



Anaesthetic Management of a Patient with G6PD Deficiency Posted for Bipolar Hemiarthroplasty

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ABSTRACT:

G6PD deficiency is a rare genetic disorder which affects the red blood cells. Anaesthetic implications of it include prevention of oxidative stress and absolute pain management. The case report here discusses the anaesthetic management of an elderly G6PD deficiency patient posted for bipolar hemiarthroplasty and the pertinent pre operative, intra operative and post operative management which helped in providing best surgical and physiological outcome of the patient.

1. Introduction

Glucose-6-phosphate dehydrogenase (G6PD) deficiency is a hereditary enzymopathy impacting human red blood cells, with a prevalence exceeding 400 million individuals globally. As an X-linked recessive genetic defect, G6PD plays a pivotal role in the production of antioxidants crucial for shielding red blood cells from oxidative stressors. In instances of G6PD deficiency, oxidative stresses induced by specific drugs, metabolic conditions, infections, fava bean ingestion, or surgical procedures can lead to damage to red blood cells, resulting in haemolysis (1). This condition commonly manifests as acute haemolytic anaemia, neonatal jaundice, or chronic non-spherocytic anaemia.

The most prevalent adverse consequence of G6PD deficiency is acute haemolysis triggered by exposure to oxidative agents, posing a substantial challenge for perioperative co-management by anaesthesiologists and surgeons. Avoidance of certain commonly used drugs such as acetaminophen and aspirin is a standard practice in G6PD-deficient patients due to the potential deleterious effects of these pharmacological agents (2) (3). However, controversy surrounds the consensus regarding the use of other medications in G6PD deficiency. However, there are no substantial proof that suggests detrimental effects to the use of other medications at therapeutic levels (3).

Critical components of successful management in G6PD-deficient patients include the careful selection of anaesthetic agents, diligent

perioperative monitoring, and navigating potential triggers for haemolysis. The case underscores the significance of a thorough preoperative assessment and provides insights into the complex considerations and decision-making processes essential for ensuring a safe and effective anaesthetic approach in individuals with this enzymatic deficiency.

Through the lens of this case, our aim is to contribute to the existing knowledge, offering valuable perspectives on the challenges faced by anaesthesia teams when caring for G6PD-deficient patients undergoing orthopaedic surgeries. A deeper understanding of the nuances in anaesthetic management is pivotal for optimizing patient outcomes, preventing complications, and fostering a more informed and patient-centric approach to perioperative care.

Case Report

An 88-year-old male, who sustained a left-sided intertrochanteric fracture due to a slip and fall, underwent left bipolar uncemented hemiarthroplasty. Notably, the patient has a longstanding history of G6PD deficiency, diagnosed four decades ago when he experienced an acute haemolytic episode after consuming chloroquine for malaria. Subsequent episodes of haemolysis occurred with the use of sulpha group antibiotics and penicillin. Additionally, the patient is being treated for type 2 diabetes mellitus. Designated as ASA 2 for surgery, the patient underwent preoperative blood investigations, all of which yielded normal results. During the surgical procedure, spinal anaesthesia was administered using 2.5



ml of 0.5% levobupivacaine and 0.5 ml of fentanyl. A single episode of intraoperative hypotension occurred, promptly managed with ephedrine, and continuous blood glucose monitoring was conducted every hour. The total surgical duration was 2 hours, with an intraoperative blood loss of 150 ml. No other perioperative events were reported. Postoperatively, the patient received a pericapsular nerve group block (PENG) to manage pain, considering the potential increase in oxidative stress. Remarkably, the patient reported being entirely pain-free on postoperative day 1. There were no subsequent episodes of haemolysis, and the patient maintained normal blood counts, leading to discharge on postoperative day 7.

2. Discussion

Various substances, including drugs, foods (favism), and infections, are recognized triggers of oxidative stress leading to haemolysis in individuals with G6PD deficiency, often resulting in acute haemolytic anaemia (4). Despite the prevalence of this enzymatic defect in more than 400 million people worldwide, many individuals with G6PD deficiency are unaware of their condition until symptoms manifest, commonly following exposure to oxidative stressors such as specific agents, infections, metabolic conditions, fava bean ingestion, or surgical procedures. Classification into five G6PD deficiency classes is based on the degree of enzyme deficiency, with haemolysis risk varying from severe (class I) to normal or slightly increased activity without clinical significance (class V) (5).

The occurrence of haemolysis is influenced by factors such as the specific mutation causing the disease, the individual's genetic makeup, gender, erythrocyte age, and the type and dosage of the triggering drug (6). A comprehensive preoperative medical history is essential, and perioperative measures, including infection prevention, avoiding hypothermia, and managing metabolic conditions (e.g., diabetic ketoacidosis, hyperglycaemia), are crucial to prevent haemolysis in G6PD-deficient patients. Anaesthetic management should prioritize avoiding drugs implicated in haemolysis and monitoring for and addressing haemolysis if it occurs (7).

There are reports of surgery-related stress causing haemolysis, emphasizing the importance of providing ample analgesia and anxiolysis in the perioperative period. Although G6PD levels are low in platelets, studies indicate no deleterious effects on platelet function (8). Vigilance is paramount for detecting acute haemolytic crises during the intraoperative phase, as immediate signs are often masked under anaesthesia. Hypotension, a non-specific indicator of crisis, may only become apparent when

haematuria is observed. If diagnosed, discontinuation of the triggering agent and maintaining urine output through crystalloid infusion with diuretics are crucial. Postoperatively, daily complete blood count monitoring aids in assessing the need for blood transfusion (9).

Considering our patient's active octogenarian status and the absence of overt signs of chronic haemolytic anaemia, we anticipated a mild form of G6PD deficiency, likely class III. To ensure safety, we carefully considered the drugs used in the perioperative period, opting for an anaesthesiological approach with minimal drug use while prioritizing efficacy and safety due to the lack of a globally agreed-upon consensus on the use of local anaesthetics or other medications in G6PD-deficient patients.

The anaesthetic management of patients with glucose-6-phosphate dehydrogenase (G6PD) deficiency presents a unique set of challenges, as this genetic disorder can make individuals more susceptible to haemolysis triggered by various factors, including certain drugs and oxidative stressors. This case report delves into the intricacies of managing a patient diagnosed with G6PD deficiency who underwent bipolar hemiarthroplasty, a surgical procedure commonly employed for hip fractures.

Despite the lack of a global consensus on the use of specific medications in G6PD-deficient patients, the decision-making process in this case prioritized safety. A judicious approach was taken, favouring anaesthetic methods that utilized as few drugs as possible, ensuring both efficacy and safety. This case report contributes valuable insights into the challenges faced by anaesthesia teams when caring for patients with G6PD deficiency undergoing orthopaedic surgeries. The emphasis on comprehensive preoperative assessments, careful drug selection, and vigilant monitoring during and after surgery underscores the importance of tailored perioperative management in ensuring optimal outcomes for patients with G6PD deficiency undergoing complex surgical procedures like bipolar hemiarthroplasty.

3. Conclusion

In conclusion, the anaesthetic management of patients with glucose-6-phosphate dehydrogenase (G6PD) deficiency requires a tailored approach to mitigate the risk of haemolysis triggered by various factors. This case report, focusing on a patient undergoing bipolar hemiarthroplasty, underscores the importance of comprehensive preoperative assessments, careful drug selection, and vigilant monitoring throughout the perioperative period. The success in managing pain, preventing stress-related haemolysis, and the prioritization of safety in drug selection, particularly in anaesthesiological approaches, highlights the need for an



individualized and cautious strategy. This discussion offers valuable insights into the challenges faced by anaesthesia teams, emphasizing the significance of a well-informed and patient-centric approach in optimizing outcomes for individuals with G6PD deficiency undergoing complex orthopaedics surgeries.

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