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SPURIOUS HYPOXIA DUE TO METHEMOGLOBINEMIA IN A PATIENT WITH GLUCOSE-6-PHOSPHATE DEHYDROGENASE DEFICIENCY: A DIAGNOSTIC CHALLENGE

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ABSTRACT

Background: Methemoglobinemia is an uncommon but important cause of hypoxia characterized by a discrepancy between pulse oximetry and arterial oxygen tension. In glucose-6-phosphate dehydrogenase (G6PD) deficiency, oxidative stress may precipitate both hemolysis and methemoglobinemia. **Case summary:** An 18-year-old male presented with jaundice, dark urine, and acute hemolysis following probable ingestion of over-the-counter medications. He developed sudden hypoxia (SpO_2 70%) without respiratory distress. Arterial blood gas revealed elevated PaO_2 (246 mmHg), indicating a saturation gap. Co-oximetry showed methemoglobin level of 21.1%. G6PD levels were reduced. Methylene blue was avoided, and the patient was treated with ascorbic acid, blood transfusion, and supportive care, resulting in recovery. **Conclusion:** Recognition of saturation gap is critical in diagnosing methemoglobinemia, especially in G6PD deficiency where standard therapy may be harmful.

KEYWORDS: Methemoglobinemia, G6PD deficiency, Saturation gap, Spurious hypoxia, Hemolysis.

INTRODUCTION

Methemoglobinemia results from oxidation of hemoglobin iron (Fe^{2+} to Fe^{3+}), impairing oxygen delivery. Pulse oximetry becomes unreliable and may lead to misinterpretation of hypoxemia in critically ill patients. In G6PD deficiency, impaired NADPH production predisposes to both oxidative hemolysis and reduced methemoglobin clearance, making this association clinically significant.

CASE DESCRIPTION

An 18-year-old male presented with epigastric pain, vomiting, jaundice, dark urine, decreased appetite, and generalized weakness for two days. He had a history of fever for five days and had taken over-the-counter medications. On admission:

- Hemoglobin: 10.8 g/dL
- TLC: 20,100/mm³
- Platelets: 2.31 lakh/mm³
- Total bilirubin: 11.7 mg/dL (Indirect 10.1 mg/dL)
- SGOT: 163 IU/L
- LDH: 3622 U/L
- Urea: 87 mg/dL, Creatinine: 1.1 mg/dL

Within 24 hours, hemoglobin dropped to 6.0 g/dL, suggestive of acute hemolysis. Infectious workup was negative. Ultrasound abdomen showed mild periportal cuffing, splenomegaly, and renal parenchymal changes.

The patient developed sudden hypoxia (SpO_2 70% on room air) and was shifted to ICU. He had no respiratory distress and normal chest examination. Oxygen saturation remained low despite oxygen supplementation (10 L/min).

Arterial blood gas analysis

- pH: 7.52
- PaO_2: 246 mmHg
- $PaCO_2$: 36 mmHg
- Lactate: 1.1 mmol/L
- HCO_3: 26.1 mmol/L

Co-oximetry

- Methemoglobin: 21.1%
- Carboxyhemoglobin: 4.5%

A significant **saturation gap** was noted.
G6PD level was reduced (1.93 U/g Hb), confirming G6PD deficiency.
Blood samples were chocolate brown in colour, and urine was dark brown.

Management

- Methylene blue was avoided
- High-dose ascorbic acid administered
- Intravenous fluids
- Packed red blood cell transfusion

The patient showed progressive clinical improvement over 5 days, with resolution of hemolysis, stabilization of hemoglobin levels, and normalization of bilirubin, and was discharged in stable condition.

Figure 1: Demonstration of Saturation Gap.

Parameter	Value	Interpretation
SpO_2 (Pulse oximetry)	70–80%	Falsely low
PaO_2 (ABG)	246 mmHg	Normal/High
Methemoglobin	21.1%	Elevated
Clinical distress	Absent	Disproportion
Blood colour	Chocolate brown	Suggestive

Figure Legend: Demonstration of saturation gap showing discordance between pulse oximetry (SpO_2) and arterial oxygen tension (PaO_2), a hallmark of methemoglobinemia.

DISCUSSION

This case illustrates spurious hypoxia due to methemoglobinemia, a condition in which pulse oximetry underestimates oxygen saturation despite adequate arterial oxygenation.

The key diagnostic feature is the saturation gap, defined as a discrepancy between low SpO_2 and normal or elevated PaO_2. Methemoglobinemia should be suspected when oxygen saturation is disproportionately low relative to clinical findings and does not improve with supplemental oxygen.[1]

Pulse oximetry becomes unreliable in methemoglobinemia because methemoglobin absorbs light at wavelengths used in standard oximeters, often resulting in falsely low readings around 80–85%.[2]

In critically ill patients, a high PaO_2 in the presence of low SpO_2 strongly suggests dyshemoglobinemia and warrants evaluation with co-oximetry.[1]

In this patient, oxidative stress—likely triggered by drug exposure—led to both hemolysis and methemoglobinemia. G6PD deficiency plays a central role by impairing NADPH production, which is required for reduction of methemoglobin and protection against oxidative injury.[3]

Standard therapy with methylene blue is contraindicated in G6PD deficiency due to risk of worsening hemolysis and reduced efficacy.[3,4]

Alternative approaches include

- High-flow oxygen
- Ascorbic acid
- Blood transfusion in severe hemolysis
- Exchange transfusion in refractory cases[4]

Early recognition is essential to avoid unnecessary escalation of respiratory support and prevent harmful interventions.

CONCLUSION

Methemoglobinemia should be considered in patients with unexplained hypoxia and a saturation gap. In G6PD deficiency, prompt diagnosis is essential, as standard therapy may be harmful. Appropriate supportive management leads to favorable outcomes.

Learning Points

- Saturation gap is a key diagnostic clue in unexplained hypoxia
- Methemoglobinemia may coexist with hemolysis in G6PD deficiency
- Pulse oximetry can be misleading; co-oximetry is essential
- Methylene blue should be avoided in G6PD-deficient patients

Declarations

- **Patient consent:** Obtained
- **Conflicts of interest:** None
- **Funding:** None

REFERENCES

1. Iolascon A, Bianchi P, Andolfo I, et al. Recommendations for diagnosis and treatment of methemoglobinemia. Am J Hematol, 2021; 96(12): 1666–1678.
2. Percy MJ, Lappin TRJ. Recessive congenital methemoglobinemia: cytochrome b5 reductase deficiency. Br J Haematol, 2021; 192(3): 454–467.
3. Luzzatto L, Ally M, Notaro R. Glucose-6-phosphate dehydrogenase deficiency. Blood, 2020; 136(11): 1225–1240.
4. Sawaftah MA, et al. Methemoglobinemia in G6PD deficiency: therapeutic challenges. Cureus, 2022; 14(9): e29000.
5. Skold A, Cosco DL, Klein R. Methemoglobinemia: pathogenesis, diagnosis, and management. South Med J., 2021; 114(11): 757–764.