Anaesthetic considerations in a patient with methylmalonyl-coenzyme A mutase deficiency

Sir,

Methylmalonyl-Coenzyme A (MM-CoA) mutase deficiency is an inborn error in branched-chain amino acid metabolism that results in the formation of methylmalonic acidaemia (MMA). With increased protein catabolism (e.g., sepsis, intestinal absorption of haem pigments, perioperative starvation or stress), these patients can develop severe metabolic acidosis, ketosis and hyperammonaemia. The goals of long-term management include a reduction in dietary protein intake, supplemental bicarbonate or citrate, and supplemental cobalamin to achieve normal development and to prevent episodes of metabolic decompensation while providing good quality of life.[1]

A 2-year-old weighing 11.7 kg child, diagnosed at birth with MMA was admitted for oral rehabilitation. He was on a low-protein diet, oral disodium hydrogen citrate, oral L-carnitine and hydroxocobalamin. A detailed history was sought from parents and instructions were given to them about pre-operative fasting period and diet plan. Investigations revealed serum bicarbonate of 21 mmol/l, serum lactate 2.30 mmol/l and urine pH of 8.5. Rest of the biochemical parameters were within normal limits.

The procedure was scheduled at 8 am. A feed at 2 am with a fixed formula having low protein was advised. Intravenous dextrose normal saline (DNS) was started at 2cc/kg/h to combat hypoglycaemia as a child would be unable to have clear fluids orally while asleep. Anaesthesia was induced with propofol 24 mg, IV fentanyl 18 μg and atracurium 6 mg. Nasotracheal intubation with 4.5 mm uncuffed endotracheal tube and throat packing was done. Anaesthesia was maintained with Sevoflurane in oxygen air mixture with minimum alveolar concentration at 1. Rectal temperature was monitored, and forced-air warming device was used. After induction, blood sugar levels were 119 mg%, serum sodium 137 mmol/l, serum potassium 4.4 mmol/l, chloride 104 mmol/l and serum bicarbonate of 20.9 mmol/l. DNS 500 ml with 50 mEq of sodium bicarbonate was infused at 60 ml/h IV for 2 h. Diclofenac suppository 12.5 mg was inserted rectally. The surgery lasted for 1 h 15 min and was uneventful. Antiemetic prophylaxis with ondansetron 1 mg IV was given. Residual neuromuscular blockade was reversed with neostigmine 0.6 mg and glycopyrrolate 0.1 mg. Throat pack was removed and the trachea extubated

after thorough suctioning. Early feed was resumed after 2 h.

The mainstay of nutrition therapy in MMA is a low protein intake, based on adequate energy supply combined with avoidance of prolonged fasting and reduced intake of precursor amino acids through a restricted natural protein diet, commonly supplemented with precursor-free synthetic amino acids. L-carnitine supplementation seems to contribute to the reduction of hyperammonaemia and demonstrates antioxidant capacity.[2] Oral citrate therapy is used to correct acidosis. Citrate is converted to bicarbonate in the liver. In MMA, forced diuresis and alkalinisation of urine with sodium bicarbonate helps to eliminate methylmalonic acid due to its high renal clearance. The impact of the pre-operative starvation period may be lessened by decreasing its duration to 2 h, a practice that does not increase the risk for perioperative aspiration of gastric contents.[3] The generous use of intravenous fluids and dextrose to minimise hypovolaemia and protein catabolism also helps. Vitamin B12 is the cofactor precursor of MM-CoA mutase, should be tried in all suspected cases by giving 1 mg hydroxocobalamin.[4] For Responders, hydroxocobalamin should be used as long-term treatment and its dose should be tailored individually depending on the clinical and biochemical results. Nitrous oxide is avoided since it can predispose to MMA in susceptible patients by inhibition of cobalamin enzymes.

Intraoperatively, measures should be taken to prevent hypoxia, hypercarbia, hypothermia and hypoglycaemia and any stress that can precipitate acidosis. Propofol[5] and atracurium are safe in MMA. Procedures involving the oropharynx, nasopharynx or upper gastrointestinal tract associated with bleeding may increase the heme pigment absorption across intestinal epithelium and impose an additional protein load for catabolism.[6] Intraoperative venous blood gas analysis is ideally used to record the pH, serum bicarbonate levels and serum electrolytes and treat accordingly. Post-operative nausea and vomiting (PONV) prophylaxis is necessary as they are prone to nausea and vomiting and subsequent dehydration resulting in acidosis.

The anaesthetic goals should aim at hydration, prevention of events that can precipitate acidosis such as hypoxia, hypercarbia, hypothermia and hypovolaemia; measures to prevent protein catabolism like prolonged fasting, bleeding into the gastrointestinal tract, stress and sepsis; correction of acid-base disturbances, analgesia, PONV prophylaxis and early resumption of oral feed post-operatively.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the legal guardian has given his consent for images and other clinical information to be reported in the journal. The guardian understands that names and initials will not be published and due efforts will be made to conceal patient identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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