have abnormal lead level that is related to clinical symptoms.

Discussion

There are some studies that describe the relationship between BLL and ADHD such as Maryam Daneshparvar et al. Results in 16 out of 18 studies revealed a significant association between BLL and one of the types of ADHD (7). Despite this reports there are some reports that 't support this results, also the level of lead is variable in different studies.

Noushin Parvaresh et al. reported that ADHD, major depressive disorder, generalized or separation anxiety disorder, obsessive-compulsive disorder and phobia in children of

addicted parents were more common than a non-addicted parents (8).

Maryam Daneshparvar et al. reported that blood lead level (BLL) of less than $10 \mu\text{g/dl}$ in children has been attributed to at least one type of ADHD.

Jae Hong Park et al. reported that Korean children with ADHD has blood lead concentrations that were significantly higher than those of the controls ($1.90 \pm 0.86 \mu\text{g/dl}$ vs. $1.59 \pm 0.68 \mu\text{g/dl}$, $p=0.003$) (7).

In another study in 578 Mexican 6–13 years by Siying Huang et al. children, Mean \pm SD blood lead levels were $3.4 \pm 2.9 \mu\text{g/dl}$. In that population of Mexican children, they mentioned that blood lead level among children with low exposure ($\leq 5 \mu\text{g/dl}$) was positively associated with hyperactive/impulsive behaviors, but not with inattentiveness (9).

Our country involved in lead poisoning epidemic in recent years related to opium alteration with lead and many cases of lead poisoning and even deaths in addicted adult patients, Talat Ghane et al. published by WHO in 2018 and Salehi H et al. (10, 11). Children who lived with addicted parents are indirect victims of lead poisoning from inhalation. Also, there are some studies related to lead poisoning & BLL in children in Loghman-Hakim hospital, the mean BLL in children in Nasim Zamani's study in 2017 was $3.4 \mu\text{g/dl}$ and in 25% above $5 \mu\text{g/dl}$, that it was lower than mean BLL in our ADHD patients (12). We have not find any article related to opium exposure as a source of lead poisoning in ADHD patients.

Every effort should be made to eliminate childhood pre-exposure. Despite the mean blood lead level dropped 78%, from 12.8 to 2.8 micrograms/dL during the time period between 1976 and 1991 in US population the recent small studies in our country showed that BLL in higher (13). Another study in Tehran, Iran that mean BLL in children was $3.4 \mu\text{g/dl}$ in 2017 (10).

Clinicians are encouraged to take accurately attention about possible lead exposure and to rule out environmental hazards when evaluating for ADHD, particularly in young children. Though lead is neither a necessary nor a sufficient cause of ADHD, it appears to be one contributor and co-existing factor that

treatment strategies may have some rules in managing this disorder, thus ongoing researches is needed into many aspects of the disorder.

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Conflict of interest

Authors declare no conflict of interest.

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