

Protocol for Clinical Management of Lead Poisoned Children

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“Confirmed”

Venous
Blood Lead
Level (BLL)

CLINICAL MANAGEMENT OF LEAD POISONED CHILDREN

I.

10-19 mcg/dL

- 1) Confirmatory venous blood lead level (BLL) within 3 months if BLL is 10-14 mcg/dL or within 1 month if $BLL \geq 15$ mcg/dL
- 2) Referral to the appropriate local health department. (The Milwaukee Health Department Lead Poisoning Prevention Program will send a public health nurse and home inspector out to the home for children less than 3 years old with a confirmed $BLL \geq 15$ mcg/dL)
- 4) Monitor venous BLL every 3-4 months until it is < 10 mcg/dL.
- 5) Supplement with iron if child is deficient.
- 6) Educate the family regarding lead in the home:
 - Causes and effects of lead poisoning
 - Possible sources of lead; Ways to reduce exposure
 - Regular monitoring of blood lead levels
 - Nutritional emphasis of foods high in iron
 - Adequate calcium and protein in the child's diet.
- 7) Test other young children in the house.

II.

20-24 mcg/dl

- 1) Confirmatory venous blood lead level and EP (erythrocyte protoporphyrin) within 1 month
- 2) Referral to local health department for nursing education and home inspection to identify and clear up lead hazards.
- 3) Complete Diagnostic Evaluation
 - History- Clinical symptoms? Nutritional status (esp. iron, calcium intake)
 - Potential sources of lead exposure
 - Pica? Home remodeling or painting?
 - Occupation or hobby of parent?
 - Unusual “FOLK” medicines?
 - Previous blood lead levels (trends)
 - Physical Exam - Neurological, developmental assessment / ongoing monitoring.
- 4) Educate the family re: Lead (as above)
- 5) Monitor venous blood lead levels every 3-4 months (every 3 months for children ≤ 3 years old)
- 6) Supplement with iron if the child is deficient.
- 7) Test other young children in the house.

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III. 25-44 mcg/dl	<ol style="list-style-type: none">1) Confirmatory venous blood lead level (BLL) and Erythrocyte Protoporphyrin (EP) within 1 week2) Referral to local health department for nursing education and home inspection.3) Complete Diagnostic Evaluation (as above) and ongoing neurodevelopmental monitoring4) Educate the family regarding lead (as above)5) Test other young children in the house.6) Continue to monitor blood lead levels every 1-3 months (every month if level rising or ≥ 30 mcg/dL or for younger children)7) Chelation is not recommended routinely at this time by AAP¹.8) I would consider chelation <u>if BLL persists $>35-40$ mcg/dL</u> for several months despite efforts to eliminate lead exposure. Some physicians chelate children with lower BLL's but the data does not show a benefit^{2, 3}.
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¹ Decision on when to start chelation is controversial. The efficacy of chelation therapy with blood lead levels in this range has yet to be demonstrated. “If blood lead levels persist in this range despite repeated environmental study and abatement, some patients may benefit from (oral) chelation therapy by enhanced lead excretion.” AAP Treatment Guidelines for Lead Exposure in Children; Pediatrics 96:1, July 1995; 155-160.

² Lead Exposure in Children: Prevention, Detection and Management; Committee on Environmental Health, Pediatrics 2005; 116;1036-1046.

³ Recent randomized, placebo-controlled, double blinded study did not show improved test scores or behavior in children who were chelated (BLL 20-44) vs. controls. NEJM Vol 344:19, May 2001. Rogan WJ Dietrich KN et al

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IV.
45 - 69 mcg/dl

- 1) Confirmatory venous blood lead level (BLL) and erythrocyte protoporphyrin (EP) as soon as possible. Chelation treatment is based on the results of a confirmed venous BLL
- 2) Notify local health department for urgent home inspection to identify sources of lead exposure.
- 3) Complete diagnostic Evaluation
 - History- Clinical symptoms?
 - Decreased appetite, abdominal pain, constipation
 - Behavior changes, fatigue, irritability
 - Potential sources of lead exposure
 - (paint, occupational hazards)
 - Nutritional status (iron, calcium intake)
 - Previous blood lead levels and EP levels (trends)
 - Physical Exam - Neuro, developmental assessment and ongoing neurodevelopmental monitoring
- 4) Educate the family regarding lead hazard reduction
 - Consider alternative housing during abatement
- 5) Hospitalize 5 days for chelation: either Succimer or CaNa₂EDTA.
- 6) Diagnostic tests, and labs to consider pre-chelation:
 - Pretreatment venous BLL and EP - order Stat
 - CBC and smear, ferritin to check iron status
 - Baseline labs: BUN, Creatinine, AST, ALT and UA to monitor for side effects of chelators
 - Ensure adequate fluid intake for prompt excretion of chelated lead
 - Monitor dipstick urines for protein, blood and specific gravity. Keep specific gravity below 1.015
 - X-ray of abdomen - optional to look for paint chips
 - X-ray of long bones (knees) – not generally recommended
 - Recheck labs (lead, EP, AST, ALT, UA) post chelation
- 7) Involve discharge planner early to ensure home inspection is completed and home is safe from lead hazards before discharge.
- 8) **Follow BLL and EP every 2 -4 weeks for several months post chelation. Recheck Ferritin in 2 months if iron deficient.**
- 9) Do not give iron while chelating with CaNa₂EDTA. It is uncertain if iron interferes with Succimer chelation⁴.

⁴Peds Research, Vol 48(5), 2000. Safety and Efficacy of Succimer in Toddlers. TLC Trial Group.

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Two Options for Chelation:

1) DMSA (Chemet or Succimer)

The drug of choice⁵

Dose: 350 mg/m²/dose tid x 5 d then bid x 3 weeks⁶

Given by mouth - may open up 100 mg capsules and put in food

Toxicity GI 10% (nausea, vomiting, slight increase liver enzymes, neutropenia, rash)

Monitor labs pre treatment after 5-7 d of tx, and post treatment (BLL, EP, CBC & diff, liver enzymes)

Need follow up labs every 2 weeks post chelation for several months

Discontinue DMSA (Chemet or Succimer) if generalized rash, AST or ALT >200 or WBC <3000

2) CaNa₂EDTA – if Succimer not tolerated.

Dose: 1000 mg/m²/day or 50 mg/kg/d x 5 d

Generally IV – 3 or 4 divided doses or continuous IV infusion with concentration ≤0.5% over 24 hours

Side effects: proteinuria, elevated BUN, Creatinine

Monitor urine specific gravity and keep <1.015

Recheck labs post chelation before discharge

Rebound of BLL after treatment is common, so monitor labs every 2 weeks for several months post chelation

HOME CHELATION

DMSA (Chemet or Succimer) 100 mg capsules

To consider home chelation, home must be free of lead hazards. Weekly nursing visits to monitor for side effects, adequate fluid intake and review compliance.

Same dose as above

Monitor labs as above

⁵ Peds in Review, Vol 21(10), Oct 2000. Lead Poisoning, Markowitz M.

⁶ Peds in Review; Vol 26(12), Dec 2005. Lead Poisoning: Successes and 21st Century Challenges

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CLINICAL MANAGEMENT OF LEAD POISONED CHILDREN

V.
>70 mcg/dl

Treat as emergency. Potential encephalopathy.
Stat confirmatory venous blood lead level (BLL) and erythrocyte protoporphyrin (EP), treatment is based on a confirmed venous BLL.

[Hospitalize immediately]. Involve case manager to coordinate referral to local health department for home inspection and to plan discharge.

Complete Diagnostic Evaluation
On Physical Exam - look for papilledema, neuro deficits

- 1) Refer to local health department for urgent home inspection to identify sources of lead exposure
- 2) Diagnostic Tests:
 - Pre-treatment labs: Stat Lead level, EP, CBC and smear, Ferritin, BUN, Creatinine, UA, AST, ALT.
 - Monitor BLL closely until <50 mcg/dL
 - X-ray: Consider KUB - If positive for lead, may give cathartic such as Polyethylene Glycol or Mg Citrate.
 - Long bone films for “lead” lines NOT recommended
- 3) Chelation
 - A. First option for BLL 70-100 mcg/dL is Succimer w/ CaNa₂EDTA
First start Succimer 350 mg/m/dose tid for 5-7 days
Give 1st dose 4 hours pre 1st dose CaNa₂EDTA to prevent worsening of symptoms.
CaNa₂EDTA 1500mg/m/d x 5 days
Check BLL and EP at the end of 5 days of EDTA before patient is discharged to lead safe environment
Continue Succimer 350mg/m/dose bid for 3 weeks post discharge.
 - B. Second option BAL w/ CaNa₂EDTA
300-450 mg/m²/day deep IM x 3 d or until BLL below 50 mcg/dL. 3-4 mg/kg/dose q 4-6 hr
Give 1st dose BAL 4 hours pre 1st dose CaNa₂EDTA to decrease BLL and prevent worsening of symptoms
CaNa₂EDTA 1500 mg/m²/d x 5 days or 75 mg/kg/day
Suggest IV continuous infusion of 0.5% concentration or less. The higher the blood lead level the more important it is to give CaNa₂EDTA continuously over 24 hours, to maximize excretion of lead and minimize redistribution of lead from bone into the soft tissues (especially brain).

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- 4) Pre-discharge labs: BLL, EP, AST, ALT, UA
- 5) Side effects of chelators:
BAL 30-50% with nausea, vomiting, headache, lacrimation, rhinorrhea – do not use if child is allergic to peanuts
CaNa₂EDTA - renal
Monitor dipstick urines for protein blood and specific gravity (keep <1.015) every day during chelation.

If patient is symptomatic, should be monitored closely for encephalopathy in intensive care setting. IV fluids should ensure adequate diuresis without increasing ICP.
- 6) Need follow up labs every 1-2 weeks post chelation since BLL will rebound due to lead in bone returning to the blood. Repeat chelation when lead rebounds over 40 mcg/dL.