Methaemoglobinaemia as a Result of Nitrite Poisoning

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Abstract

Methaemoglobinaemia due to nitrite poisoning is rare. Awareness of this condition in the cyanosed patient not responding to oxygenation and timely administration of methylene blue may be life saving. We report a case of methaemoglobinaemia as a result of sodium nitrite poisoning.

Introduction

Cyanosis occurring due to methaemoglobinaemia is a rare condition. When cyanosis fails to improve after usual measures, one should think of presence of methaemoglobinaemia. Sodium nitrite poisoning is a rare but an important cause of methaemoglobinaemia. Sodium nitrite is used in industry during manufacture of synthetic dyes. In low concentrations, it is also used as a meat preservative. Nitrites convert haemoglobin to methaemoglobin. Severe methaemoglobinaemia, a potential fatal condition if left untreated, may be managed effectively with administration of i.v. methylene blue 1%. Therefore, the awareness of this condition in a cyanosed patient not responding to oxygenation, and timely administration of methylene blue may be life saving.

Case Presentation

A 21 year old, unmarried female brought in an unconscious state in emergency room after alleged ingestion of an unknown substance. Her family was involved in dye industry. On examination she was deeply cyanosed and unconscious with a feeble pulse of 130 per minute and systolic blood pressure of 60 mm of Hg. She was shifted to ICU where ventilation with 100% oxygen and vasopressor support with dopamine and noradrenaline failed to improve her cyanosis or blood pressure. During blood sampling, the blood was chocolate brown in colour. The arterial blood gas analysis showed a pH of 7.34, PO₂=186 mm Hg, SO₂= 99%, PCO₂=30 mm Hg, HCO₃⁻=16.2 mEq/L and methaemoglobin (metHb) levels= 64.2%.

In view of elevated metHb levels, a diagnosis of sodium nitrite dye poisoning causing methaemoglobinaemia leading to central cyanosis was kept.

She was given methylene blue 1% i.v. infusion in normal saline, in a dose of 1 mg/kg body weight as an antidote. Later on cyanosis and sensorium improved, vasopressor support was tapered off. On subsequent ABG after 12 hours, metHb levels reduced to 0.7%. Next day she was discharged in stable condition.

Discussion

Acute methaemoglobinaemia is a metabolic disorder that occurs when haemoglobin in blood is oxidised to methaemoglobin (metHb) which is unable to bind and transport oxygen1. Ingestion of oxidising agents such as nitrites and nitrates are among the most frequent causes2. Nitrite and nitrates can convert Hb to metHb by oxidising iron from ferrous to ferric form. Sodium nitrite is used in industry during manufacture of synthetic dyes. In low concentrations, it is also used as a meat preservative.
The world health organization has indicated a toxic dose of 0.4-200 mg/kg body weight and a lethal dose of 33-250 mg/kg body weight for nitrites taken orally.³

Signs and symptoms of methaemoglobinaemia (methaemoglobin >1%) include shortness of breath, cyanosis, mental status changes (~50%), headache, fatigue, exercise intolerance, dizziness and loss of consciousness. Healthy people may not have many symptoms with methaemoglobin levels < 15%, however, patients with co-morbidities such as anaemia, cardiovascular disease, lung disease, sepsis, or presence of other abnormal haemoglobin species (e.g. carboxyhaemoglobin, sulphhaemoglobin or sickle haemoglobin) may experience moderate to severe symptoms at much lower levels (as low as 5-8%).⁴ Arterial blood with elevated methaemoglobin levels has a characteristic chocolate-brown colour as compared to normal bright red oxygen-containing arterial blood.⁴

In severe methaemoglobinaemia (methaemoglobin > 50%) patients may have hypotension, dysrhythmias, seizures, coma and death may occur in 70% of cases.⁴

Acute nitrite poisoning is treated with i.v. methylene blue 1% (1-2 mg/kg body weight) (1-2% solution in normal saline) as the antidote. Methylene blue acts by promoting reduction of the oxidised haem iron back to its ferrous state.⁵

Nitrite poisoning and methaemoglobinaemia are rare. Awareness of this condition in the cyanosed patient not responding to oxygenation and timely administration of methylene blue may be life saving.

References