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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±9.61kg. The Mean and Standard deviation of Blood lead level was 4.83±3.50µg/dL. 10% of samples had lead levels greater than 10µg/dL. 53.3% of patients have convulsion and other don't have it. Blood lead levels was 4.91±3.65µg/dL in children with convulsion and 4.73± 3.38µg/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 convulsion 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 transfered 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 ± 9.61kg.

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±3.50µg/dL. The highest and lowest blood lead level in all samples was 14.80 and 0.3 µg/dL. According to international standards, amounts of blood lead levels in 6 cases (10%) was greater than 10µg/dL and in 54 cases (90%) was less than 10µg/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± 3.65µg/dL, and 4 cases of samples with seizures (12.5%) had blood lead levels above 10µg/dL.

In samples without seizures, the mean and standard deviation of sample's blood lead level was 4.73 ± 3.38 µg/dL; The 2 cases without seizures (7.14%) had blood lead levels above 10µg/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 10µg/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 10µg/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 10µg/dL,

that was lower than in our study (19). In one study, blood lead levels in children with neurologic symptoms such as seizures was 19.3µg/dL, compared with 11.69µg/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 10µg/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.

References

1. Aub JC, Fairhill LT, Minot AS, Reznikoff P, Hamilton A. Lead Poisoning. Medicine Monographs. Volume 7. Baltimore Md: Williams & Wilkins; 1926.
2. Guidotti TL, Ragain L. Protecting children from toxic exposure: three strategies. Pediatr Clin North Am. 2007; 54(2):227-35, vii. Review. Erratum in: Pediatr Clin North Am. 2007 Jun; 54(3):xv.
3. Rossi E. Low level environmental lead exposure: a continuing challenge. Clin Biochem Rev. 2008; 29(2):63-70.
4. Woolf AD, Goldman R, Bellinger DC. Update on the clinical management of childhood lead poisoning. PediatrClin North Am. 2007; 54(2): 271-294.
5. Sanders T; Liu Y, Buchner V, Tchounwou P B. Neurotoxic effects and biomarkers of lead exposure: a review. Rev Environ Health. 2009; 24 (1): 15–45.
6. Meyer PA; McGeehin M A, Falk H. A global approach to childhood lead poisoning prevention. Int J Hyg Envir Heal. 2003; 206 (4-5): 363–369.
7. Bellinger DC. Very low lead exposures and childrens neurodevelopment. Current opinion in pediatrics. 2008; 20 (2): 172–177.
8. Romero RA, Granadillo VA, Navarro JA, Rodriguez-Iturbe B, Pappaterra J, Pirela H. Placental transfer of lead in mother/newborn pairs of Maracaibo City (Venezuela).J Trace Elem Electrolytes Health Dis. 1990; 4(4):241-243.
9. Lin C M, Doyle P, Wang D, Hwang Y H, Chen P C. The role of essential metals in the placental transfer of lead from mother to child. Reprod Toxicol.2010; 29(4): 443-446.
10. Goldstein G W. Brain capillaries: a target for inorganic lead poisoning. Neurotoxicology. 1984; 5: 167-176.
11. Needleman HL, Schell A, Bellinger D, Leviton A, Allred EN. The long term effects of exposure to low doses of lead in childhood. An 11-year follow-up report. N Engl J Med. 1990; 322(2):83-88.
12. Countera S A, Buchananc L H, Rosasd D, Ortegae F. Neurocognitive effects of chronic lead intoxication in Andean children. J Neurol Sci.1998; 160:47–53.
13. Centers for Disease Control and Prevention (CDC). Blood lead levels in children aged 1-5 years - United States, 1999-2010. Morb Mortal Wkly Rep (MMWR). 2013; 62(13):245-248.
14. Grandjean P, Lyngbye T, Hansen O N. Lessons from a Danish study on neuropsychological impairment related to lead exposure. Environ Health Perspect. 1991; 94: 111 -115.
15. National Institute of Neurological Disorders and Stroke. Seizures and Epilepsy Hope Through Research. NINDS. USA. 2014. Available at: http://www.ninds.nih.gov/disorders/epilepsy/detail_epilepsy.htm
16. Jones R L, Homa D L, Meyer P A, Brody D J, Caldwell K L, Pirkle J L, et al. Trends in blood lead levels and blood lead testing among US children aged 1 to 5 years, 1988-2004. Pediatrics. 2009; 123(3):e376-e385.
17. Advisory Committee on Childhood Lead Poisoning Prevention (ACCLPP). Recommendations for blood lead screening of young children enrolled in Medicaid: targeting a group at high risk. MMWR Recomm Rep. 2000; 49(RR-14):1-13.
18. Parsons PJ, Reilly AA, Esernio-Jenssen D. Screening children exposed to lead: an assessment of the capillary blood lead finger stick test. Clin Chem. 1997; 43(2):302-311.
19. Rowshanzamir S, Irani M H. Assessment of Air pollution in Tehran. Third Iranian National Conference of energy.Tehran.2002.
20. Rossi E, McLaughlin V, Joseph J, Bulsara M, Coleman K, Douglas C, et al. Community blood lead survey with emphasis on preschool children following lead dust pollution in Esperance, Western Australia. Aust N Z J Public Health. 2012; 36(2):171-175.
21. Kumar A, Dey PK, Singla PN, Ambasht RS, Upadhyay SK. Blood lead levels in children with neurological disorders. J Trop Pediatr. 1998; 44(6):320-322.