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# Lead intoxication: A summary of the clinical presentation among Thai patients☆

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**Abstract**

Lead is an important toxic metal found in industrial communities. Due to the industrialization in the recent decade in Thailand, lead intoxication as a toxicant-related disorder becomes a new public health problem. A retrospective study on clinical presentation of hospitalized patients with diagnosis of lead intoxication during year 1990–1999 in King Chulalongkorn Memorial hospital, the largest Thai Red Cross Society Hospital, was performed. All 14 cases diagnosed with lead intoxication were identified in our series. Average age of the subjects was $25.55 \pm 21.93$ years old. Male predominance was detected in our series (male:female = 12:2). Two main groups of subjects as; (1) childhood aged below 10 years old (male:female = 4:2) and (2) adult aged between 24 and 60 years old ($n = 8$, all male), can be identified. For the first group, the clinical presentations were convulsion ($n = 3$), unexplained anemia ($n = 1$), attention deficit ($n = 1$) and asymptomatic ($n = 1$), respectively. All of the subjects in this group presented the history of living at the old battery plant area. Five of the six cases came from the same village. For the second group, the clinical presentations were unexplained abdominal pain ($n = 5$), chronic renal failure ($n = 1$), unexplained anemia ($n = 1$) and asymptomatic ($n = 1$), respectively. Most of the subjects (75%) in this group presented the history of working in the battery plant for more than 10 years. Another case presented the history of gunshot and residual bullet in the bone marrow. The other one left is an interesting case with the history of prolonged usage of ritual pill and holy paper incineration. Like other studies, battery plant had strong relation with the lead intoxication. Although the total identified cases are rather few, there may be more undetected asymptomatic lead intoxication cases in the community. Specific control of lead resulted from battery plant and monitoring of the workers as public health strategies are still recommended.

## Introduction

Metals, particularly toxic metals such as lead, cadmium, and arsenic, constitute significant potential threats to human health in both occupational and environmental settings (Hu 2000). Lead is one of the most abundant of the toxic metals in the Earth's crust. Lead is an important toxic metal agent found in many industrial processes in the present day. It has been used since prehistoric times, and has become widely distributed and mobilized in the environment. Nowadays, it is considered as a hazardous chemical agent and serious pollutant for human beings (Srianujata 1998).

Lead exposure must be of particular concern because of ongoing exposure to thousands of workers in the industrial plants and recent research

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indicating that asymptomatic lead exposure can result in chronic toxicity manifestations, such as hypertension, kidney impairment, and cognitive disturbances (Pagliuca & Mufti 1990). Its toxicity correlates with blood concentrations and progresses from biochemical and subclinical abnormalities at levels around 100 $\mu$g/l to coma and death at levels over 1,000 $\mu$g/l (Markowitz 2000).

Exposure to and uptake of this non-essential element have consequently increased. Both occupational and environmental exposures to lead remain a serious problem in many developing and industrializing countries, as well as in some developed countries (Lee 1999). In most developed countries, however, introduction of lead into the human environment has decreased in recent years, largely due to public health campaigns and a decline in its commercial usage, particularly in petrol. Acute lead poisoning has become rare in such countries, but chronic exposure to low levels of the metal is still a public health issue, especially among some minorities and socioeconomically disadvantaged groups (Juberg *et al.* 1997; Staudinger & Roth 1998). In developing countries, including Thailand, awareness of the public health impact of exposure to lead is growing but relatively few of these countries have introduced policies and regulations for significantly combating the problem.

Surprisingly, according to the review literature, there has been no epidemiological report about lead intoxication in Thailand. Therefore, we performed this retrospective study as an epidemiological study on clinical presentation of hospitalized patients with diagnosis of lead intoxication in a Thai tertiary hospital.

## Materials and methods

This study was designed as a retrospective study. A study on clinical presentation of hospitalized patients with diagnosis of lead intoxication during year 1990–1999 in King Chulalongkorn Memorial hospital, the largest Thai Red Cross Society Hospital, was performed. In all cases, the diagnosis of lead was made biochemically following the suspicious physical examination and history. Blood sample from each subject was collected and confirmed for the high blood lead concentration. The lead concentration in the blood was analyzed by the same toxicology laboratory using the same atomic absorption spectrophotometer (AAS) analyzer under standard quality control system (normal range $< 40$ $\mu$g/l).

## Results

All 14 cases diagnosed with lead intoxication were identified in our series. Average age of the subjects was $25.55 \pm 21.93$ years old. Male predominance was detected in our series (male:female = 12:2). Average blood lead level was $205.4 \pm 217.5$ $\mu$g/l. In addition, the basophilic stripplings were also detected in blood smear of every subject. Two main groups of subjects as; (1) childhood aged below 10 years old ($n = 6$, male:female = 4:2, average blood lead = $107.3 \pm 38.8$ $\mu$g/l) and (2) adult aged between 24 and 60 years old ($n = 8$, all male, average blood lead = $403.2 \pm 209.9$ $\mu$g/l), can be identified. For the first group, the clinical presentations were convulsion ($n = 3$), unexplained anemia ($n = 1$), attention deficit ($n = 1$) and asymptomatic ($n = 1$), respectively. All of the subjects in this group presented the history of living at the old battery plant area. Five of the six cases came from the same village. For the second group, the clinical presentations were unexplained abdominal pain ($n = 5$), chronic renal failure ($n = 1$), unexplained anemia ($n = 1$) and asymptomatic ($n = 1$), respectively. Most of the subjects (75%) in this group presented the history of working in the battery plant for more than 10 years. Another case presented the history of gunshot and residual bullet in the bone marrow. The other one left is an interesting case with the history of prolonged usage of ritual pill and holy paper incineration.

## Discussion

Lead is an important toxic substance. It is found naturally in earth and present in almost all parts of the environment, such as foods, air, water, dust, soil, paint, and tissues of living organisms including human. This metal is being used in various aspects including the manufacturing of storage batteries, production of chemicals, paints and gasoline additives. Human exposure to lead is mainly from foods and other environments. The

well-known and excessive environmental exposures are air of industrial and heavy traffic areas.

According to WHO criteria documents, blood lead levels are a useful indicator of exposure (WHO 1995). The current Centers for Disease Control and Prevention screening guideline of 100 $\mu$g/l is a risk management tool and should not be interpreted as a threshold for toxicity (al Khayat *et al*. 1997; Bellinger 2004). However, some data are consistent with effects well-below 100 $\mu$g/l, especially in the pediatric cases (Bellinger 2004). Its toxicity can cause aberrant in function of multiple organs. The continued occurrence of occupational lead overexposure and lead poisoning remains a serious problem despite awareness of its adverse health effects. Lead exposure is arguably the oldest known occupational health hazard. It is a particularly insidious hazard with the potential for causing irreversible health effects, including hypotension, central nervous system problems, anemia and diminished hearing acuity before it is clinically recognized (Pagliuca & Mufti 1990; Hu 2000). Similar to other developing countries, lead pollution becomes an important public health problem of Thailand, especially for the big cities as Bangkok. Due to the rapid growing of industrialization without good introduced policies and regulations for the pollutants in the recent decade, a number of occupational health disorders can be expected.

Like other studies, battery plant had strong relation with the lead intoxication (Pagliuca & Mufti 1990; Markowitz 2000). More than 75% of our cases had the history of living or working in the battery plant area. Considering all pediatric subjects in our first group, all presented the history of exposure to lead in their house where there had ever been the battery plant. The contamination of the lead in the surrounding of the house is a common cause of lead intoxication in pediatric patients. In 1989, Singh and Singhi (1989) reported severe lead intoxication in children in a family caused by use of residential premises for battery manufacturing. The common source of lead intoxication from the same village in Samutprakarn province, the industrial area of Thailand was identified. Considering this group the neurological complications could be detected. Indeed, a common manifestation of lead poisoning among the pediatric patients is lead encephalopathy due to acute poisoning (al Khayat *et al*. 1997). The central nervous system effects of lead on children seem not to be reversible. Children differ from adults in the relative importance of lead sources and pathways, lead metabolism, and the toxicities expressed (Bellinger 2004). al Khayat *et al*. (1997) indicated that in very young infants acute lead encephalopathy might occur at low lead level. The average lead level among the pediatric cases in this report is lower than that of the adults.

Considering the adult subjects in the second group, most subjects were the battery plant workers. Of interest, the average blood lead level among the subjects in this group is higher than the other group. Indeed, chronic accumulation of lead in the battery plant workers is mentioned (Menezes *et al*. 2003). Menezes *et al*. (2003) noted that incidences of lead poisoning could be seen in adults working in lead-based industries, where many still remain unaware of the adverse effects of exposure to unusually high levels of lead. For battery manufacturers, said that workers with high blood lead levels tended to have higher prevalence of most symptoms of lead toxicity (Matte *et al*. 1989). The most common presentation as unexplained abdominal pain was identified. Indeed, this is a common manifestation of chronic lead intoxication (Pagliuca & Mufti 1990; Markowitz 2000). Also, an interesting case of intoxication due to using of the ritual pill and incineration of holy paper as Chinese tradition was also detected. These topics are interesting and required further study.

A number of forgotten high-risk workers can be detected in Thailand. Monitoring of lead exposure in these workers is still important. Protective equipment for them such as gloves and masks are necessary and should be provided. Although the total identified cases in our series are rather few there may be more undetected asymptomatic lead intoxication cases in the community. Specific control of lead resulted from battery plant and monitoring of the workers as public health strategies are still recommended. Annual check up for blood lead as a marker for lead exposure in these workers is recommended and there should be a specific law on this subject.

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