ARCHIVES OF HELLENIC MEDICINE: ISSN 11-05-3992

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ARCHIVES OF HELLENIC MEDICINE 2014, 31(2):245
ΑΡΧΕΙΑ ΕΛΛΗΝΙΚΗΣ ΙΑΤΡΙΚΗΣ 2014, 31(2):245

Acid-Base Balance-Electrolyte Quiz – Case 42

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A 42-year-old-man received intravenous mannitol over 20 min to reduce cerebral edema. One hour from the start of mannitol, infusion tall T-waves in the ECG were noted. Serum potassium levels were 6.4 mEq/L (baseline value 4.6 mEq/L) and bicarbonate levels 20 mEq/L (baseline value 25 mEq/L).

Which is the cause of hyperkalemia?

a. Mannitol-induced renal failure

b. The administration of mannitol

c. The decrease of bicarbonate levels (metabolic acidosis)

d. The potential administration of potassium chloride in the intravenous solutions

Comment

Hyperkalemia was possibly due to the administration of mannitol, which is due to mannitol-induced hyperosmolarity in the extracellular fluid leading to the shift of water (and potassium) into the extracellular fluid to maintain the tonicity (solvent drag phenomenon). Furthermore, it has been suggested that the loss of water from the cells can increase the intracellular potassium concentration, which then promotes the favorable gradient-induced passive potassium movement from the cells to the extracellular fluid through potassium channels in the cell membrane. The coexistent dilutional acidosis [due to the mannitol-induced expansion of the extracellular volume (evidenced by the decreased HCO_3^- levels)] may play a minor role in the development of acute hyperkalemia. It should be mentioned that life-threatening hyperkalemia has been repeatedly reported in patients treated with mannitol mainly in individuals with decreased renal function, with prolonged infusions of high doses of the drug. The mannitol should be used in low doses (<1 g/kg) slowly over a period of 20–30 minutes, under ECG monitoring, while frequent monitoring of renal function, as well as acid-base and electrolytes is advised, especially in patients with decreased renal function. It is worth mentioning that mannitol administration is followed by a variety of acid-base and electrolyte abnormalities, such as a dilutional acidosis, hyponatremia or hypernatremia, as well as hyperkalemia or even hypokalemia.

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Answer: *The administration of mannitol*