Delay In Transitions Of Care In Children Admitted For Lead Chelation Therapy With Succimer

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Abstract

Introduction: Lead-based paints were banned for housing since 1978 but paint deterioration continues to expose children in at least 4 million households and increase risk of permanent neurological sequelae. Lead toxicity management includes chelation therapy with succimer among other modalities. If hospital admission is warranted, delays in initiation of succimer therapy or outpatient transition may affect hospital length of stay, school days missed, and cost.
Objective: To identify presence of delays in transitions of care surrounding succimer.
Study Design: Retrospective chart review of children admitted for succimer therapy.
Methods: All children admitted between September 2, 2013 and September 2, 2015 for management of lead toxicity with succimer therapy were included. Electronic health records were reviewed to obtain data. Primary endpoint was incidence of delay in initiation upon hospital admission (≥ 4 hours) and delay in discharge based on difficulty obtaining succimer in outpatient setting.
Results: Five children received succimer during the study period: 4 males (80%), mean age 36.4 months (± 7.45), and lead source was house paint in 4 patients (2 patients consumed paint chips), and an herbal remedy for one patient. One patient was admitted twice; 6 admissions were reviewed. Mean lead levels at admission was 51 mcg/dL ± 15.2. Mean length of hospital stay was 3 days ± 1.94. One patient (16.7%) experienced a delay to administration of chelation therapy; 4 hours. No patients experienced a delay to discharge. However, 2 of the patients had assistance with transition; succimer prescription faxed to outpatient pharmacy prior to discharge. Delay in care occurred in 1 of the 6 admissions upon initiation of chelation therapy.
Conclusion: Delay in care occurred in 1 of the 6 admissions upon initiation of chelation therapy. Further investigation is warranted to evaluate delays in care associated with lead toxicity management.

Background

- Childhood lead poisoning is considered the most preventable environmental disease among young children, with ~0.5 million U.S. children having blood lead levels above 5 mcg/dL, which requires public health actions be initiated according to CDC.[1]
- Lead-based paints were banned for use in housing in 1978; however, there are now at least 4 million households with children exposed to high levels of lead from the deterioration of the paint.
- Other common sources of lead: dust, soil, water, food, ethnic folk remedies, and cosmetics. [2]
- Low blood levels have been shown to cause permanent neurological developmental consequences that affect a child's IQ, ability to pay attention, and academic achievement. Long term effects of lead exposure cannot be corrected; early detection and treatment is critical.[1]
- Children (ages 1 to 5 yr) have increased risk of lead toxicity due to hand-to-mouth behaviors.
- Management: Removal of the lead risk from environment and the child, and chelation therapy.[3,4]
- Chelation therapy [e.g., ethylenediaminetetraacetic acid (EDTA), dimercaptosuccinic acid (succimer), or 2,3 dimercaptopropanol (BAL)] is required when lead levels are ≥ 45 microg/dL to decrease lead concentrations by binding metals and excretion, but chelate complex can stay in tissues and redistribute to other tissues or become absorbed into the bone.[3,4]
- Succimer is the only oral chelating agent, and is equally effective as EDTA[3]
- Succimer dosing options: Weight or BSA based: 10 mg/kg/dose (or 350 mg/m^2/dose) q8h for 5 days followed by 10 mg/kg/dose (or 350 mg/m^2/dose) q12h for 14 days; Standardized dosing protocol: patient weight 8 - 15 kg, 100 mg q8h, and 16 - 23 kg, 200 mg q8h.[6]
- Patients with lead levels of 45 – 59 mcg/dL are recommended inpatient care, or if there is poor compliance or exposure reduction cannot be assured.
- Lead levels >70 mcg/dL are considered a medical emergency and hospitalization is required to reduce lead exposure, chelation with EDTA and succimer, and monitor progress.[7]
- Our institution's medication incident reporting system identified concerns regarding delays in care or poor transitions to the outpatient setting for children requiring chelation therapy.
- At the time of this study, there was no literature defining delays in transition of care.

Methodology

Patient selection: Five children were admitted to the Children's Regional Hospital (CRH) at Cooper University Hospital between September 2, 2013 and September 2, 2015, for management of lead toxicity with succimer chelation therapy.
Data collection: Each patient's electronic medical record and notes were reviewed via Epic for data collection including blood lead levels, succimer therapy details.
Delay of care: For this study, the incidence of delay in initiation upon hospital admission was defined as ≥ 4 hours and delay in discharge was based on difficulty obtaining succimer in outpatient setting
Purpose: To determine the presence of delays in transition of care surrounding succimer chelation therapy for lead toxicity, including time to administration upon hospital admission and subsequent time to discharge.

Results

Patient A
- A 24 month old female, weighing 10.7 kg, presented with lead poisoning from exposure in her previous house: patient often played in the dirt and window sills which most likely resulted in her elevated lead level, but father worked with landscaping; therefore, it was not determined if soil transported into the house contributed to the high levels of lead.
- No significant past medical history (PMH), past surgical history (PSH), medication use, and no known drug allergies (NKDA). Routine blood work identified anemia and iron therapy was initiated.
- Admitted with lead level of 42 mcg/dL; succimer 100 mg was initiated within 3 hr of presentation.
- During her 4-day hospital stay, she received succimer 100 mg by mouth q8h for 13 doses.
- Prior to discharge, her lead level was 28 mcg/dL and given an outpatient prescription for succimer 100 mg by mouth q12h for an additional14 days.
- She was not readmitted for poor adherence or inability to obtain outpatient therapy. Nor were there any notes of outpatient delays in therapy or follow-up.

Patient B
- A 36 month male, weighing 15.4 kg presented with high lead levels from the patient's residence and difficulty obtaining outpatient succimer due to unclear social issues.
- No significant PMH or PSH, and NKDA.
- Admitted with lead level of 49 mcg/dL; succimer 200 mg was initiated within 3 hours.
- During 4-day hospital stay, he received succimer 100 mg by mouth at breakfast, 200 mg by mouth at 1400, and 200 mg nightly for 13 doses.
- Prior to discharge, his lead level was 29 mcg/dL and was given an outpatient prescription.
- The patient's house was also inspected house tracing but there was no note of the clearance.
- No note of readmission or delays in therapy initiation or discharge documented.

Patient C
- A 37 month male, weighing 16.4 kg, had a history of abnormal lead levels twice from outdoor paint chips in his previous house prior to presenting to CRH with an abnormal lead level of 33 mcg/dL after moving to an unconfirmed lead-free environment.
- No significant PMH or PSH, and NKDA.
- Admitted to an outside hospital (OSH) with lead level of 52 mcg/dL and received 5 days of succimer before discharge with lead level of 22 mcg/dL and prescription for 1-2 more weeks.
- Second admission to an OSH for lead levels of 50's mcg/dL and received 3 days of succimer therapy prior to discharge with lead levels of 26 mcg/dL and continued 2-3 weeks outpatient.
- Admitted to CRH with lead level of of 33 mcg/dL and succimer 200 mg initiated within 4 hours.
- During 3-day hospital stay, he was given succimer 200 mg by mouth q8h for 7 doses and concurrently given iron therapy for iron-deficiency anemia.
- Prior to discharge, a prescription was faxed to the outpatient pharmacy to complete therapy.
- No readmission or delay in discharge noted; however succimer initiation was delayed.

Patient D
- A 15.8 kg male patient presented twice for elevated lead levels.
- At 40 months of age, he presented with lead poisoning from an unknown herbal remedy.
- PMH included a history of Streptococcal pharyngitis and a PSH of a tooth extraction.
- Admitted with a lead level of 66 mcg/dL; succimer 200 mg given within an hour after admission.
- During his one-day hospital stay, he received succimer 200 mg q8h for a total of 4 doses and pediatric multivitamins with iron and minerals for anemia.
- Prior to discharge, patient was given 4 days of oral therapy 200 mg TID and a prescription for 200 mg BID for 14 days faxed to the pharmacy.
- Although the home was cleared by the Dept. of Health (DOH), he was readmitted 3 months later with elevated lead levels from unidentified source.
- Admitted with lead level of 45 mcg/dL; succimer 200 mg given within 3 hours of admission.
- During his second one-day hospital day, he received 200 mg of succimer q8h for 3 doses.
- Prior to discharge, the patient was given a prescription for succimer completion.
- No readmission or delay in therapy initiation noted for either admission.

Patient E
- A 45 month male, weighing 14.6 kg, presented with lead toxicity. from eating paint chips for 3 months, and dirt for the past 2 years.
- PMH and PSH were not significant
- Admitted with a lead level of 73 mcg/dL, classified as medical emergency, and received BAL before starting succimer 96 hours after admittance.
- During 6-day hospital stay, he received 100 mg of succimer q12h, then 100 mg q8h for 14 doses.
- Prior to discharge, his lead level was 12 mcg/dL and given his last dose of oral succimer every 8 hours to be completed at home in 3 days, then a prescription for succimer q12h for 14 days.
- Patient's house did not pass inspection, a hotel was provided by a charity group to keep the patient safe from lead exposure and prevent readmission.
- No documentation of readmission or delay in discharge.

Results (cont.)

Table 1: Summary of Pertinent Patient Information

	Patient A	Patient B	Patient C	Patient D (1st // 2nd admit)	Patient E	Totals
Age (months)	24	36	37	40 // 43	45	36.4 ± 7.45
Gender	Female	Male	Male	Male	Male	80% male
Weight (kg)	10.7	15.4	16.4	15.8	14.6	14.57 ± 2.28
Lead source	House & Dirt	House	Outdoor paint chips & soil	Herbal remedy// unknown source	Paint chip & dirt intake	NA
Admission lead level (mcg/dL)	42	49	33	66 //45 (4 days prior)	73	51 ± 15.19
Hospital stay (days)	4	4	3	1 // 1	6	3 ± 1.94
Time to 1st chelation dose (hr)	3	3	4	1 // 3	4	3 ± 1.10
Total number of succimer doses during stay	13	13	7	4 // 3	14	9 ± 4.94
Discharge lead level (mcg/dL)	28	29	NA	NA // 43	12	28 ± 12.68
Delay in succimer (Y/N)	N	N	Y	N // N	NA	20% delayed
Delay in discharge (Y/N)	N	N	N	N	N	None
Discharge assistance	N	N	Faxed Rx	Faxed Rx	Dose provided	60% assisted

[a] Continuous data presented as average with standard deviation and nominal data as quantity with percent.

Discussion

- Over the course of 2 year, 5 patients received succimer over 6 admissions, with 1 patient had a slight delay of succimer initiation (20%), and 2 patients had assistance in outpatient transition.
- Concerns surrounding delays in succimer therapy are because it is not commonly prescribed or stocked; therefore, delays may occur while inpatient or outpatient pharmacy is waiting for stock.
- 3 patients (60%) required assistance for transition to outpatient; strategies included faxing the succimer prescription to outpatient pharmacy for preparation prior to discharge and providing one dose of succimer for after discharge while waiting for the prescription to be filled.
- Of note, patient B may have been admitted due to issues obtaining succimer in outpatient setting.
- To prevent delays in care, assistance strategies as mentioned should be implemented.
- Our institution added succimer to formulary to ensure consistent stock and prevent delays in chelation therapy initiation.
- Limitations include lack of evidence-based definition of delay in care and study's small size.

Conclusion

One patient experienced a delay in initiation of chelation therapy, and there were no delays in discharge; however 3 of the patients had assistance with transition. Further investigation is warranted to evaluate delays in care associated with acquisition of succimer in order to minimize cost, hospital stay, and missed school days for children.

References

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