Mannitol-induced intraoperative hyperkalemia, a little-known clinical entity

Sir,

Mannitol is commonly used in neuroanesthesia as a hypertonic infusion to reduce intracranial pressure and volume. However, its use can lead to serious electrolyte abnormalities. We report a case of a 23-year-old man, who received 1.5 g/kg mannitol over 20 min during excision of cerebellar hemangioblastoma. After 30 min from the start of mannitol infusion, electrocardiogram (ECG) showed tall T-waves with QRS widening. Arterial blood gas (ABG) and electrolyte analysis was immediately done and 100% oxygen was delivered. Ten milliliters of 10% calcium gluconate intravenous (IV) was administered slowly over 10 min. Tall T-waves persisted. Arterial Blood Gas picture showed pO_2 = 207, pCO_2 = 29.2, pH = 7.32, and K^+ = 9.0 mEq/l. An IV infusion of 20 units insulin in 10% dextrose (GI) was started. Repeat serum K^+ after 30 min was 6.9 mEq/l. The same therapy was continued and furosemide 20 mg was also given. Serum K^+ at 1 h and 1 h 45 min was 5.3 mEq/l and 4.1 mEq/l, respectively. ECG changes reverted to normal after 50 min of therapy with GI infusion. No acidosis was found at any time. The rest of the intraoperative course was uneventful, and the patient was observed in the intensive care unit for 24 h.

Mannitol 20% (osmolality approximately 1100 mOs/l) is given intraoperatively to reduce the intracranial and intraocular pressure, to preserve renal function and urine output in acute renal failure, and to reduce cerebral edema before and after neurosurgery. It should be used with caution in patients with deranged renal functions and should be infused slowly over a period of 20–30 min, avoiding extravasations and under proper cardiovascular and renal function monitoring. Mannitol in high doses (2 g/kg) is known to cause a significant increase in serum K^+ levels, while low doses (1 g/kg) are known to cause hypokalemia.[1] Hyperkalemia may be due to an expansion in extracellular fluid (ECF) volume leading to dilution of bicarbonate and hence dilutional acidosis, RBC crenation leading to hemolysis, and solvent drag phenomena causing shift of intracellular K^+-rich fluid to the ECF compartment to maintain the tonicity.[1] The strong ion difference (SID) theory may also have a role.[2]

Life-threatening increase in serum K^+ level has been previously reported in literature while administering mannitol for reducing the intracranial pressure.[3] Mannitol-induced acute high serum levels of potassium can also lead to life-threatening ventricular tachycardia,[4] with or without severe metabolic acidosis.[5]

Mannitol should be used in low doses (0.75–1 g/kg) under continuous ECG monitoring, keeping in mind the electrolyte disturbances that the administration of mannitol can entail. Frequent monitoring of electrolytes and acid–base status is recommended.

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