Case Reports
Toxicology International, *May-Aug 2015 / Vol-22 / Issue-2, 129-131*
ISSN (Print) : 0971-6580
ISSN (Online) : 0976-5131
DOI: 10.22506/ti/2015/v22/i2/137681

Nitrobenzene Poisoning with Methemoglobinemia due to Plant Growth Nutrient Ingestion

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Abstract

Poisoning due to plant growth nutrient is uncommon and rarely reported. High content of nitrobenzene in plant growth nutrient results in toxic methemoglobinemia and multiple complications. A case of nitrobenzene poisoning which was successfully treated with methylene blue on clinical suspicion is described. We emphasize early recognition and aggressive management with antidote to reduce the mortality.

Keywords: Methemoglobinemia, Methylene Blue, Nitrobenzene

Received: 03-08-2015 **Revised:** 21-08-2015 **Accepted:** 26-08-2015

1. Introduction

Nitrobenzene is an aromatic organic compound used in dyes, paints, printing, lubricating oil, and synthetic rubber. The major source of exposure to nitrobenzene is from occupational exposure, by inhalation or dermal absorption. Nitrobenzene is readily absorbed following inhalation, ingestion and dermal contact [1]. In India, nitrobenzene emulsion is commonly used as pesticides for plant growth regulator. It is marketed under various brand names such as Synflower, Rudra-n and the concentration of nitrobenzene varies from 20 to 35%. There is an increase in use of these compounds recently as it promotes flowering, increase the size of flowers and prevent shedding of flowers. Oral ingestion of plant growth nutrient and development of methemoglobinemia is reported by few authors[2-5]. The principal adverse effect following exposure to nitrobenzene is methemoglobinemia**.** Oral ingestion of nitrobenzene results in gastric irritation, nausea and vomiting. Methemoglobinemia will develop 1-4 hours post-exposure, which is indicated by cyanosis. Severe exposure to nitrobenzene may result in drowsiness, seizures, coma, and may be fatal due to respiratory failure[2].

2. Case Report

52-year male, agriculturist presented with history of consumption of 100 ml of pesticide with suicidal intention. He was brought after eight hours of consumption. On arrival, he was unresponsive with GCS of 8. Examination revealed central cyanosis and tachypnea with respiratory rate 24 / minute. His BP was 116/74 mm Hg, pulse rate 120/min, SpO_2 80% on room air. Chest and cardiac examination was normal. Bitter almond like pungent smell was observed. He was treated with high flow oxygen, intravenous fluids. Endotracheal intubation was done to protect the airway and connected to ventilator with 100% FiO_2 and a PEEP of 5 cm of H_2O. His arterial blood sample was chocolate brown in colour which raised the suspicion of methemoglobinemia. Diagnosis of methemoglobinemia was considered. After the treatment attender brought the empty bottle, which contained 20% nitrobenzene. ABG analysis showed metabolic acidosis with pH-7.30 and bicarbonate 16.7meq/l. On clinical suspicion IV methylene blue, 1 mg/ kg [50 mg] was given over 10 minutes and 500mg ascorbic acid was given. His saturation dropped after 3 hours to 85%, and

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50 mg IV methylene blue was repeated. Blood glucose was 110 mg/dl. Investigations revealed Hb of 12 gm/dl, WBC count of 11,000/mm^3. Liver enzymes, bilirubin, creatinine and electrolytes were normal. X ray chest was normal. Blood methemoglobin level was 21%, following administration of two doses of methylene blue. His SpO_2 was 85% to 90% during initial two days. He started to follow command after 3 days, and was extubated on third day. His methemoglobin level was 2.1% on day 4. He was observed for development of jaundice and renal failure. Blood smear showed normocytic, normochromic red blood cells with no signs of hemolysis. Serial blood tests remained normal. He was discharged on seventh day.

3. Discussion

Acute exposure to nitrobenzene leads to the development of methemoglobinemia, in which the iron within the hemoglobin is oxidized from ferrous (Fe^{2+}) to ferric (Fe^{3+}) state, resulting in the inability to transport oxygen. Normal methemoglobin concentration is 0 to 2%, with 10 to 15% only cyanosis may be present. Above 20% headache, dyspnea, chest pain, tachypnea, tachycardia develops. Above 40% confusion, lethargy, metabolic acidosis, coma, seizures, dysrhythmia and hypertension develops. More than 70% is fatal and leads to death[3]. The lethal dose ranges from 1 to 10 grams. Nitrobenzene is very lipid soluble and accumulates in the adipose tissues and gets released later. Clues for diagnosis are a history of ingestion, characteristic smell of almonds, central cyanosis with no apparent respiratory distress, and low pulse oximeter (observed) oxygen saturation with normal ABG (calculated) oxygen saturation and persisting cyanosis on oxygen therapy, without cardiopulmonary disease. Bedside detection can be made by observing for colour change after placing few drops of blood on white filter paper where deoxyhemoglobin brighten and methemoglobin holds colour[4]. Cutaneous pulse oximetry estimation of oxygen saturation is lowered by methemoglobinemia. Spuriously high pulse oximetry recordings may happen with increasing concentrations. Patients with symptomatic methemoglobinemia require careful monitoring until symptoms subside or level falls below 15% [5].

Methylene blue is the antidote for the methemoglobinemia. Methylene blue is an exogenous cofactor that donates electron which rapidly reduces methemoglobin to ferrous state through NADPH dependent methemoglobin reductase system. It is administered IV at 1-2 mg/kg (up to 50 mg) as a 1% solution over 5 minutes; with a repeat in 1 hour, if necessary. Response occurs within 1 hour and reduces the elimination half-life of methemoglobinemia to 45-90 minutes [5]. Methemoglobin levels should be checked 1 hour after infusion and a repeat dose may be needed. Methylene blue is known to cause erroneous SpO_2 levels and the antidote is toxic at doses more than 7mg/kg. It is contraindicated in G6PD deficiency. Ascorbic acid is an antioxidant, free radical scavenger that may be administered at doses of 0.5-1gm 8th hourly. Dextrose should be administered as it's the major source of NADH in the erythrocyte. Exchange transfusion and hyperbaric oxygen therapy are usually reserved for refractory cases[3]. This case had many manifestation of methemoglobinemia like central cyanosis, altered mentation, smell of bitter almonds, persisting cyanosis on oxygen therapy. Diagnosis was confirmed by raised methemoglobin level and nitrobenzene compound brought by attendant. His methemoglobin level was 21% and he had few complications. Recurrent methemoglobinemia is defined by persistence of significant levels up to 72-96 hours. Amount consumed was large but he didn't develop renal insufficiency, hemolytic anemia. Early recognition, availability of methylene blue and quick administration lead to uncomplicated outcome.

4. Conclusion

Ingestion of pesticide containing plant growth nutrient and development of fatal methemoglobinemia poses significant diagnostic and therapeutic challenges in developing countries. Treating physician should have high index of clinical suspicion for the early diagnosis. Estimation of methemoglobin level may not be feasible at all centers. Non availability of IV methylene blue has been reported by few authors. In such situation methylene blue powder can be made into 1% solution and administered. We emphasize early antidote administration based on clinical suspicion to reduce mortality.

5. References

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