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CASE REPORT

Infantile lead poisoning from an Asian tongue powder: A case report & subsequent public health inquiry

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Introduction. Lead poisoning from novel environmental sources continues to present a challenge to clinicians who treat infants and children. **Case report.** A 12 month old infant of Thai parents was found during well child care to have a venous blood lead concentration of 61 mcg/dL. He was hospitalized for parenteral chelation with CaNa₂EDTA and subsequently managed as an outpatient with oral succimer, with a reduction in blood lead concentration to 23 mcg/dL. Chronic lead poisoning was attributed to the use of a Thai tongue powder by the parents for the first seven months of the infant's life. This ethnic remedy was applied to the tongue to absorb toxins, reduce white patches present after milk feedings, and preserve the infant's health. **Investigations.** Lead contaminated the powder at 109,000 ppm as measured by x-ray fluorescence spectrometry. Two poison centers in Thailand were contacted and initiated a public health inquiry with the Thai Food & Drug Administration (Thai FDA) to remove contaminated products from the marketplace. Their investigation found six additional contaminated tongue powders (of 10 tested) in a Bangkok shop offering Chinese remedies, some with lead levels > 9000 ppm. These products, unregistered with the Thai FDA, were confiscated and the shop closed. Local media attention and case-finding activities of health officials identified one additional infant suffering from lead poisoning due to tongue powders. **Conclusions.** Asian tongue powders can be a source of lead poisoning. Medical toxicologists, poison centers, and public health agencies can work together internationally to accomplish effective post-marketing product surveillance.

Keywords Herbs; Lead poisoning; Poison control centers; Pediatric; Dietary supplement

Introduction

Lead poisoning from novel environmental sources and ethnic remedies continues to present a challenge to clinicians who treat infants and children. We present here a 12 month old infant whose lead poisoning was caused by the use of a 'tongue powder', an Asian health product brought into the United States from Thailand by his parents.

Case report

An asymptomatic 12 month old infant of Thai parents was discovered to have a blood lead concentration of 61 mcg/dL (Centers for Disease Control & Prevention threshold for the definition of childhood lead poisoning: 10 mcg/dL) (1) at a well child visit. A blood zinc-chelated protoporphyrin concentration was 880 mcg/mol of heme (reference 25 to

65 mcg/mol for hematocrit 35%). Other red blood cell (RBC) studies documented a hemoglobin of 10.6 g/dL (reference >11 g/dL), reticulocyte hemoglobin concentration of 22.6 pg/L (reference > 28.5 pg/L), RBC mean corpuscular volume of 56.6 (reference > 72). Long bone radiographs showed metaphyseal sclerosis consistent with chronic lead poisoning. The child was hospitalized and received five days of parenteral chelation with CaNa₂EDTA (50 mg/kg/day) that reduced the blood lead concentration to 33 mcg/dL at discharge. He subsequently received four 19-day cycles (1500 mg over 5 days in divided doses; 2800 mgs over 14 days in divided doses) of oral chelation therapy with succimer (DMSA) to achieve a blood lead concentration of 23 mcg/dL.

Investigation of the family's apartment found no lead hazards. Neither parent had an occupational exposure or worked with lead in hobbies. They had no imported cookware or spices, but had spent the previous two months in Bangkok, Thailand, visiting relatives. Upon further questioning, mother revealed that she used a Chinese patent remedy *Khao Gui* in tablespoon amounts for treatment of fever as needed. She acknowledged using a black powder, *Ya Kward Pak* (Thai translation: "medicine to be applied to the mouth"), daily for the infant's first 7 months of life (see Figure 1). According to the parents, who were highly trained professionals, this

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Fig. 1. Containers of tongue powder purchased in Bangkok, Thailand and used in the U.S. case described.

ancient practice was handed down through their Chinese ancestry. The unlabeled vials of powder were purchased at a local shop in Bangkok. These remedies were confiscated from the parents, who notified relatives in Bangkok of the potential dangers of the product. The case was reported to the Food & Drug Administration's Medwatch Program in the United States.

Laboratory analysis

Four ethnic products were collected from the family home and sent to the regional Environmental Protection Agency (EPA) laboratory in Chelmsford, Massachusetts for testing. Samples included *Ya Kward Pak* (tongue medicine) and *Khao Gui* (cold/fever medicine), a sample of baby food, and a religious paper to which the child was exposed to during a ritual practice at his home country. The EPA laboratory used a Spectro Analytical X-lab 2000 (Spectro Analytical Instruments, Inc., Fitchburg, Massachusetts) energy dispersive x-ray fluorescence spectrometer (XRF) instrument to test the samples, using the turboquant method (2).

Test results detected a small amount of lead in the baby food powder (5 ppm) and 25 ppm lead in the religious paper. The powder *Ya Kward Pak* had the highest lead concentration, 109,000 ppm (>10% product weight). The other medicine *Khao Gui* did not contain any metals. Further testing of tongue powder samples was also done by cold vapor atomic absorption spectroscopy. Mercury was detected at 17 ppm. Arsenic was not detected above the reporting limit by inductively coupled plasma - atomic emission spectrometry.

Bangkok public health inquiry

Two poison control centers in Thailand, the Ramathibodi Poison Control Center and Siriraj Poison Control Center, were contacted to launch a public health inquiry and product

recall. In turn, the Siriraj Poison Control Center contacted the Thai Food and Drug Administration (FDA) with the address of the Bangkok shop where the tongue powder was purchased. This store was discovered to sell Chinese traditional medicines, making many of its herbal remedies on site. A pharmacist affiliated with the Siriraj Poison Control Center anonymously purchased tongue powders which, when tested by the poison control center laboratory, contained 9,582 ppm of lead. Two other samples from the same store were tested by the Department of Medical Sciences, Ministry of Public Health, and were found to contain 2000 to 7000 ppm of lead. There were seven other ingredients tested. One called *Jew Tung* was contaminated with lead oxide (2,000 ppm).

The shop's contaminated products were confiscated and it was ordered to cease such unlawful sales practices. Subsequently, the Thai FDA conducted a press conference alerting the public in Bangkok to the dangers of these products and directing them to call a 24-hour hotline maintained by the poison control centers to report any cases of suspected infant poisoning. The poison control center staff were instructed to obtain detailed caller information, including brand and FDA registration of the products in question. The information was then cross-checked with available information from the Thai FDA. If the product was FDA registered and inspected, the parents were reassured of the product's safety.

Over the subsequent two week period, there were 25 calls from the public regarding tongue powder preparations without the appropriate Thai FDA registration. The department of Medical Sciences, Ministry of Public Health found that six of ten different products tested had heavy metal contents that exceeded the limit set by the Thai FDA (see Table 1). One product contained > 9,000 ppm of lead. Some also had measurable levels of both arsenic and cadmium.

One user of such products, the parents of a 4 month old male, brought their son to Siriraj Hospital for medical care.

Table 1. Compliance of ten Bangkok tongue powder preparations with Thai FDA standards

Sample	Arsenic	Lead	Cadmium
Thai FDA Standard	≤ 4 ppm	≤ 10 ppm	≤ 0.3 ppm
1	Yes	Yes	Yes
2	No (9.7)	No (4122.7)	No (0.72)
3	No (7.7)	No (9338.2)	No (0.69)
4	Yes	Yes	Yes
5	Yes	No (51.2)	No (0.96)
6	Yes	Yes	No (0.86)
7	No (6.8)	No (21.1)	No (1.81)
8	No (5.8)	Yes	Yes
9	Yes	Yes	Yes
10	Yes	Yes	Yes

Key: Products are either compliant or not (YES or NO) with Thai FDA standard. If non-compliant, the concentration of metal is given in ppm.

His mother stated that his grandmother insisted on using the tongue powder on the patient daily since birth. His physical examination was normal and his blood lead concentration was 6 mcg/dL. Additional efforts are ongoing in Thailand in order to notify the public at large and to identify any additional infants suffering from chronic lead poisoning due to tongue powders.

Discussion

Families who move to the United States from countries where traditional medicines are commonly used are likely to continue such practices here, acquiring supplies of ethnic medicines either from buying them from shops that import them or bringing supplies with them during travel. Saper et al. reported that 20% of Ayurvedic medicines purchased in the Boston area were contaminated by heavy metals (3). Ko reported that at least 83 of 240 (32%) Asian patent medicines tested by the California Department of Health Services were adulterated by undeclared pharmaceuticals or heavy metals (4).

A recent survey of Thai children in the Bangkok area found their average blood lead concentration to be 5.65 mcg/dL, with 8.1% of children having lead levels greater than 10 mcg/dL (5). Peeling paint, paint chips, and dust were identified in that report as significant indicators of those Thai children who were at high risk of lead poisoning. Herbal remedies were not mentioned as another source of exposure. Yet Chinese and other East Asian patent remedies have been reported previously as sources of unintentional contamination or intentional adulteration with heavy metals such as lead, arsenic, mercury, and cadmium, posing a health hazard to individuals who take them. Severe cases of lead poisoning, including encephalopathy and death, have been previously reported in children after they were given contaminated herbal ethnic remedies (6–15). We performed a search of the medical literature on ‘tongue powders’ using the Medline, Index Medicus, and OVID medical search engines. We also searched the Thai Medical Index, using the keywords: ‘tongue powder’ ‘Chinese herbals’ ‘traditional medicine’ in both Thai and English. We could find no mention of toxicity related to contamination of Asian tongue powders and believe that this is the first reported case of lead poisoning implicating an herbal tongue powder intended for infants.

Tongue powders are reportedly used in Thailand to insure the health of infants by adsorbing toxins from the tongue, to promote tissue healing, and to relieve the white patches seen after milk feedings. Tongue powders typically contain a variety of herbal ingredients such as *Kaempferia galanga* Linn, *Rhus javanica* Linn, borneal, menthol, and activated charcoal. More than 40 such products are registered with the Thai Food & Drug Administration. (personal communication: Winai Wananukul, January 2008) There are several explanations for the presence of lead in the tongue powder implicated in the current case. Heavy metals are sometimes included in ethnic

remedies for their alleged medicinal properties. In traditional Chinese medicine, mercury salts, such as cinnabaris (mercury sulphide), calomel (mercury chloride), and hydrargyri oxydum rubrum (mercury oxide), are added to some preparations to insure proper function of the body. Lead is also used as Mi Tuo Seng (lithargyrum) and arsenic as Xiong Huang (realgar) in the manufacture of other Chinese traditional medicines. Lead may also inadvertently contaminate herbs grown in lead-containing soil, or it may be inadvertently introduced during grinding and manufacturing processes. When herbal medicines are sold by weight, the addition of heavy lead salt powders to such products by the seller can be used to boost profits.

The infant presented here had class IV (“moderate-severe”) lead poisoning as designated by the Centers for Disease Control (1). He already manifested the bone changes at the metaphyses usually associated with a long duration of exposure to a very high blood concentration of lead. The high concentration of lead, more than 10%, in this particular health product contributed to the severity of poisoning, and it illustrates the special dangers of metal-contaminated ethnic remedies when used repetitively in young children. Unlike other sources of lead hazard, where periodic or occasional exposure may result from pica behaviors, there was daily dosing in this case during a critical period of infant development because of the parental health beliefs that daily application of the powder would detoxify the infant and preserve his good health. In another published case, an 8 month old Indian infant died from encephalopathy associated with a blood lead concentration measured at 214 mcg/dL, following the parents’ use of an Indian folk remedy for the preceding six months of life (13).

Lead poisoning in this infant was discovered serendipitously during a well child care visit, as a result of the policy of universal lead screening of infants annually in Massachusetts. Without such screening, it is likely that continued use of the tongue powder would have resulted in even higher blood lead concentrations, with diagnosis tendered only after the onset of potentially life-threatening symptoms. The practice of always taking a good, careful history during well child and sick visits of children to pediatric health practitioners, with specific inquiries about the use of dietary supplements, herbal products, or ethnic remedies in children, is well advised. Others have also recommended that blood lead concentrations be obtained on all infants and young children immigrating to the United States who are at high risk for childhood lead poisoning (16).

Finally this case illustrates the sentinel value of case finding, which led to a public health inquiry discovering an additional infant with an elevated blood lead concentration in Bangkok and removal of the offending tongue powders from the marketplace. Some Asian countries are attempting to regulate the quality of traditional remedies; health officials in Singapore cite the effectiveness of such controls (17). However the current case underscores the importance of vigilance in the post-marketing surveillance for toxicity related to herbs and dietary supplements and the public health value of case-finding.

Conclusion

Asian tongue powders used to promote infant health by cleaning or treating the tongue may pose a potential hazard of heavy metals contamination. Medical toxicologists, poison control centers, and public health agencies can work together internationally to accomplish effective post-marketing product surveillance.

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