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CASE REPORT

Naphthalene mothball ingestion without hemolysis in a five-year-old female: a case report

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ABSTRACT

Background: Naphthalene poisoning from mothball exposure is a prevalent cause of toxicity in children worldwide. Naphthalene poisoning can lead to hemolytic anemia, methemoglobinemia, and hepatic and renal damage. Studies regarding naphthalene ingestion not associated with complications do not exist.

Case Report: We report a novel case of unwitnessed naphthalene mothball ingestion in a 5-year-old child who did not exhibit any complications, such as hemolysis or methemoglobinemia, and was discharged safely with no sequelae.

Conclusion: Awareness of the dangers of naphthalene poisoning is important to prevent poisoning and death.

Keywords: Case report, naphthalene, mothball, toxicology.

Background

Naphthalene poisoning from mothball exposure is a known cause of toxicity in children globally [1]. Naphthalene, marked by a potent scent, exists within mothballs, insect repellents, and certain cleaning products [1]. Systemic exposure to naphthalene leads to oxidative damage to hemoglobin molecules, forming oxidized forms such as methemoglobin; subsequent hemoglobinuria and hemolytic anemia; and hepatic and renal damage [2,3]. Ingesting even small quantities of naphthalene can be highly toxic and can lead to serious long-term effects on the body, including hemolytic anemia, neurological impairment, respiratory problems, kidney damage, potential carcinogenic effects, and gastrointestinal damage. Immediate medical attention is necessary for exposure [2,3]. Treatment options include decontamination with activated charcoal, supportive care such as hydration and electrolyte management, blood transfusions for severe anemia, oxygen therapy for respiratory distress or hypoxia secondary to anemic conditions, dialysis for kidney damage or acute injury, and medications like anticonvulsants if seizures occur [4].

Studies regarding naphthalene ingestion not associated with complications do not exist. This case report discusses a novel case of unwitnessed yet definite naphthalene mothball ingestion by a 5-year-old female who did not exhibit any complications such as hemolysis or methemoglobinemia.

Case Presentation

A 5-year-old female without known comorbidities presented to our Emergency Department (ED) after unwitnessed ingestion of naphthalene mothballs within the past 2 hours. Her mother noticed a mothball smell from her mouth along with remnants between her teeth. The mother mentioned using six mothballs in the washing machine before the incident, and the child herself admitted to swallowing multiple pieces. Only two pieces of the mothball were found, suggesting that four pieces were ingested. The mother promptly brought her to our ED. She denied any symptoms such as headache, altered mental status, abnormal movements, cyanosis, shortness of breath, abdominal pain, vomiting, diarrhea, fever, or changes in urine or stool color. Additionally, there was no family history of hematological diseases or glucose-6-phosphate dehydrogenase (G6PD) deficiency. No other toxins or medications were ingested.

Upon arrival at our ED, she appeared well, oriented, pink in color, well-hydrated, and not in respiratory distress.

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Cyanosis, jaundice, and skin changes were not noted. She was not in pain. Her vitals were appropriate for her age: temperature, 37°C; heart rate, 103 beats per minute; blood pressure, 93/64 mmHg; respiratory rate, 20 breaths per minute; and oxygen saturation, 97% in room air.

Physical examination, including neurological, pupillary, cardiovascular, respiratory, and abdominal examinations reveal no abnormality. A peripheral line was secured, and basic labs and venous blood gas were collected, as shown in Table 1. No signs of hemolysis were noted, and the methemoglobin level was 1%. An intravenous bolus of normal saline (20 ml per kg) and oral activated charcoal (1 g/kg) were administered. The toxicology department was consulted; apart from the laboratory examinations, fluids, and activated charcoal, they recommended admitting the child for 2-3 days to observe signs of neurological manifestations - including lethargy, abnormal movements, and altered mental status - or hemolysis.

After 48 hours under observation, the patient was stable and was subsequently discharged without any sequelae. Her mother was instructed regarding red flag symptoms requiring ED consultation. A follow-up call was performed 1 week after discharge. The mother denied any changes in her child's medical condition. She reported no headache, change in urine color, decrease in activity, fatigue, or change in skin or eye color.

Discussion

Naphthalene is a volatile hydrocarbon that exists in a crystalline form and is colorless. It is used as an insecticide, moth-repellent, deodorant, and surface cleaner in both industrial and household settings. Various adverse consequences have been reported after consumption of repellent-containing mothballs [5]. The primary adverse effects include acute hemolytic anemia and methemoglobinemia [1-5]. It is characterized by Heinz bodies, reduced hemoglobin and hematocrit levels, decreased reticulocyte count, and elevated blood bilirubin levels [5].

Naphthalene induces oxidative stress by increasing the production of free oxygen radicals. Oxidative stress caused by naphthalene causes methemoglobinemia, which is the oxidation of hemoglobin. Methemoglobin is the ferric (Fe+3) form of hemoglobin and does not bind oxygen. The attraction of oxygen to the partially oxidized component of hemoglobin increases. When the methemoglobin level is >1.5 g/dl, the patient becomes cyanotic. Conventional pulse oximeters cannot detect methemoglobin or accurately measure oxygen saturation

Table 1. *Laboratory results.*

Laboratory parameter		Result	Normal range	Interpretation
Complete blood count	White blood cells	8.19	>4.30-<11.30 10^3/ul	Normal
	Red blood cells	4.49	>4.30-<5.50 10^6/ul	Normal
	Hemoglobin	13.3	11.0-15.0 g/dl	Normal
	Platelets	261	150-450 10^3/ul	Normal
Renal profile	Urea	5.6	2.50-6.00 mmol/l	Normal
	Creatinine	39.4	27.00-54.00 µmol/l	Normal
	Sodium	134	134.00-1450.00 mmol/l	Normal
	Potassium	3.9	3.40-4.70 mmol/l	Normal
	Chloride	98	98.00-107.00 mmol/l	Normal
	Carbon dioxide	22.60	20.00-28.00 mmol/l	Normal
	Glucose	4.5	>3.5 mmol/l	Normal
Liver function test	Alanine transaminase	22	<35 U/l	Normal
	Aspartate aminotransferase	31	15-37 U/l	Normal
	Total bilirubin	3.88	5-17 µmol/l	Low
	Albumin	39	34-50 g/l	Normal
	Gamma-glutamyl transpeptidase	22	5-85 U/l	Normal
	Alkaline phosphatase	312	<350 U/:	Normal
Coagulation profile	Protime	17.8	11.9-15.9 seconds	Normal
	International normalized ratio	1.1	0.87-1.16	Normal
	Activated partial thromboplastin clotting time	38.1	28.7-39.7 seconds	Normal
Urine analysis	Urine WBC	Nill	Not applicable	Not applicable
	Urine RBC	Nill	Not applicable	Not applicable
Venous blood gas	pH	7.38	7.35-7.45 pH	Normal
	PCO_2	45	35.0-48.0 mmHg	Normal
	PO_2	85	83.0-108.0 cmmHg	Normal
	Methemoglobin	1%	0%-1.5%	Normal
	HCO_3	24	21-28 mmol/l	Normal

due to methemoglobinemia because they employ two light wavelengths. Pulse oximetry is thus inaccurate in patients with methemoglobinemia. Patients will have poor pulse oximetry measurements despite acceptable blood gas levels [5].

Naphthalene toxicity is associated with gastrointestinal symptoms - such as nausea, vomiting, and diarrhea - and renal symptoms - such as hematuria and renal failure [2,3]. Neurological symptoms - including seizures, disorientation, cerebral edema, and coma - and hepatic sequelae - such as hepatitis, hepatomegaly, and jaundice - have been reported [5]. Individuals deficient in G6PD may experience hemolytic anemia upon exposure to naphthalene [5].

Ascorbic acid functions as an antioxidant that can help alleviate the oxidative stress caused by naphthalene [5]. Methylene blue (MB) is used to manage methemoglobinemia. In individuals with a G6PD deficiency, MB can cause hemolysis and paradoxical methemoglobinemia. Therefore, a G6PD test should be conducted before MB use [2]. N-Acetyl Cysteine treatment should be used as a reducing agent to treat methemoglobinemia, especially in individuals with G6PD deficiency. Exchange transfusion is a viable alternative in certain situations [5].

In this case report, the patient presented with no symptoms. No previous studies have described pediatric mothball ingestion without complications. Only one case report of isolated methemoglobinemia exists, that of a 12-year-old male without hemolysis after naphthalene ingestion who was discharged home in good condition [3].

The study has several important future implications and potential applications, particularly in the area of long-term patient care and educational awareness in the community. We can develop campaigns and put in educational efforts to prevent accidental ingestions, especially in at-risk populations like children. These potential applications can significantly impact patient care, public health, and environmental safety, and overall contribute to a better understanding of the long-term effects of naphthalene toxicity.

Conclusion

In summary, methemoglobinemia frequently occurs after naphthalene poisoning, typically in conjunction with hemolysis and hemoglobinuria. Here, we report a unique case of uncomplicated naphthalene ingestion. Individuals should be informed about the hazardous consequences of this often-used household item, which can lead to systemic poisoning and death.

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List of Abbreviations

ED	Emergency Department
G6PD	Glucose-6-phosphate dehydrogenase
MB	Methylene Blue

Conflict of interests
The authors declare that there is no conflict of interest regarding the publication of this article.

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Consent for publication
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Ethical approval
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