Methemoglobinemia and Uremia from an Unusual Poison

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Abstract

Introduction: Naphthalene toxicity is an unusual form of poisoning and poses a diagnostic and therapeutic challenge due to its rare occurrence and complicated clinical course.

Case Report: We report a case of naphthalene toxicity from non-accidental, non-suicidal ingestion of mothballs in a 56 year old male who presented with methemoglobinemia, hemolytic anemia and respiratory failure. He was treated with supportive management with blood transfusions, urinary alkalinization; hemodialysis for acute kidney injury and he also required noninvasive ventilation for hypoxemic respiratory failure.

Discussion: The crucial aspect in the acute management of any poisoning is knowledge about its toxic manifestations, lethal dose and options for treatment including available antidotes. Mothball poisoning is rarely encountered in North America and awareness of its toxicity and treatment is crucial as the history may not be forthcoming in many instances. In many parts of the world naphthalene containing mothballs are still available commercially. We discuss the method for determining the more toxic form of mothball poisoning and the spectrum of its toxicity. We review the multidisciplinary approach to manage its complicated clinical course including possible antidotes.

Introduction

Naphthalene toxicity is a rare form of poisoning and poses a diagnostic and therapeutic challenge due to its complicated clinical course.

We report a case of naphthalene toxicity from non-accidental, non-suicidal ingestion of mothballs in a 56 year old male who developed methemoglobinema, hemolytic anemia and respiratory failure. He received blood transfusions, urinary alkalinization, and hemodialysis for acute kidney injury and high flow oxygen for hypoxemic respiratory failure.

We discuss the bedside method for determining the more toxic form of mothball poisoning and the spectrum of its toxicity. We also describe the steps in managing hemolysis and hypoxemia caused by naphthalene toxicity including the therapeutic utility of methylene blue.

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Case Presentation

A 56 year African American male presented to the hospital with shortness of breath and jaundice. Symptoms began after he started chewing and sniffing a total of 4 mothballs a few days earlier with a perception that it would improve his halitosis as suggested by his friend. Dyspnea progressively worsened and he also noticed yellowish discoloration of his eyes, fatigue and dark red colored urine. Past medical history was pertinent only for hypertension for which he was advised lifestyle measures.

Initial vital signs revealed; BP-160/85 mmhg, pulse rate 80 beats per minute, respiratory rate 24 per minute, SpO₂ 85% on room air which improved to 94% on 6 liters of O₂. Positive physical findings included scleral icterus, mild cyanosis, tachypnea with clear lungs and no respiratory distress.

Investigations

Initial biochemical markers showed total white count 21.4 *10³ (3.9-11/microL), anemia with hemoglobin (Hb) 8.0 (12.5-17.0 g/dl), hematocrit (Hct) 25.4% (36-50%), BUN 35 (5-26 mg/dl), creatinine 1.45 (0.6-1.5 mg/dl), total bilirubin 16.1 (0.01-1.2 mg/dl), direct bilirubin 0.8 (0.0-0.4 mg/dl) and methemoglobin (Methb) level 9.1% (Normal <1.5%).

Positive hemolytic markers included a reticulocyte count 5.7% (0.6-2.6%), absolute reticulocyte count 146.7 (35-101), lactate dehydrogenase (LDH) 979 (Normal<226 U/L), low hemoglobin and some schistocytes and bite cells in the peripheral smear. Urine analysis showed grossly red urine, few WBC’s and no RBC’s or casts, suggesting hemoglobinuria. Initial arterial blood gas was normal.

G6PD levels tested initially were normal 200 U (Normal: 146-376 U) and toxicology screen for salicylates, acetaminophen and other addictive substances negative. Hepatitis panel, chest imaging and renal ultrasound were normal.

However, few hours later his respiratory status worsened and he became more hypoxic requiring 100% supplemental oxygen. Arterial blood gas showed pH 7.37 (7.38-7.42), pCO₂ 34.8 (38-42 mmhg), pO₂
Methemoglobin was still high at 4.5%. (Refer table 1 for trend of both. This simple test helped us identify the more severe form of poisoning in our patient.

Methemoglobin levels trended down to undetectable levels. On discharge, hypoxia had resolved, creatinine improved to 6.7 mg/dl and hemoglobin 8.8 g/dl. The initial leukocytosis resolved spontaneously after a few days. A few weeks later CBC was normal but G6PD levels were low at 62 U (Normal: 146-376 U) confirming G6PD deficiency. A simple test for mothball component differentiation using water and a float in salt solution [1]. Naphthalene mothball sinks in water and can present with hemolysis and methemoglobinemia. Differentiate between the two is to test the ability to float in water and differentiate the two is to test the ability to float in water and saturated salt solution [1]. Naphthalene mothball sinks in water and floats in salt solution where as a paradichlorbenzene mothball sinks in water and can be fatal, differentiation from PDCB is crucial. One simple way to differentiate between the two is to test the ability to float in water and saturated salt solution [1]. Naphthalene mothball sinks in water and floats in salt solution where as a paradichlorbenzene mothball sinks in both. This simple test helped us identify the more severe form of poisoning in our patient.

Naphthalene is readily absorbed in the systemic circulation by the skin or inhalation and is initially metabolized into a number of reactive metabolites by cytochrome P450 oxidation and then excreted in the urine. Following liver metabolism, naphthal-ampha, the most potent derivative of naphthalene, causes hemolysis with severe anemia and Heinz bodies’ formation [2]. Patients with low tolerance to oxidative stress like those with G6PD deficiency are particularly at higher risk for hemolysis. In our patient, G6PD testing done during active hemolysis was normal, but low weeks after the acute hemolysis had resolved. During active hemolysis measuring G6PD levels is unreliable as it can be falsely normal.

Clinically, naphthalene has a wide spectrum of toxicity (table 2). There have been deaths associated with naphthalene toxicity [3].

Discussion

Mothballs may contain naphthalene or paradichlorbenzene (PDCB). Mothballs are used to protect clothing and fabrics from moths by acting as insecticides. PDCB containing mothballs are also sold as air fresheners. As the toxicity from naphthalene is severe and can be fatal, differentiation from PDCB is crucial. One simple way to differentiate between the two is to test the ability to float in water and saturated salt solution [1]. Naphthalene mothball sinks in water and floats in salt solution where as a paradichlorbenzene mothball sinks in both. This simple test helped us identify the more severe form of poisoning in our patient.

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