



(CASE REPORT)



Methemoglobinemia caused by nitrobenzene ingestion treated with methylene blue and ascorbic acid: A case report

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Abstract

Nitrobenzene (NBZ) is a pale-yellow coloured compound, moderately water-soluble oily liquid, and odour similar to bitter almonds. It is commonly used in the manufacture of aniline, benzidine, quinolone, drugs, dyes, solvent in shoe, metal polishes, and in screen printing]. It is a potent oxidizer of the iron moiety of haemoglobin causing methemoglobinemia leading to its inability to transport oxygen. Clinical features of nitrobenzene poisoning include gastric irritation, nausea, vomiting, cyanosis, drowsiness, seizures, coma and finally respiratory failure culminating in death. Intravenous methylene blue and ascorbic acid are commonly used for treatment of significant poisoning.

Keywords: Nitrobenzene; Methemoglobinemia; Methylene blue; Ascorbic acid

1. Introduction

Nitrobenzene (NBZ) is a chemical with a pale yellow colour that is greasy and moderately water soluble and has odour similar to bitter almonds. It is frequently used in the production of aniline, benzidine, quinolone, drugs, dyes, solvent in shoe, metal polishes, and in screen printing. Nitrobenzene poisoning is uncommon in therapeutic settings [1]. The first report of nitrobenzene poisoning came in 1886 and subsequent fatality reports followed. Intoxication can be accidental or suicidal, or the side effect of some drugs, including metoclopramide[2]. Nitrobenzene is a potent oxidizer of the iron moiety of haemoglobin causing methemoglobinemia a condition in which the iron within the haemoglobin is oxidized from the ferrous (Fe^{2+}) state to the ferric (Fe^{3+}) state, impairing oxygen transport and causes a brownish discoloration of the blood[2,3]. Clinical features of nitrobenzene poisoning include gastric discomfort, nausea, vomiting, cyanosis, drowsiness, seizures, coma and finally respiratory failure that results in death. Intravenous methylene blue and ascorbic acid (vitamin C) are commonly used for treatment of significant poisoning [3].

Herein, we report a rare case of nitrobenzene poisoning managed with infusion of methylene blue and ascorbic acid after diagnosing with methemoglobinemia.

2. Case Report

A 40 year-old male was admitted in the emergency department after ingestion of nitrobenzene. On examination, the patient was conscious and coherent with cyanosis of fingers and tongue, presence of pallor, clubbing and edema. The patient complained of epigastric burning sensation. His blood pressure was 110/70 mmHg, pulse rate- 88 beats per minute. His oxygen saturation (SpO_2) was 77% which was not maintained even with oxygen flow of 6-8 litres per minute. His chest was clear with no murmurs was heard on auscultation. His bilateral pupils were 2mm and reactive to light. Blood samples were drawn for ABG, CBP, LFT and RFT. His arterial blood gas analysis (ABG) reported, pH: 7.45 , pCO_2 : 33.7, pO_2 : 50.2, HCO_3 : 23.5. His blood parameter revealed normal leucocytes with normal haemoglobin and renal

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function tests. The oxyhaemoglobin report shows methHb- 4.8%, the patient was diagnosed with methemoglobinemia and was treated accordingly. A solution of methylene blue 60mg in 100ml normal saline was injected intravenously over 5 minutes. A solution of 1.5 grams of vitamin C was also intravenously injected twice a day. His oxygen saturation increased to 88% and arterial blood analysis was repeated which showed pH: 7.43, pCO₂: 37.2, pO₂: 92.6, HCO₃: 24.1. The patient was administered with methylene blue 60 mg over 30 minutes and vitamin C 1.5 grams BD intravenously for treating methemoglobinemia for the next 7 days including injection pantoprazole 40mg OD, injection ondansetron 4mg BD and tablet Librium 25 mg QID for alcohol withdrawal and subsequently the patient was discharged with oral vitamin C.

3. Discussion

Nitrobenzene, a pale yellow greasy liquid, with an odour of bitter almonds is used as an intermediate in the synthesis of solvents, like paint remover^[2]. When intentionally or inadvertently exposed, nitrobenzene is readily absorbed through the skin, gastrointestinal tract, or respiratory tract. Because of its high lipophilicity, the highest concentrations get accumulated in the liver, brain, blood and stomach^[3]. Once absorbed into bloodstream, it will oxidize the iron (Fe) moiety present in haemoglobin (Fe+2) which results in the formation of methemoglobin (Fe+3) (methHb) which will be incapable of oxygen transportation leading to hypoxia condition^[4]. Under normal physiological conditions, methemoglobin (MetHb) which makes up <1% of total haemoglobin and levels above this is defined as methemoglobinemia^[5]. Once generated, Methemoglobin is reduced enzymatically either through an Nicotinamide Adenine Dinucleotide (NADH)-dependent reaction, catalyzed by cytochrome b5 reductase, or an alternative pathway the Nicotinamide Adenine Dinucleotide Phosphate (NADPH)- dependent methemoglobin reductase system^[6].

Our patient with methHb of 4.8% was brought to the hospital with cyanosis of fingers, nails and tongue being evident. Recommended treatment is based on the principles of decontamination and symptomatic and supportive management.

Methylene blue is the antidote of choice for acquired methemoglobinemia. It functions as an exogenous cofactor that significantly accelerates the NADPH-dependent MetHb reductase system. The initial dose is 1–2 mg/kg intravenously infused over 5 min; response is usually evident within an hour. MetHb levels should be checked 1 h after infusion, and a repeat dose is indicated if MetHb levels remain high and the patient is still exhibits symptoms^[5]. Oral methylene blue (2 mg/kg) also can be used as an alternative to intravenous preparation. It is contraindicated in patients with G6PD deficiency as it can induce severe haemolysis^[6]. In conditions in which methylene blue is contraindicated or ineffective, high dose ascorbic acid (Vitamin C) (10g IV) can be given but has a slow reducing capacity. In extreme circumstances, when these options are ineffective, exchange transfusion is recommended. ^[7]. Exchange transfusions equal to or less than the total volume and up to greater than twice the volume have been recommended^[5].

In conclusion, NBZ ingestion in excess amounts will lead to methemoglobinemia, a life-threatening condition which can be managed with oxygen, methylene blue, and ascorbic acid^[4]. The present case documents an uncommon occurrence of nitrobenzene poisoning and was successfully managed by methylene blue, ascorbic acid and other supportive management. The present case also highlights the fact that early recognition of this condition and institution of specific treatment can be life-saving.

4. Conclusion

Nitrobenzene poisoning can result in methemoglobinemia which is a life threatening condition. Early detection of nitrobenzene poisoning and methemoglobinemia can lead to a positive prognosis, as seen by our patient's speedy recovery after initiating methylene blue, ascorbic acid, and oxygen therapy.

Compliance with ethical standards

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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