ORIGINAL RESEARCH PAPER

Anesthesiology

KEY WORDS: Glucose 6 Phosphate Dehydrogenase (g6pd) Deficiency, Oxidative Stress, Haemolysis, Methaemoglobinemia.

CASE OF GLUCOSE 6 PHOSPHATE DEHYDROGENASE DEFICIENCY: ANAESTHESIA CHALLENGES AND MANAGEMENT

Dr Reshma Shenoy* MD Anaesthesiology ,Senior Resident Department of Anaesthesiology,Grant Government Medical College & Sir JJ Group of Hospitals* Corresponding Author

Dr Usha Badole MD Anaesthesiology ,Head of Department Department of Anaesthesiology,Grant Government Medical College & Sir JJ Group of Hospitals

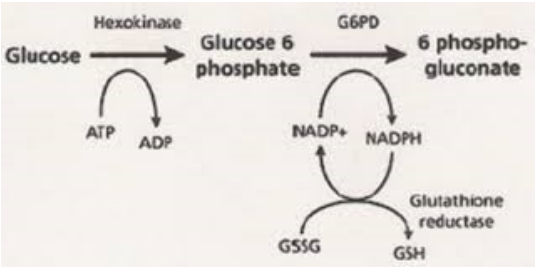
Dr Sujata Priyadarshini MD Anaesthesiology ,Assistant Professor Department of Anaesthesiology,Grant Government Medical College & Sir JJ Group of Hospitals

ABSTRACT

Glucose -6-phosphate dehydrogenase (G6PD) deficiency is an X linked recessive inborn error of metabolism causing acute haemolysis following exposure to oxidative stress. Drugs used for anaesthesia and perioperative pain management can induce haemolysis.5 years old male child with G6PD deficiency was admitted to our paediatric surgery services for urethrostomy. Patient was a diagnosed case of double urethra on cystoscopy done at another institute.All routine investigations were within normal limits . The child was premedicated with glycopyrrolate and midazolam. Induction was done with Fentanyl, Propofol and Atracurium. Anaesthesia was maintained with O2, air and sevoflurane and intermittent boluses of Fentanyl and Atracurium. At the end of the procedure, the child was reversed and extubated on table. Postoperative analgesia was given with Tramadol. Postoperative Haemoglobin done on day 1 and day 3 was normal.Anaesthesia management was focused on avoiding the triggering factors for oxidative stress which can lead to haemolysis. This was achieved with good antibiotic coverage perioperatively and reducing the surgical stress with adequate anxiolysis and analgesia. We also avoided oxidative drugs and precipitants of methaemoglobinemia. Monitoring and management of acute haemolysis was also a major concern in case it

Introduction

Glucose -6-phosphate dehydrogenase (G6PD) deficiency is an X linked recessive inborn error of metabolism. This condition is characterised by abnormally low levels of Glucose-6-phosphate dehydrogenase, an enzyme involved in pentose pathway that is especially important in red blood cells.G6PD converts glucose-6-phosphate into 6-phosphogluconate and is rate limiting enzyme of this metabolic pathway that maintains the levels of co enzyme Nicotinamide adenine dinucleotide phosphate(NADPH).The NADPH in turn maintains the supply of reduced glutathione which clears the free radicals that cause oxidative damage and haemolysis. Therefore patients with G6PD deficiency are at risk of haemolytic anaemia in states of oxidative stress.



Case Description:

5 years old male child with G6PD deficiency weighing 16 kg was admitted to our paediatric surgery services for urethrostomy. Patient was a diagnosed case of double urethra on cystoscopy done at another institute. A suprapubic catheter was inserted in view of stricture urethra. Patient was operated for tracheoesophageal fistula in the past at birth and later on a leak repair was done at 6 months of age. He was a case of classical Hodgkin's lymphoma treated with 12 cycles of chemotherapy (doxorubicin), last cycle being given in May 2017.There was no history of haemolysis or jaundice. There was history of blood transfusion at 6 months of age with no post transfusion complications. All routine investigations were within normal limits (Haemoglobin 13.4 gm%, unconjugated bilirubin 0.5mg/dl).G6PD levels were 24.1U/10^{12} RBCs (Moderate deficiency). Echocardiography was done to rule out cardiac pathology which revealed a normal study. Coomb's test was negative. Peripheral smear showed predominantly normocytic normochromic appearance. The child was premedicated with glycopyrrolate and midazolam. Fentanyl 2mcg/kg and Propofol 2mg/kg was administered and intubation carried out with atracurium 0.5mg/kg. The child was placed in lithotomy position first and then supine position for the surgery. Intraoperative monitoring included ECG, oxygen saturation (SPo2), Non-invasive blood pressure (NIBP) and end tidal carbon dioxide (ETCO2). Anaesthesia was maintained with O2, air and sevoflurane and intermittent boluses of Fentanyl and Atracurium. Blood loss was 80ml and 450ml of Ringers Lactate was infused. The surgery lasted for 3 hours and the course of anaesthesia was uneventful. At the end of the procedure, the child was reversed with neostigmine and glycopyrrolate and extubated on table. Postoperative analgesia was given with Tramadol. Postoperative investigations done on day 1 showed haemoglobin 11.5 gm%, complete blood count(CBC) 7.2x10^3 and platelet count 2 lakhs day 3 showed haemoglobin 11.2 gm%, CBC 6.4x10^3 and platelet count 2.05 lakhs.

Discussion:

Anaesthetic goals in a case of G6PD deficiency are a) Avoidance of oxidative stress such as oxidative drugs, infection, hypoxia, hypothermia, metabolic conditions (metabolic acidosis, ketoacidosis), pain.

b) Avoid precipitation of methaemoglobinemia.
c) Management of haemolytic crisis.

Drugs known to cause haemolysis in G6PD are antimalarial drugs (primaquine, chloroquine), antibiotics (sulphonamides, nitrofurantoin, chloramphenicol),methylene blue, certain analgesics (non-narcotic such as NSAIDs and acetaminophen),anticonvulsants(phenytoin),diuretics, insulin. Local anaesthetics such as benzocaine, prilocaine, lidocaine (rare) are known to precipitate methemoglobenemia which can cause haemolysis. Hence we avoided the use of local anaesthetics for analgesia. Most of the intravenous and inhalational anaesthetic drugs are considered safe in G6PD deficiency patients. Active infections in preoperative period can lead to release of free oxygen radicals which can cause haemolysis. Hence any active infection in the preoperative period should be treated with appropriate antibiotics safe in G6PD deficiency. Our patient was given antibiotic prophylaxis with Augmentin (Amoxicillin and Clavulanate) preoperatively and continued postoperatively for 5 days. Adequate anxiolysis and analgesia is important in the perioperative period to avoid oxidative stress. This can be provided with benzodiazepines and narcotic analgesics which are safe in G6PD deficiency. We used intravenous midazolam for sedation and anxiolysis and repeated boluses of Fentanyl intraoperatively

and Tramadol in postoperative period for analgesia. Hypothermia was prevented by using warming blankets. Acute haemolysis is rare in these patients.Clinical signs and symptoms of haemolysis appear 24 to 48 hours post exposure to triggering agent. These include cyanosis, headache, fatigue, tachycardia, dyspnoea, abdominal pain, haemoglobinuria and icterus. General anaesthesia masks most of the signs of haemolytic crisis. Hypotension and tachycardia under anaesthesia may be attributed to other causes. The appearance of free haemoglobin in urine or plasma may indicate acute haemolysis. Management is done by stopping the triggering agent and infusion of crystalloids and diuretics like furosemide and/or mannitol. Most cases are self-limiting and rarely blood transfusions are required, except in children.Laboratory tests show reduced haemoglobin whereas unconjugated bilirubin, Lactate dehydrogenase and reticulocyte levels are elevated. Coomb's test is negative as the cause of haemolytic anaemia is usually non immunological. As our patient showed no signs and symptoms of haemolysis and haemoglobin levels were within normal limits on day 1 and day 3 post surgery no further investigations to look for haemolysis were done.

Conclusion

Though G6PD deficiency is a benign and self-limiting condition it presents numerous issues perioperatively. Avoidance of the triggering factors which cause oxidative stress and treatment of haemolytic crisis remains the mainstay of management in such patients.

Conflict of Interest: Nil
Sources of Funding: Nil

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