***Case report***

**A unique case of Lead-Paint Pica in a 14-year-old girl**

**ABSTRACT**

**Aims:** To describe a unique case of pica and elucidate the importance of early recognition and management in order to avoid long-term complications.

**Background:** Pica, as defined by the DSM-V, is the persistent consumption of non-nutritive, non-food substances for at least one month, which cannot be explained by developmental stage or cultural norms. While commonly associated with developmental disorders, pregnancy, and iron deficiency, pica can result in serious medical complications, particularly when toxic substances are ingested.

**Case Description:** Here we present a rare case of a 14-year-old female with no significant past medical or psychiatric history who developed lead poisoning secondary to chronic ingestion of lead-based paint, consistent with a diagnosis of pica. The patient was hospitalized with elevated blood lead levels, microcytic anemia, and gastrointestinal symptoms. Imaging revealed radio-dense material in the colon, consistent with ingested paint chips. She required chelation therapy, bowel decontamination, and psychiatric evaluation. Her psychiatric assessment revealed compulsive urges to ingest paint, without evidence of underlying psychosis, intellectual disability, or obsessive-compulsive disorder.

**Conclusion:** This case underscores the importance of considering pica in the differential diagnosis for unexplained lead toxicity, especially in the context of iron deficiency. Early recognition and multidisciplinary management are essential to prevent long-term complications.

***Key words****: Pica; paint; non-food substance; lead; anemia*

**INTRODUCTION**

The DSM-V defines pica as eating non-nutritive, non-food substances over a period of at least one month that is not explained by someone’s developmental age or explained by someone’s cultural or social background (Al Nasser, 2023). Commonly, infants will start mouthing at about 3-5 months of age, and it will begin to peak until 6-9 months of age. After about 9 months the behavior will slowly begin to fade (Koterba, 2014). As children grow older, they begin to explore more with their hands, ending this oral stage of exploration.

Pica itself can be at any age and is likewise common in individuals among the intellectually impaired, and in women it is most often seen during pregnancy. Pica can be associated with intellectual disability (McNaughten, 2017), schizophrenia (Khosravi 2021), autism spectrum disorder, pregnancy, trichotillomania (hair pulling disorder), and excoriation (skin picking) disorder, obsessive compulsive disorder, and sickle cell disease (Clark et al., 2020). The nature of ingested items is variable, including but not limited to earth (geophagy), raw starches (amylophagy), ice (pagophagia), charcoal, ash, paper, chalk, cloth, baby powder, coffee grounds, and eggshells (Al Nasser, 2023).

While the exact pathophysiology of pica is currently unknown, the strong association of pica with iron deficiency anemia (IDA) lends credence to the hypothesis that dopamine transmission may be disrupted in this disorder, as iron is a crucial cofactor in dopamine synthesis. Current treatments for nutritive picas are focused on treating the underlying deficiency. Picas associated with ASD are resistant to medications but can be treated with applied behavioral analysis therapy (ABA) (Schnitzler, 2022).

**CASE DESCRIPTION**

A 14-year-old girl with no significant past medical history presented to the hospital with complaints of daily headaches, diffuse abdominal pain, generalized body aches, and intermittent constipation. She was admitted for evaluation and management of markedly elevated blood lead levels identified on recent outpatient testing.

Initial venous lead level obtained on September 11, 2024, was 79 mcg/dL. Despite the severity of elevation, chelation therapy had not yet been initiated. The patient denied drug use and reported regular but heavy menses, 8–10 pads daily at the peak, currently on her period at the time of admission. She was taking over-the-counter oral ferrous sulfate (Ferosul) 325 mg daily for iron supplementation at home. A urine pregnancy test was negative on admission.

On arrival, the patient was alert and oriented, in no acute distress. Initial vital signs included blood pressure 117/77 mmHg, pulse 104 bpm, temperature 36.7°C, respiratory rate 16 breaths per minute, and oxygen saturation 99% on room air. Neurologic examination was unremarkable with no focal deficits, tremor, or signs of encephalopathy. Cranial nerves were intact. She displayed a thin bluish-black line along the gingival margins, consistent with Burton lines associated with chronic lead exposure. Mild diffuse abdominal tenderness was noted on examination without rebound or guarding.

Laboratory testing was notable for hemoglobin 10.3 g/dL, hematocrit 33.3%, and mean corpuscular volume (MCV) 74.0 fL, consistent with microcytic anemia. Red cell distribution width (RDW) was elevated at 20.3%. Peripheral smear demonstrated target cells. Sodium was 137 mmol/L, and AST was mildly elevated at 37 U/L. Urinalysis revealed minimal bacteria but was contaminated with epithelial cells.

Table 1: Initial lab values upon presentation and two weeks later.

|  |  |  |
| --- | --- | --- |
| **Lab value** | **9/11/24 (admission)** | **9/27/24** |
| **Sodium** | 142 mmol/L | 137 mmol/L |
| **potassium** | 4.2 mmol/L | 3.8 mmol/L |
| **chloride** | 109 mmol/L | 106 mmol/L |
| **BUN** | 10 mg/dL | 11 mg/dL |
| **Cr** | 0.52 mg/dL | 0.53 mg/dL |
| **Glucose** | 77 mg/dL | 81 mg/dL |
| **Albumin** | 4.1 g/dL | 4.4 mg/dL |
| **Magnesium** |  | 2.0 mg/dL |
| **calcium** |  | 10.3 mg/dL |
| **AST** | 22 IU/L | 37 IU/L |
| **ALT** | 13 IU/L | 20 IU/L |
| **WBC** |  | 10.1 x 10E3/uL |
| **Hgb** |  | 10.3 g/dL |
| **RDW** |  | 20.3 % |
| **MCV** *(80-99 fL)* |  | 70.7 fL *(low)* |
| **platelets** |  | 555 x 10E3/uL |

Poison Control was contacted for management recommendations. Oral chelation therapy with succimer was initiated at 10 mg/kg/dose three times daily for five days, followed by twice daily for 14 days. An alternative dosing regimen of 350 mg/m²/dose was considered but not used.

On hospital day 2, an abdominal radiograph demonstrated numerous small radiodensities scattered throughout the colon, suggestive of retained lead-containing material, likely from ingested paint chips. No radiopaque material was seen in the stomach or small intestine. In response, chelation therapy was temporarily held due to the risk of enhancing absorption of ingested lead. A bowel regimen was initiated, including polyethylene glycol (Miralax) and magnesium citrate, to promote gastrointestinal clearance. Repeat abdominal imaging was planned prior to resuming chelation.

By September 28, the patient reported episodes of green, watery diarrhea. Follow-up radiography showed no remaining radiodensities within the colon. Chelation therapy was resumed with oral succimer 500 mg three times daily for five days, followed by 500 mg twice daily for 14 days. Daily iron supplementation was continued. Repeat venous lead levels declined to 70.3 mcg/dL on October 3 and 37.1 mcg/dL on October 6, indicating appropriate response to treatment.

Table 2: Lead levels during treatment.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Date | 9/11/24 | 9/28/24 | 10/1/24 | 10/6/24 | 10/13/24 |
| Lead Level | 79 mcg/dL | 64.8 mcg/dL | 70.3 mcg/dL | 37.1 mcg/dL | 34.1 mcg/dL |

Table 3: Peripheral blood smear findings prior to reinitiation of chelation therapy and at its conclusion.

|  |  |  |
| --- | --- | --- |
| **Lab value** | 9/27/24 | 10/13/24 |
| RBC morphology | present | present |
| stomatocytes | slight | slight |
| Target Cells |  | slight |
| anisocytosis | moderate | slight |
| hypochromia | slight | slight |
| microcytes | moderate | slight |

Psychiatric consultation was requested to assess the patient’s ongoing ingestion of paint and other non-nutritive substances. The patient reported a two-year history of paint consumption that began while living abroad. She described intrusive urges to eat paint, with mounting internal discomfort if unable to do so. She denied eating paint due to hunger or curiosity and reported no longer consuming other substances such as chalk or plaster. She denied hallucinations, trauma, suicidal ideation, or compulsive rituals.

Mental status examination revealed a calm, cooperative adolescent who appeared her stated age, maintained appropriate eye contact, and demonstrated linear, goal-directed thought processes. She was fully oriented, with no evidence of mood disturbance, psychosis, or cognitive impairment. The patient was performing well in school as a ninth grader and actively participated in Junior ROTC. Her siblings were asymptomatic and had normal lead levels. The family resided in a townhome built in 1900, raising concern for ongoing environmental lead exposure.

Given the persistent, non-nutritive ingestion of lead-containing paint without nutritional or cultural explanation, the patient met DSM-5 criteria for pica. Although the intensity of urges raised consideration of a compulsive component, the absence of intrusive thoughts or ritualistic behavior did not support a diagnosis of obsessive-compulsive disorder. Outpatient psychiatric follow-up was recommended.

The patient completed chelation therapy without further complication. With elimination of retained lead material, improvement in lead burden, and clinical stabilization, she was deemed appropriate for discharge. She was advised to avoid returning to the home environment due to ongoing exposure risk and referred for follow-up with pediatric hematology, psychiatry, and public health services.

**DISCUSSION**

Pica is characterized by the persistent ingestion of non-nutritive substances and commonly includes items such as chalk, paper, dirt, hair, soap, rocks, and ice. This case presents a rare and notable variant of pica involving the ingestion of lead-based paint; one of the few rare cases since the first documented case of childhood lead poisoning due to paint ingestion reported in Queensland, Australia nearly a century ago (Gibson, 1904).

The association between pica and lead poisoning extends beyond the direct ingestion of lead-contaminated substances like soil or paint chips. Iron deficiency, often seen in individuals with pica, increases lead absorption by upregulating the divalent cation transporter in the duodenum. This transporter, which normally facilitates Fe²⁺ absorption, also permits uptake of Pb²⁺, thereby increasing lead absorption in iron-deficient individuals (Kwong, 2004). In this patient, it remains unclear whether lead toxicity led to iron deficiency or vice versa, however, her history of heavy menstrual periods suggests a possible chronic iron deficiency.

Nutritional factors may further influence pica-related lead toxicity. In an animal model, calcium deficiency significantly increased lead ingestion, while magnesium and zinc deficiencies showed intermediate effects (Snowdon, 1977). In a study of 43 children aged 1 to 6, lower calcium and zinc intake correlated with higher blood lead levels. Children with higher lead levels consumed less calcium and were more likely to fall below recommended nutrient intakes. A negative correlation between milk consumption and blood lead levels further suggests a protective role for calcium. The incidence of pica was also higher among children with elevated lead levels, supporting a nutritional basis for this behavior (Johnson, 1979).

This patient's admission labs showed no deficiencies in calcium or magnesium with a serum calcium of 10.3 mg/dL and a serum magnesium of 2.0 mg/dL. Although serum zinc levels were not assessed, no clinical signs of zinc deficiency such as dermatitis, hair loss, or diarrhea were noted on physical exam. Nonetheless, zinc testing may be worth considering in similar cases despite it not being routinely performed.

Emerging research into the gut-brain axis provides additional insight into pica pathogenesis. Alterations in gut microbiota have been linked to behavioral changes, with methane-producing bacteria—particularly in the context of Small Intestinal Bacterial Overgrowth (SIBO)—impairing nutrient absorption and contributing to iron and vitamin B12 deficiencies (Margolis, 2021; Wielgosz-Grochowska, 2024). Although this patient had no formal diagnosis of IBS, her history of constipation raises the possibility of such a mechanism contributing to her behavior.

This case illustrates an uncommon form of pica without underlying psychiatric or developmental disorders. Nutritional deficiencies, especially in iron, calcium, and zinc, are known contributors to pica. Given the medical complications associated with this behavior, recognizing and addressing its underlying causes is essential. Environmental lead exposure remains a concern, especially through ingestion of lead-based paint in older housing and in immigrant populations from regions without strict regulations (Brown & Margolis, 2012). The patient’s history of initiating paint ingestion abroad and continuing the behavior post-immigration underscores the persistence of pica and the global scope of lead exposure. Environmental assessments are critical for children with elevated blood lead levels, particularly when behavioral factors like pica are involved.

Lead exposure has well-documented neurodevelopmental consequences, including cognitive deficits, behavioral dysregulation, and long-term academic underperformance (Lanphear, 2005). Although this patient currently demonstrates normal academic performance and no overt neurological deficits, her history of chronic exposure and high lead levels pose a risk for subtle neurocognitive impairments. Effective management of pica-related lead toxicity requires a multidisciplinary approach involving psychiatry, toxicology, nutrition, and social services. Continued follow-up is essential to monitor for recurrence, reassess lead levels, and ensure a safe, lead-free environment for the patient and family.

**CONCLUSION**

This case underscores the clinical importance of recognizing pica as a potential underlying cause of lead toxicity, even in adolescents without developmental delays, psychiatric history, or overt nutritional deprivation. This patient’s presentation - a previously healthy 14-year-old girl with compulsive ingestion of lead-based paint - highlights the potential for serious medical consequences, including lead poisoning and microcytic anemia. Her case illustrates how pica can occur in the absence of traditional risk factors and may present primarily with physical symptoms rather than psychiatric ones. Early identification and a multidisciplinary treatment approach, including medical stabilization, environmental intervention, nutritional supplementation, and psychiatric assessment, were essential in her recovery. Clinicians must maintain a high index of suspicion for pica in patients - particularly in children and adolescents - with unexplained anemia or heavy metal exposure, as timely diagnosis and intervention can prevent long-term cognitive and physiological complications.

**CONSENT**

Written informed consent was obtained from the patient’s guardians for publication of this case report.

**ETHICAL APPROVAL**

All procedures performed in this study are in accordance with the ethical standards of the institutional and/ or national research committee.

**References:**

1. Al Nasser Y, Muco E, Alsaad AJ. Pica. [Updated 2023 Jun 26]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK532242/
2. Brown, M. J., & Margolis, S. (2012). Lead in drinking water and human blood lead levels in the United States. MMWR Supplements, 61(4), 1-9.
3. Clark, O. M., & Williams, R. (2020). Pica behaviors in pediatric patients with sickle cell disease: a scoping review protocol. JBI evidence synthesis, 18(9), 2018–2024. https://doi.org/10.11124/JBISRIR-D-19-00241
4. Gibson JL. A plea for painted railings and painted rooms as the source of lead poisoning amongst Queensland children. Australasian Med Gazette 1904;23:149–53.
5. Johnson, N. E., & Tenuta, K. (1979). Diets and lead blood levels of children who practice pica. Environmental Research, 18(2), 369–376. https://doi.org/10.1016/0013-9351(79)90113-0
6. Khosravi M. (2021). Pica behaviors in schizophrenia: a call for further research. Journal of eating disorders, 9(1), 117. https://doi.org/10.1186/s40337-021-00472-y
7. Koterba EA, Leezenbaum NB, Iverson JM. Object exploration at 6 and 9 months in infants with and without risk for autism. Autism. 2014 Feb;18(2):97-105. doi: 10.1177/1362361312464826. Epub 2012 Nov 22. PMID: 23175749; PMCID: PMC3773524.
8. Kwong WT, Friello P, Semba RD. Interactions between iron deficiency and lead poisoning: epidemiology and pathogenesis. Sci Total Environ 2004;330:21–37. Search PubMed
9. Lanphear, B. P., Hornung, R., Khoury, J., Yolton, K., Baghurst, P., Bellinger, D. C., ... & Roberts, R. (2005). Low-level environmental lead exposure and children's intellectual function: an international pooled analysis. Environmental Health Perspectives, 113(7), 894–899.
10. Margolis KG, Cryan JF, Mayer EA. The Microbiota-Gut-Brain Axis: From Motility to Mood. Gastroenterology. 2021 Apr;160(5):1486-1501. doi: 10.1053/j.gastro.2020.10.066. Epub 2021 Jan 22. PMID: 33493503; PMCID: PMC8634751.
11. McNaughten, B., Bourke, T., & Thompson, A. (2017). Fifteen-minute consultation: the child with pica. Archives of disease in childhood. *Education and practice edition*, 102(5), 226–229. https://doi.org/10.1136/archdischild-2016-312121
12. Schnitzler E. The Neurology and Psychopathology of Pica. Curr Neurol Neurosci Rep. 2022 Aug;22(8):531-536. doi: 10.1007/s11910-022-01218-2. Epub 2022 Jun 8. PMID: 35674869.
13. Snowdon, C. T. (1977). A nutritional basis for lead pica. Physiology & Behavior, 18(5), 885–893. https://doi.org/10.1016/0031-9384(77)90198-6