

Lead Exposure in Children: Prevention, Detection, and Management

Introduction

Fatal lead encephalopathy has disappeared and blood lead concentrations have decreased in US children, but approximately 25% still live in housing with deteriorated lead-based paint and are at risk of lead exposure with resulting cognitive impairment and other sequelae. Evidence continues to accrue that commonly encountered blood lead concentrations, even those less than 10 µg/dL, may impair cognition, and there is no threshold yet identified for this effect. Most US children are at sufficient risk that they should have their blood lead concentration measured at least once. There is now evidence-based guidance available for managing children with increased lead exposure. Housing stabilization and repair can interrupt exposure in most cases. The focus in childhood lead-poisoning policy, however, should shift from case identification and management to primary prevention, with a goal of safe housing for all children.

Recommendations for Pediatricians

- Provide anticipatory guidance to parents of all infants and toddlers aged 6 months to 3 years about preventing lead poisoning. Parents should be made aware of normal mouthing behavior and should assess the safety of their home, work and hobbies. Inform parents that lead can be present in dust and can be ingested by hand to mouth contact.
- Inquire about lead hazards in home and child care settings. Home inspections could be necessary and necessary repairs made by certified individuals
- Know state Medicaid regulations and measure blood lead concentration in Medicaid-eligible children. Find guidance from city or state health departments about screening in non-Medicaid-eligible children. Children should be tested at 12 and 24 months of age, and children 3 to 6 years of age if never tested regardless of their risk factors. Children between 24 months and 72 months should receive a blood lead screening test if there is no record of a previous test.
- Be aware of local special risk groups such as immigrants, foreign-born adoptees, refugees or children whose parents may have an occupation or hobby that may be at risk for lead exposure.
- Keep current with the work of the national Advisory Committee on Childhood Lead Poisoning Prevention and any relevant local committees.

Suggested Clinical Evaluation for Lead Exposure

Medical History: Ask about symptoms, development history, mouthing activities, pica, previous blood lead concentration measurements, family history of lead poisoning

Environmental History

Paint and Soil Exposure: age and condition of residence, evidence of chewed or peeling paint, how long has family been at current residence, renovation and repair history of house, newness of windows, other sites where child spends a significant amount of time, condition of indoor play areas, bare soil exposure in outdoor play areas, attempts to control dust and dirt

Relevant Behavioral Characteristics of the Child: degree of hand to mouth activity by the child, child exhibition of pica, hand washing before meals and snacks

Exposures to and Behaviors of Household Members: Occupation of household members, Household members hobbies, painted or unusual items burned in household fireplaces

Miscellaneous: home contain vinyl mini-blinds made overseas and purchased before 1997, child access to imported food, cosmetics, or folk remedies, food prepared or stored in imported pottery or metal vessels. Family use of imported foods in soldered cans. Candies imported from Mexico

Nutritional History: Take a dietary history, evaluate child's iron status, ask about history of food stamps or participation in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC)

Physical Examination: pay particular attention to the neurologic examination and the child's psychosocial and language development.

Summary of Recommendations for Children With Confirmed (Venous) Elevated Blood Lead Concentrations ($\mu\text{g}/\text{dL}$)

10-14 $\mu\text{g}/\text{dL}$: Dietary and environmental lead education; follow-up blood lead monitoring as per State Guidelines

15-19 $\mu\text{g}/\text{dL}$: Dietary and environmental lead education; follow-up blood lead monitoring; environmental investigation, proceed to actions for 20-44 $\mu\text{g}/\text{dL}$ if a follow-up blood lead concentration is in this range at least 3 months after initial venous test OR blood lead concentration increases

20-44 $\mu\text{g}/\text{dL}$: Dietary and environmental lead education; follow-up blood lead monitoring; complete history and physical examination; lab work including hemoglobin or hematocrit and iron status; environmental investigation; lead hazard reduction; neurodevelopmental monitoring; abdominal radiography (if particulate lead ingestion is suspected) with bowel decontamination if indicated

45-69 $\mu\text{g}/\text{dL}$: Dietary and environmental lead education; follow-up blood lead monitoring; complete history and physical examination; lab work including hemoglobin or hematocrit, iron status and free EP or ZPP; environmental investigation; lead hazard reduction; neurodevelopmental monitoring; abdominal radiography with bowel decontamination if indicated; chelation therapy.

$\geq 70 \mu\text{g}/\text{dL}$: Hospitalize and commence chelation therapy; proceed according to actions for 45-69 $\mu\text{g}/\text{dL}$.

Not Recommended at Any Blood Lead Concentration

- Searching for gingival lead lines
- Evaluation of renal function (except during chelation with EDTA)
- Testing of hair, teeth, or fingernails for lead
- Radiographic imaging of long bones
- X-ray fluorescence of long bones

Sources of Lead Exposure and Prevention Strategies

Environmental

- *Paint:* Identify and abate
- *Dust:* Wet mop (assuming abatement)
- *Soil:* Restrict play in area, plant ground cover, wash hands frequently
- *Drinking Water:* Flush cold-water pipes by running water until it becomes as cold as it will get (a few seconds to 2 minutes or more; use cold water for cooking and drinking)
- *Folk Remedies:* Avoid use
- *Cosmetics containing additives such as kohl or surma:* Avoid use
- *Old ceramic or pewter cookware, old urns/kettles:* Avoid use
- *Some imported cosmetics, toys, crayons:* Avoid use
- *Contaminated mineral supplements:* Avoid use
- *Parental occupations:* remove work clothing at work; wash work clothes separately
- *Hobbies:* Proper use, storage, and ventilation
- *Home renovation:* Proper containment and ventilation
- *Buying or renting a new home:* Inquire about lead hazards

- *Lead dust in carpet:* Cover or discard

Host

- *Hand-to-mouth activity (or pica):* Frequent hand washing; minimize food on floor
- *Inadequate nutrition:* Adequate intake of calcium, iron, vitamin C
- *Developmental disabilities:* Enrichment programs

References: American Academy of Pediatrics Policy Statement, Committee on Environmental Health. Lead Exposure in Children: Prevention, Detection, and Management. Pediatrics, Volume 116, Number 4, 2005. <http://aappolicy.aappublications.org/cgi/reprint/pediatrics;116/4/1036.pdf>

Centers for Disease Control and Prevention. Preventing Lead Poisoning in Young Children. A Statement by the Centers for Disease Control and Prevention (CDC). 2005. <http://www.cdc.gov/nceh/lead/publications/PrevLeadPoisoning.pdf>

Georgia Childhood Lead Poisoning Prevention Program (GCLPPP). <http://health.state.ga.us/programs/lead/>

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