



A RARE CASE REPORT : "THE CYANOTIC CONUNDRUM: UNRAVELING NITROBENZENE POISONING

General Medicine

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ABSTRACT

Nitrobenzene, widely used in industrial applications, is a potent oxidizing agent that induces methemoglobinemia by converting hemoglobin's iron from its ferrous (Fe^{2+}) to ferric (Fe^{3+}) state, impairing oxygen transport. We report a case of a 19-year-old female presenting with severe hypoxia and cyanosis following nitrobenzene ingestion. Her methemoglobin level was 37.5%. Prompt diagnosis and intravenous methylene blue administration led to significant improvement. Early recognition of nitrobenzene poisoning is crucial, as delayed treatment can result in severe complications or death. Clinicians must maintain a high index of suspicion for timely intervention, significantly improving patient outcomes.

KEYWORDS

INTRODUCTION

Nitrobenzene is a pale-yellow aromatic nitro compound extensively utilized in the synthetic rubber, dye, and paint industries. It acts as a powerful oxidizing agent, converting the iron in hemoglobin from its ferrous (Fe^{2+}) state to its ferric (Fe^{3+}) state, resulting in methemoglobinemia. This condition impairs oxygen transport, leading to hypoxia. Clinical manifestations of nitrobenzene poisoning include gastrointestinal irritation, nausea, vomiting, cyanosis, drowsiness, seizures, and coma. In severe cases, it can cause respiratory failure and death. Treatment for significant poisoning involves the intravenous administration of methylene blue, sometimes accompanied by vitamin C.

CASE REPORT

A 19-year-old female with no previously known comorbidities presented to the emergency department with complaints of shortness of breath for three days, which had worsened significantly over the past four hours. She also reported bluish discoloration of her fingers for the past two days. Her medical history revealed that she had ingested a poisonous substance one week earlier following a domestic dispute with her husband. She was admitted to a local hospital, underwent multiple sessions of gastric lavage, and was discharged after symptomatic improvement. Further inquiry confirmed the ingestion of a nitrobenzene-containing compound.

On Presentation

General Condition: Conscious but gasping for breath.

• **Vitals:**

- Blood Pressure: 102/66 mmHg
- Pulse Rate: 128 beats per minute (regular)
- Respiratory Rate: 34 breaths per minute
- Temperature: Afebrile
- Oxygen Saturation: 60% on room air
- Random Blood Sugar: 171 mg/dL
- **Laboratory Findings:** Methemoglobin level: 37.5%
- **Physical Examination:** Bluish discoloration noted on the extremities and tongue.

DISCUSSION

Nitrobenzene poisoning is primarily attributed to its ability to induce methemoglobinemia, wherein hemoglobin's iron is oxidized from its ferrous (Fe^{2+}) to ferric (Fe^{3+}) state. This alteration renders hemoglobin incapable of binding and transporting oxygen, resulting in brownish discoloration of the blood.

Clinical Manifestations by Methemoglobin Levels:

- **10–15%:** Cyanosis, often asymptomatic.
- **>20%:** Symptoms such as headache, dyspnea, chest pain, tachypnea, and tachycardia.
- **40–50%:** Confusion, lethargy, metabolic acidosis, potentially

progressing to coma, seizures, bradycardia, ventricular arrhythmias, and hypotension.

- **>70%:** Typically fatal.
- **Other Complications:** Hepatosplenomegaly, altered liver function, Heinz body hemolytic anemia.

Diagnosis:

Diagnosis is confirmed through spectrophotometric methods. Additional tests include:

- The butanone test of Schrenk.
- Blood methemoglobin level measurement.
- Urinary detection of metabolites such as p-nitrophenol and p-aminophenol.

Treatment

Methylene Blue is the antidote of choice, acting as an electron donor to rapidly reduce methemoglobin back to hemoglobin. It is indicated for methemoglobin levels exceeding 30% and is administered intravenously as a 1% solution at 1–2 mg/kg (up to a maximum dose of 50 mg in adults) over five minutes.

Contraindications:

Methylene blue should not be used in patients with glucose-6-phosphate dehydrogenase (G6PD) deficiency, as it may precipitate severe hemolysis.

Adjunctive Therapies:

- **Ascorbic Acid:** Functions as a free radical scavenger and may be used in conjunction with methylene blue.
- **Hyperbaric Oxygen Therapy:** Reserved for cases unresponsive to standard treatments.

CONCLUSION

Nitrobenzene poisoning, though rare, can lead to severe methemoglobinemia with significant morbidity and mortality if not promptly managed. Clinicians should remain vigilant and consider this diagnosis in patients presenting with cyanosis and unexplained hypoxia. Early recognition and timely administration of methylene blue are essential for improving patient outcomes. With prompt intervention, methemoglobinemia induced by nitrobenzene exposure can be effectively reversed, reducing complications and mortality risks.

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