An unusual case of lead poisoning in an infant: Nursing-associated plumbism

CRETE and ATHENS, GREECE

Lead poisoning remains a common environmental threat for children today. The majority of cases of lead poisoning are caused by oral intake of lead dust or lead-containing paint flakes and thus occur during the second and third years of life. An unusual case of severe lead poisoning in a breast-feeding infant girl is here presented; the source proved to be a nipple shield made of a lead-containing metal. Despite the severity of the intoxication, by the end of treatment and for a year afterwards the infant has been well and her psychokinetic development has been normal. (J Lab Clin Med 1999;134:522-5)

Lead poisoning remains an important environmental threat for children today. Lead is a poison that affects virtually every system in the body. It is especially toxic to erythropoiesis, to the kidneys, and to the central nervous system. Lead absorption takes place throughout the respiratory and gastrointestinal tracts and less frequently through the skin. Children are more vulnerable to lead exposure than adults because of the frequency of pica and hand-to-mouth activity and a greater rate of intestinal absorption of what lead is ingested.

Lead poisoning in children results from the ingestion of lead from environmental media including paint chips, dust, soil, drinking water, consumer products, enamel utensils, and traditional medicines and usually occurs between the second year and third year of life. However, lead poisoning may also appear in the first year of life. For example, it may occur because of placental transmission of lead by women who are intoxicated or exposed to high levels of lead; in infants, exposure may occur through formula preparation with lead-contaminated water.

Although the problems caused by acute, chronic, and subchronic toxicity of lead are well known and although public awareness has increased, some cases appear in Greece where severe problems arise because of the improper use of the metal. These cases reveal some unusual sources of lead. These can be lead parts of children's toys, homemade alcoholic beverages such as the local drinks raki and tsipouro that are polluted by the lead pipes of the distillers, homemade bread polluted by lead parts of the flour mill or the glaze of pottery kitchen utensils that contain lead.

Another unusual case of severe lead poisoning that revealed an equally unusual source of lead is presented in this article.

CASE REPORT

A 5-month-old girl was admitted to the Pediatric Department after an episode of generalized tonic-clonic seizure followed by loss of consciousness lasting for 20 minutes. She was the fourth child of a healthy family free from hereditary disorders. The infant was born at full term. The perinatal period and subsequent development were uneventful. Until admission, the infant was exclusively breast fed and had been found well during a pediatric examination 15 days before admission. Soon after, however, she developed vomiting, constipation, gradual loss of weight, pallor, and sluggishness; her appetite was normal.

On admission, the patient was unresponsive; physical examination showed pallor of skin and mucosa, an elevation of the anterior fontanel, and a palpable liver (approximately 4 cm). Her temperature was 37°C, pulse rate 120/min, and blood pressure 80/35 mm Hg.

The first laboratory findings were as follows: hemoglobin 9 g/dL, white blood cell 9.0 × 10⁹/L, platelet count 160 × 10⁹/L. Basophilic stippling of the erythrocytes was noted on the blood smear (the parents were not carriers of β-thalassemia), the reticulocyte count was 13%, and the direct

From the Department of General Pediatrics, University of Crete; the Laboratory of Forensic Medicine, University of Athens; and the Unit of Toxicology, University of Crete.
Submitted for publication April 30, 1999; accepted May 27, 1999.
Reprint requests: Aristidis M. Tsatsakis, PhD, Head of Toxicology Laboratory, Medical School, University of Crete, Iraklion, 71409, Crete, PO Box 1393, Greece.
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Coombs' test results were negative. Hepatic and renal function test results, urine and stool test results, and results of ultrasonography and computed tomography of the brain and abdomen were normal.

Anticonvulsant drugs and mannitol for suspected cerebral edema were administered. The girl did not improve, and her condition gradually deteriorated further. Vomiting increased, repeated episodes of generalized seizures occurred, and the infant became comatose (score 7 on the Glasgow scale). The hemoglobin value dropped to 6.5 g/dL, and a blood transfusion was given.

A second interview with her mother revealed that she had been using nipple shields made of lead. These had been made for her by a plumber, and she applied them after each breastfeeding (Fig 1). The use of metallic nipple shields was a custom of the family, originating from Asia Minor. The mother had previously used shields made of non-lead-containing metal for breast-feeding her first three children. However, those shields had been lost and were replaced by others, which in ignorance were made of lead by a plumber. The use of such shields is unknown in Greece, and we know of no precedent for lead intoxication via this route. Other sources of lead exposure were excluded after the family environment and the mother's medical history were examined. An x-ray of the knees at this stage showed the characteristic density band of lead poisoning.

Lead concentrations measured in blood samples from the mother and the infant were 8 and 240 µg/dL, respectively (analyzed by atomic absorption spectrometry). Subsequent blood samples were collected from the infant at various time intervals for the measurement of hemoglobin, hematocrit, alkaline phosphatase, aspartate aminotransferase, alanine aminotransferase, γ-glutamyl transpeptidase, and lead concentration.

Treatment was started initially with intravenous edetate calcium disodium (40 mg/kg per 24 hours, in two doses for the first 5 days) and intramuscular dimercaprol (2.5 mg/kg per 24 hours in six doses for 2 days). With treatment, the infant improved gradually and lead levels gradually dropped to 10 µg/dL after 3 months.

Laboratory findings are presented in Figs 2, 3, 4, and 5. Fig 2 depicts data from the period of therapeutic treatment and the monitoring of lead concentrations during this period. It can be seen that the lead concentration in the first blood sample taken from the infant was 240 µg/dL, whereas the lead concentration in the sample from the mother was 8 µg/dL. The duration of time (in days of therapy) when the chelating agents edetate calcium disodium and dimercaprol were administered is shown in relation to the decrease in lead concentrations. Fig 2 illustrates the rebound of lead from organs and tissues back to the blood circulation. The persistence, in time and degree, of the rebound is dependent on the time elapsed until the start of the new session of edetate calcium disodium or dimercaprol administration and thus the lowering again of the lead levels. Fig 3 reflects the changes in hemoglobin levels during the first 60 days of hospitalization. Fig 4 represents the changes in alkaline phosphatase up to 45th day of hospitalization. The changes in the hepatic enzymes aspartate aminotransferase, alanine aminotransferase, and γ-glutamyl transpeptidase during the first 45 days of hospitalization are shown in Fig 5.

**DISCUSSION**

Healthy children need healthy environments, and everyone benefits when the overall environment is made healthy for children.

In 1991 the statement of the Centers for Disease Control and Prevention regarding the prevention of lead poisoning in young children redefined elevated blood lead levels as those of >10 µg/dL and recommended a new set of guidelines for the treatment of lead levels of >15 µg/dL. The most serious manifestation of lead poisoning is acute encephalopathy, which includes persistent vomiting, ataxia, seizures, papilledema, impaired consciousness, and coma. Lead encephalopathy rarely occurs at blood lead levels of <100 µg/dL. But there is evidence that lower levels may be associated with less dramatic central nervous system toxicity, manifest as neurobehavioral disorders and poor intellectual growth in children with blood lead levels of approximately 35 µg/dL.

A detailed environmental investigation was necessary to identify the exact source of lead exposure in our case. The infant was exclusively breastfeeding, so the lead poisoning as a cause of encephalopathy was not immediately suspected. The mother was using metal nipple shields after breastfeeding, a practice that is unknown in Greece. We confirmed that the shields were a credible source by modeling the clinical use: the shield was applied to the mother's breast, which was subsequently wiped by a cotton bud that had been previously immersed in the mother's breast milk. The lead level in such a sample was 6.5 µg/mL.
Although we believe this case to be unique, there have been a number of other unusual lead sources reported in Greece. They include a lead ball that was found inside a child's toy and swallowed, a homemade traditional alcoholic beverage (tsipouro) that was contaminated during its distillation because of lead pipes, and a homemade bread that was contaminated by corn flour that had been ground in a traditional windmill with grindstones that had been repaired with lead.  
Some years ago it was discovered that in the Greek market there were ceramic kitchen utensils such as cups, jugs, or jars that were unexpected sources of lead. Lead was a constituent of the glaze that was used to cover the inside of the utensils. The use of lead-containing glaze is officially prohibited today in Greece.

We are pleased to report that in addition to the prompt recovery described above, our patient has continued to do well. The infant has now been followed for 12 months, and body growth, kidney and liver function, and psychokinetic development are all quite normal for her age.

In conclusion, lead poisoning is an important but preventable health problem. Lead poisoning in suckling infants is rare; it may not be suspected immediately, and diagnosis may be delayed. It is suggested that lead poisoning should be included in the differential diagnosis of every case of encephalitis of unknown origin in infancy. Although many uses of lead are now prohibited or tightly regulated, there remain opportunities for exposure. Moreover, "uncommon" exposures become proportionately more common as the traditional sources are contained. Medical practitioners and parents must therefore remain vigilant. Continued public health initiatives to remove lead from the environment in conjunction with routine lead screening of young children will be a key to meeting the goal of the Centers for Disease Control.
and Prevention of eliminating childhood lead poisoning by the year 2011.

REFERENCES


