BLOOD LEAD LEVELS OF CHILDREN IN ISTANBUL WHO WORK AT HIGH RISK JOBS

Elif Erkan, M.D.* / Demet Başdemir, M.D.** / İşıl Barlan, M.D.**
Turgay İspir, M.D.*** / Müjdat Başaran, M.D.**

* Department of Pediatrics, School of Medicine, University of Albert Einstein, New York, USA.
** Department of Pediatrics, School of Medicine, Marmara University, Istanbul, Turkey.
*** Department of Medical Biology (DE TAM), School of Medicine, Istanbul University, Istanbul, Turkey.

ABSTRACT

Objective: Lead poisoning is one of the most common and preventable health problems today. Children are particularly susceptible to the toxic effect of lead. New data indicate significant adverse effects of lead exposure in children at blood levels previously believed to be safe. The majority of poisoned children show no signs and therefore remain undiagnosed and untreated. The aim of the study is to obtain data concerning the extent to which Turkish children are exposed to lead poisoning.

Methods: One hundred and twenty children who work in the auto repair centers were recruited for the study group. One hundred and twenty subjects who applied to Marmara University Hospital outpatient clinics with upper respiratory complaints made up the control group.

Results: The blood lead level of children who work in the car repair centers was 32.25±10.89 µg/dL, whereas this level was 22.95±6.69 µg/dL in the control group. This difference in the blood lead level was statistically significant (p<0.0001).

Conclusion: It is suggested that lead exposure may be a serious problem in Istanbul. Considering the fact that even the control group demonstrated high blood lead level above the 'accepted level', larger studies including more subjects are needed in order to verify these results. We believe that the public should be informed of this important issue and preventive measures should be taken.

Key Words: Lead intoxication, Public health, Environment, Children.

INTRODUCTION

Lead poisoning is one of the most common and preventable pediatric health problem today. Lead is ubiquitous in the human environment as a result of industrialization. Lead is a poison that affects virtually every system in the body (1-4). The adverse effects of lead on children and adults are summarized in Figure 1. It is particularly harmful to the developing brain and nervous system of fetuses and young children. Children are particularly susceptible to lead's toxic effects. New data indicate significant adverse effects of lead exposure in children at blood levels previously believed to be safe. It is established that a lead level as low as 10µg/dl may have deleterious effect on children (5,6). Blood lead levels between 10 and 14µg/dL are in
Blood lead levels of children

a border zone. The Agency for Toxic Substances and Disease Registry estimated that in 1984, 17% of all American preschool children had blood lead levels that exceeded 15μg/dl (7). The goal is to reduce children's blood lead levels below 10 μg/dL. Community prevention activities should be triggered by blood lead levels of greater than 10 μg/dL.

The impact of lead exposure on cognition in young children at BLLs ≥ 10μg/DL has been amply demonstrated and the literature is remarkably consistent (8,9). On the other hand, most children with high blood lead levels have no signs. The vast majority of cases therefore go undiagnosed and untreated.

There is no reliable data available regarding the extent of this hazardous intoxication among Turkish children. In the study we aim to determine blood lead levels in a high risk group of children and compare them with the children who does not have any known risk for lead intoxication.

MATERIALS AND METHODS

Subjects: One hundred and twenty children and young adults were recruited for the study group. The ages of the study group ranged between 9-25 years (mean age was 17 years). Two of the subjects were female and the rest of the subjects were male (Table I). The study group was recruited from workers at car repair centers on the Asian side of Istanbul (Koşuyolu, Bostancı, Yukarı Dudullu) who had been exposed to lead containing gasoline and were more at risk for lead intoxication. 120 children and young adults were chosen for the control group. The ages were between 2-34 years (mean age was 19.5 years). There were 43 females and 77 males in this group. The control group consisted of patients treated at Marmara University outpatient clinics for mild upper respiratory infection. None of the subjects had any known risk for high lead exposure by history.

Methods: A blood sample of 5 mL was drawn from each patient. Sterile vacutainers containing EDTA were used to screen for blood lead levels. Tubes were centrifuged in the 1200 rpm for 15 minutes. Serum was separated and was stored in -35 °C. Blood lead level was determined by adding methylisobutylketone (MIBK) to the serum of each subject as organic solvent and burning the samples in the graphite furnace. Standard lead and then ammonium pyrrolidine dithiocarbamat (APOC) was added to the blood samples. Atomic absorption was used to reduce Pb++ to Pb. The amount that was absorbed by the lead molecule was determined by spectrophotometry (1). These values were determined as μg/dL after comparison with the standard curve.

Table I. Characteristics of the study and the control groups.

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<tr>
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<th>Study Group (n:120)</th>
<th>Control Group (n:120)</th>
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</thead>
<tbody>
<tr>
<td>Mean age (yr)</td>
<td>17.12</td>
<td>19.25</td>
</tr>
<tr>
<td>Minimum age (yr)</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>Maximum age (yr)</td>
<td>25</td>
<td>34</td>
</tr>
<tr>
<td>Gender (M/F)</td>
<td>118/2</td>
<td>77/43</td>
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</table>

Table II. Blood lead levels in the study and the control groups.

<table>
<thead>
<tr>
<th></th>
<th>Study Group (n:120)</th>
<th>Control Group (n:120)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean blood lead level (μg/dL)</td>
<td>32.25</td>
<td>23.29</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>0.99</td>
<td>0.61</td>
</tr>
<tr>
<td>Minimum blood lead level</td>
<td>16.2</td>
<td>12.3</td>
</tr>
<tr>
<td>Maximum blood lead level</td>
<td>54.3</td>
<td>42.6</td>
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RESULTS

The blood lead level was 32.25±10.89 µg/dL in the study group. This level was 22.95±6.69 µg/dL (Table II, Fig 2) in the control group. Mann Whitney U test was used as a statistical test to compare the results between the two groups. The difference between these two groups showed statistical significance (p<0.0001). The difference between the blood lead level based on the gender of the subject was not significant (p>0.05).

DISCUSSION

The results of our study showed a significant increase in blood lead levels in children who work in automobile repair centers in Istanbul. BLLs of the control group, although significantly lower than those of the study group were still high (≥10 µg/dL). None of these subjects showed any clinical signs of lead poisoning. A recent study conducted in Rochester, New York showed that variables associated with increased risk of elevated BLLs in children were living within the city, in older housing of lower housing value, in areas of higher population density, their families showed higher rates of poverty, and there was lower percent of high school graduates and lower rates of owner occupied housing (11). Presumably, living in Istanbul involves numerous risk factors, including air pollution through lead containing gasoline, population density, older and inadequate housing and poverty.

The first study concerning blood lead levels in Turkey was conducted by Güray et al in 1966 (2). In this study blood and urine lead levels were determined in 87 high risk subjects and the lead level in the air was also determined. It was shown that blood and urine lead levels were significantly elevated in the high risk subjects who worked in the environment where the lead level in the air was also elevated. In a study conducted in Ankara which included 619 subjects (2-80 years), the geometric mean of blood levels of children was found to be 16.95 µg/dL whereas it was 8.39 mg/dL in the adult subjects (13). In 1990 in Mersin, whilst the blood levels were between 15.58 µg/dL and 28.36 µg/dL in the high risk subjects, this level was only 7.26 µg/dL in the normal population (14). Gökşen showed that in 201 healthy children (6 months - 17 yr) in Istanbul, the mean blood lead level was 5.55 µg/dL and in 8.5 % of these children blood lead level was above 10 µg/dL (15).
In our study the fact that none of the subjects in the control group had a BLL < 10 µg/dL raises the possibility of contamination of the specimens. The ubiquity of lead in the environment adds to these concerns. To lower this possibility, we used venous blood sampling which is a preferred method because it has a less likelihood of contamination compared to blood collected by fingerstick. In addition, venous specimens provide a larger volume for analysis than capillary specimens which also lowers the risk of false positive test results. Although we used sterile vacutainers for blood sampling, because blood sampling was done in the automobile repair centers, the lead contamination through air is still a possibility.

The analytical technique that we used was atomic absorption spectroscopy with graphite furnace which is capable of achieving detection limits of 2-5 µg/dL. This technique is considered as one of the best techniques for blood lead determination.

Two hundred and forty subjects from a certain region of Istanbul were recruited for our study. In order to have a better understanding of the dimensions of this problem in Turkey, studies with larger number of subjects should be carried out and testing and treating children for lead exposure must be carried out in cooperation with public health programs to ensure environmental investigation, transitional lead-safe housing assistance, and follow-up for individual cases.

In theory, primary prevention has always been the goal of childhood lead poisoning prevention programs (16). With the prevention programs, the percentage of US children of 1 to 5 years of age with blood lead levels ≥ 10 µg/dL has decreased from 88.2% to 4.4% (17,18). In practice, however, most programs focus exclusively on secondary prevention, dealing with children who have already been poisoned. As programs shift the emphasis to primary prevention, their efforts must be designed to systematically identify and remediate environmental sources of lead. The shift from case management to community-level intervention will require a fundamental shift in perspective. The focus must shift from the individual child to the population of children at risk and the environment in which they live. This preliminary study allowed us to know that lead poisoning could be a major public health problem in Istanbul. Government, like the medical community, should focus its efforts on children who are most at risk. To do this, more data about the prevalence of elevated BLLs in specific communities are needed. A better understanding of the distribution of lead in the environment would allow more efficient screening efforts.

REFERENCES


