New York State Regional Lead Resource Centers

Lead Poisoning Prevention Program

Case Study #1

This case study is not meant to be a treatment protocol for a lead poisoned child. Regional Lead Resource Centers (RLRC) provide consultations for medical management of lead poisoned children and some, but not all, RLRCs have a specialty clinic to provide direct care for a lead poisoned child.

The New York State Department of Health (NYSDOH) Lead Poisoning Prevention Program (LPPP) strongly advises health care providers to consult with a Regional Lead Resource Center if a child has an elevated venous blood lead level (EBLL) $\geq$ 45 mcg/dL although consultation may be sought at any time.

Case Presentation

Chief Complaint: An asymptomatic 11-month-old African-American female with a confirmatory venous BLL of 42 mcg/dL on 6/20.

History of Present Illness: The child's pediatrician had performed a fingerstick (capillary) blood lead test on 6/15 as part of routine one-year old well child care. The results were 41 mcg/dL. Upon receipt of a confirmed venous BLL of 42 mcg/dL on 6/20, the pediatrician referred the child to the Regional Lead Resource Center for medical management.

Past Medical History: The baby has had no illnesses, hospitalizations, or surgeries, nor does she have any known drug or food allergies. Her vaccines are up to date.

Pregnancy/Birth: The patient's mother had a normal pregnancy without complications. She does not know whether she was tested for lead during her pregnancy and denies any history of pica. The infant was born at full-term, by normal, vaginal delivery and weighed 7 lb 4 oz. The infant was formula-fed.

Family History: Neither mother nor father were tested for lead. A 3-yr-old sibling's recent BLL was 15 mcg/dL. There is no family history of disease.

Personal/Social/Environmental: The family consists of a mother, who is a 27-year-old homemaker; a father, who is a 27-year-old, self-employed financial advisor; a 3-year-old female sibling; and the patient. The family resides in a single family house that the family owns. They have lived in the house for 14 months. The family does not know the year house was built, but it is an older home. They have been renovating it themselves. As recent as one month ago, the father was dry sanding and dry scraping the stairway in the home. The paint was removed down to the natural wood. The children were home while the work was done. There were no lead dust precautions taken. Currently there are no renovations being done in home. The local health department (LHD) was notified of the EBLL by the pediatrician and a referral was made for an environmental inspection of the home. The family does not have health insurance.

Developmental History: The patient's first words were spoken at 5-6 months. She rolled over at 4 months, crawled at 6 months, and walked at 10 months. The parents have no concerns about the child's development. The child does have significant hand to mouth behavior with hands, toys, and "anything else she can get her hands on."

Review of Systems: The child was negative for constipation, vomiting, or abdominal pain.

Medications: None.

Physical Exam: Negative.

Diagnostic Testing: The patient had a follow-up venous BLL of 43 mcg/dL on 6/22.

Treatment Plan

The RLRC, in collaboration with the child's primary care provider and the LHD's Lead Poisoning Prevention Program, developed and implemented a plan for clinical management and follow up services. The family was educated by the Lead Clinic staff regarding lead dust hazards. The importance of thorough, proper cleaning of lead dust using lead safe work practices was stressed. Education was provided regarding HEPA vacuuming, wet mopping and wet cleaning of all surfaces. Frequent hand washing, washing toys, additional sources of lead and other risk reduction education was given. A nutritional assessment including an iron status was performed. Parents were counseled regarding the importance of a diet adequate in calcium and iron. The parents were referred to Child Health Plus to apply for health insurance.

Environmental Investigation

The environmental inspection of the family's home was done by the LHD on 6/23. Analysis of painted surfaces with portable x-ray fluorescence (XRF) analyzer found many of the surfaces contain lead, however a visual inspection found all interior and exterior paint to be intact. Dust wipe samples were taken, per protocol for instances when lead is identified in paint found in an intact condition, and because of the recent renovations. Results of several dust wipe samples were found to be unacceptable (at or above the EPA action level for lead in dust), including 45 ug/sq ft taken from a kitchen floor, 270 ug/sq.ft. taken from the child's bedroom window sill, and 450 ug/sq ft taken from the playroom window trough. These results were above the EPA action level of 40 ug/sq ft for floors, 250 ug/sq ft for window wells, and 400 ug/sq ft for window troughs. Education was provided to the homeowner on how to safely remove the lead dust using safe work practices, and to regularly wash the child's hands, toys, and pacifier, as well as areas of the home where dust can accumulate.

Clinical Course

On 7/20 the child's venous BLL increased to 49 mcg/dL; above the 45 mcg/dL action level to initiate chelation therapy. Prior to starting treatment, a KUB was done and results were negative for radiopacities. She was admitted to the hospital for five days of chelation therapy and was discharged with a BLL of 15 mcg/dL. Because there were positive dust wipes in the primary residence, the child was discharged to the maternal grandmother's home. The child's grandmother's home was built in 2000 and an inspection of paint, soil, dust, water, and other media found the dwelling to be lead-safe.

Outcome

The child had a BLL of 30 mcg/dL on 7/27. This is a typical "rebound" level that generally occurs within a few weeks of treatment, presumably from release of lead from bone stores. The results ranged from 34 mcg/dL on 8/17 to 33 mcg/dL on 10/17 and then slowly began to decrease.

Environmental staff made repeat visits to the home, reinforced the importance of lead safe work practices, including no dry sanding and scraping, and collected dust wipe samples until they were reduced to levels within acceptable standards.

On 4/10, a year and a half after the first EBLL, the child's venous BLL had finally dropped to 8 mcg/dL. The child's growth and development continues to be monitored by her pediatrician.

Case Study Questions

1. What is currently the most common source of lead contributing to childhood lead poisoning and are the sources different for young infants?

2. What criteria are used to assess children for lead exposure?
3. What tests are used to assess lead exposure and toxicity?
4. What are the NYSDOH physician and laboratory reporting requirements for children with elevated BLLs?
5. What blood lead level requires follow-up action (s)?
6. What drugs are used to treat lead poisoning and when are they appropriate for treatment?

Case Study Answers

1. The main source of lead exposure for all children is contact with deteriorating old paint (pre-1978) and lead contaminated dust. Other sources of direct lead exposure for children include lead-contaminated soil, toys containing leaded parts or lead paint, some traditional remedies, and indirect exposure from adult occupations and hobbies. Young infants may also be lead poisoned from contaminated formula or breast milk. .[1] [2]

2. Blood lead levels peak at age 2 years in the U.S. In New York State, blood lead testing for lead is mandated for all children at or around 1 and 2 years of age. In addition, at each routine well-child visit health care providers (HCPs) should assess all children aged 6 months to 6 years of age for lead exposure using a risk assessment tool based on currently accepted public health guidelines.¶ If the child is at risk, a blood lead test should be recommended.[3] High risk groups include: recent immigrants/refugees from foreign countries, those with a history of living in homes with peeling old paint, those with adults living with them who are occupationally exposed and those with a sibling already identified as lead poisoned.

3. Venous blood lead testing remains the gold standard for assessing exposure. However, it is only an indirect measure of how much lead may have accumulated in the child and does not indicate the duration of exposure. It is correlated with measures of effect. One available biochemical test of lead effect is the erythrocyte protoporphyrin level (EP level). This measure is elevated with chronic lead exposure with blood lead levels of 20 mcg/dL and higher.[4] Recent use of point-of-care devices (LeadCare II) by private physician offices allows for lead testing of children in their offices. A result of $\geq$ 8 mcg/dL must be confirmed with an appropriately collected venous sample, analyzed by a clinical laboratory that holds a NYS permit in toxicology blood lead using another test method.

4. Current NYS Public Health Law Rules and Regulations* require HCPs to communicate and coordinate with LHDs§ to ensure that each child with an EBLL receives appropriate follow-up. [5] Permitted and limited service laboratories are required to report the results of all blood lead analysis to the NYSDOH and to the ordering HCP within 5 business days of analysis. Effective June 20, 2009, results of blood lead analysis performed in a HCP's office that is certified by the Centers for Medicare and Medicaid Services under regulations implementing the federal Laboratory Improvement Amendments of 1988 (CLIA) must be reported to the NYSDOH within fourteen business days of the date of analysis. In addition, if a BLL result is $\geq$ 45 mcg/dL, the laboratory must notify the health care provider within 24 hours of analysis if the child is less than eighteen years of age. The HCP must then notify the LHD.

5. Although there is no established threshold for the harmful effects of lead, the federal Centers for Disease Control and Prevention (CDC) has defined a BLL of $\geq$ 10 mcg/dL as the definition of lead poisoning (EBLL) and the action level for public health intervention. Specific medical and public health follow-up activities depend on the BLL, but may include:

- Risk reduction education
- Nutrition counseling
- Monitoring of venous BLL in accordance with a follow-up schedule recommended by the CDC
- Environmental investigation
- Detailed lead exposure assessment
- Communication between the LHD and health care provider
- Developmental screening
- Hospitalization and chelation therapy

It is important to note that a BLL of 10 ug/dL in children is not a toxicological threshold. BLLs below 10 mcg/dL have been associated with adverse health outcomes; including measurable decrements in population IQs of children. [6] [7] [8] [9] Consistent with NYS regulations, the CDC stresses that *all* parents of young children should receive

anticipatory guidance on lead poisoning prevention. The CDC also recommends that providers consider more frequent testing (i.e. more than annually) for a child whose BLLs are approaching 10 mcg/dL, particularly children under 2 years old, or those who are at risk for lead exposure.

6. Chelation treatment refers to the use of medications to remove lead from the body. Four drugs are available in the U.S. currently. None are very effective at increasing lead excretion when blood lead levels are < 45 mcg/dL; although all can reduce blood lead levels temporarily. However, the purpose of chelation therapy is to reduce the amount of lead available in a person to produce toxicity; [4] it is not merely to manipulate the chemical measure of lead in blood. [10] [11] Consultation with a Regional Lead Resource Center£ is strongly recommended if a child has a BLL ≥ 45 mcg/dL.

References

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[4]Pediatrics in Review, Oct 2000; 327-335, *Lead Poisoning. Markowitz M.*

[5] NYCRR Title 10 Subpart 67-1 and 67.3.

[6] Curr Opin Pediatric, 2008 Apr; 20 (2):172-7, *Very low lead exposures and children's neurodevelopment.* Bellinger DC.

[7]Neurotoxicology, 2007 Nov; 28(6):1170-7. Epub 2007 Jul 25. *Neuropsychological function in children with blood lead levels <10 mcg/dL.* Surkan PJ et al.

[8] Environ Health Perspect. 2008 Feb; 116(2):243-8. *Blood lead concentrations <10 microg/dL and child intelligence at 6 years of age.* Jusko TA et al.

[9] Neurotoxicology. 2006 Sep; 27(5):693-701. Epub 2006 Aug 4. *A rationale for lowering the blood lead action level from 10 to 2 mcg/dL.* Gilbert SG, Weiss B.

[10] Pediatrics. 2004 Jul; 114(1):19-26, *Effect of Chelation Therapy on the Neuropsychological and Behavioral Development of Lead-Exposed Children after School Entry. Dietrich KN et al.*

[11] Am J Health System Pharm. 2007 Jan 1; 64(1):45-53, *Lead Toxicity and Chelation Therapy*. Gracia RC, Snodgrass WR.

¶NYSDOH Childhood Lead Poisoning Risk Assessment Questionnaire is available at www.health.state.ny.us/environmental/lead/exposure/childhood/risk_assessment.htm

* NYS Public Health Law and Regulations is available at www.health.state.ny.us/environmental/lead/

§ Contact information for NYS LHDs is available at www.health.state.ny.us/nysdoh/lhu/map.htm

£Contact information for RLRCs is available at www.health.state.ny.us/environmental/lead/exposure/childhood/regional_lead_resource_centers.htm