

Assessments of blood lead levels in children with febrile convulsion

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Abstract

Background: Lead elements have an adverse effect on human health. The most important complications of lead poisoning are disorders of nervous system particularly seizure. This study aimed to evaluate the blood lead levels and its association with convulsion in a group of hospitalized febrile children.

Methods: In this analytic cross-sectional study, 60 hospitalized febrile children with 1- 60 month old participated in the study via non-probability convenience sampling method. All of the information included sex, age, weight, blood lead levels and history of convulsion gathered in the questionnaire. Finally all of data were statistically analyzed.

Results: 66.7% of samples were male and 33.3% were female. The mean age was 32.57 ± 38.27 months and the mean weight was 13.04 ± 9.61 kg. The Mean and Standard deviation of Blood lead level was 4.83 ± 3.50 $\mu\text{g/dL}$. 10% of samples had lead levels greater than $10 \mu\text{g/dL}$. 53.3% of patients have convulsion and other don't have it. Blood lead levels was 4.91 ± 3.65 $\mu\text{g/dL}$ in children with convulsion and 4.73 ± 3.38 $\mu\text{g/dL}$ in children without it; the difference was not significant ($p=0.8$).

Conclusion: Overall, no significant association was found between blood lead levels and convulsion.

Keywords: Lead, Convulsion.

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Introduction

Lead is an element that expanded on the environment as a result of human activity during the past thousands of years. Lead poisoning is due to increased levels of lead in the body (1) and hasn't specific signs or symptoms. Lead is found in a variety of organs including the heart, bones, intestines, kidneys and nervous system, and enters in the body via air, water, soil and food (2-4); but food is the main way of entering,

through contaminated grains and vegetables.

Years ago, literature emphasized on the toxic effects of lead including infertility, miscarriage and premature birth. Lead toxicity interferes with the normal development of central and peripheral nervous system (5). Lead can cause nervous system disorders of brain development in children. Increase in blood lead levels over than 10 microgram per deciliter can decrease the

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memory, intelligence quotient, focus and attention (5-7).

Various studies have shown that high levels of blood lead in pregnant women, even in limited quantities, can increase this element in the fetal blood (9-10). In other studies it was concluded that brain edema and finally irreversible brain damage may result from exposure to high levels of lead (11,12).

In all studies, it is concluded that lead poisoning in children causes severe disorders in the nervous system and leads to neuro developmental disabilities which may result in sensory, motor and cognitive impairments (13,14,21). Seizures are the prevalent nervous disorders and all of seizures can result from exposure to variant poisons such as lead (21). Febrile convulsions are seizures that appear during the course of an illness with a high fever in a child (21). Therefore, it is important to examine the association between febrile convulsions and exposure to the lead. The diagnostic scale for lead poisoning is measuring the blood lead levels. A study in patients with amyotrophic lateral sclerosis (ALS) showed a significant association between lead levels in plasma and cerebrospinal fluid. Many studies in children have been done on blood lead levels, but there are few researches on the cerebrospinal fluid lead levels (15-17). Assessment of cerebrospinal fluid levels and plasma levels of lead can help to further understanding of the mechanisms of its effects on the brain.

In some parts of the world including major cities of Iran, the air contains high level of emissions, and lead is the important ingredient in the emissions. Tehran is an industrial city and there is high level of lead in the air of Tehran (18).

This study investigated the blood lead concentration and its association with con-

vulsion in a group of febrile children that admitted to the pediatric ward of Rasoul Akram Hospital and Bahrami hospital in Tehran in the year 2012 AD.

Methods

This cross-sectional study conducted in children admitted to pediatric ward of Rasoul Akram Hospital and Bahrami Hospital in Tehran. Research field consisted of hospitalized babies aged 1-72 months whom fever was detected by physical examination. After permission from the university's ethic committee and hospital authorities, sixty babies, enrolled to the research via non-probability sampling (convenience method). A questionnaire was designed for data collection.

Following the informed consent of all Parents, all of babies underwent blood sampling. Then blood samples collected in the Propylene heparinized tubes. The blood lead levels measured by atomic absorption spectrometry method, then these values enrolled in the questionnaire. Also other samples information including gender, age, weight and history of seizures recorded in the questionnaire.

Statistical Analysis

Finally all of data transferred to the SPSS version 20 software for statistical analysis. P values of lower than 0.05 were considered statistically significant.

Results

A total of 60 cases of febrile children enrolled in this study. 40 of the samples (66.7%) were male and 20 samples (33.3%) were female. The mean and standard deviation of sample's age was 32.57 ± 38.27 months, ranging from one month to 168 months (14 years). The mean and standard deviation of sample's weight was 13.04 ± 9.61 kg.

Table 1. Frequency of sex in samples of two groups (with and without seizure)

Outcome	Sex		p
	Female	Male	
with seizure	13 (41 %)	19 (59 %)	0.27
without seizure	7 (25 %)	21 (75 %)	

Table 2. Frequency of age in samples of two groups (with and without seizure)

Outcome	Age (months)		p
	Mean	standard deviation	
with seizure	19.18	15.67	0.007
without seizure	48.44	50.69	

Table 3. Frequency of weight in samples of two groups (with and without seizure)

Outcome	Weight (kg)		p
	Mean	standard deviation	
with seizure	10.62	3.80	0.053
without seizure	15.90	13.16	

Table 4. Frequency of blood lead levels in samples of two groups (with and without seizure)

Outcome	blood lead levels (microgram per deciliter)		p
	Mean	standard deviation	
with seizure	4.91	3.65	0.8
without seizure	4.73	3.38	

The mean and standard deviation of sample's blood lead level was $4.83 \pm 3.50 \mu\text{g/dL}$. The highest and lowest blood lead level in all samples was 14.80 and $0.3 \mu\text{g/dL}$. According to international standards, amounts of blood lead levels in 6 cases (10%) was greater than $10 \mu\text{g/dL}$ and in 54 cases (90%) was less than $10 \mu\text{g/dL}$.

In general, seizure was found in 32 cases (53.3%) and other cases (46.7%) were seizure free. In samples with seizures, the mean and standard deviation of sample's blood lead level was $4.91 \pm 3.65 \mu\text{g/dL}$, and 4 cases of samples with seizures (12.5%) had blood lead levels above $10 \mu\text{g/dL}$.

In samples without seizures, the mean and standard deviation of sample's blood lead level was $4.73 \pm 3.38 \mu\text{g/dL}$; The 2 cases without seizures (7.14%) had blood lead levels above $10 \mu\text{g/dL}$.

The mean of sample's blood lead levels in children with seizures and without seizures wasn't significant difference ($p = 0.8$). According to international standards (blood lead levels above and below the $10 \mu\text{g/dL}$), wasn't significantly different between two groups ($p = 0.67$).

Tables 1 to 4 show the Frequency of variables and the P-value corresponding to the difference between two groups (with seizure and without seizure).

Discussion

This study showed that blood lead levels in babies with fever and a seizure (febrile convulsion) has no significant difference with those without seizure. The results of this study is similar to findings of some other studies have concluded that higher levels of lead in the blood can cause neurological symptoms. In one study, noted that blood lead levels over than $10 \mu\text{g/dL}$, may decreased intelligence and concentration, and impaired short term memory. In that study, blood lead levels of patients was not associated with fever and age of patients (3). The result of some other studies is different to the present study. In one study, 2.1% of the children and 1.3 % of adults have blood lead levels above $10 \mu\text{g/dL}$,

that was lower than in our study (19). In one study, blood lead levels in children with neurologic symptoms such as seizures was $19.3 \mu\text{g/dL}$, compared with $11.69 \mu\text{g/dL}$ in the control group; and Blood lead levels in both groups were higher than in our study (20). In some previous studies, high levels of blood lead levels have been associated with seizures in children. The study of Woolf et al. found that trace amounts of lead (less than $10 \mu\text{g/dL}$) can cause neurological disorders (4). But Talia Sanders study emphasizes that lead can Passes from to blood - brain barrier in children. Meyer and colleagues emphasizes that lead can

cause seizures, coma and death in the children (6). In the study by Bellinger, it was seen that severe intelligence decline and academic impairment is associated with less than 10µg/dL of blood lead levels. Also in this study it was concluded that there is no safe level of lead exposure, and contact in low amounts on children causes neurodevelopment disorders; so primary prevention of lead exposure is the most important mechanism (7).

Conclusion

In this study, febrile convulsion in babies has no significant relationship with blood lead levels. It is recommended that future studies be done by more samples to validate the results and to increase the ability of generalize the results to other populations. Moreover, the association of seizures and other neurological disorders should be evaluated with lead levels in various samples such as cerebrospinal fluid.

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