ARCHIVES OF HELLENIC MEDICINE: ISSN 11-05-3992

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ARCHIVES OF HELLENIC MEDICINE 2010, 27(5):858
ΑΡΧΕΙΑ ΕΛΛΗΝΙΚΗΣ ΙΑΤΡΙΚΗΣ 2010, 27(5):858

Acid-Base Balance-Electrolyte Quiz – Case 18

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A seriously ill 62-year-old woman was admitted to the hospital. Laboratory investigation showed: Arterial pH 7.31, PCO_2 20 mmHg, HCO_3^- 10 mEq/L, glucose 90 mg/dL, creatinine 2.8 mg/dL, urea 150 mg/dL, sodium 128 mEq/L, potassium 5.6 mEq/L, chloride 99 mEq/L and albumin 2 g/dL.

Which are acid-base abnormalities of the patient?

a. Respiratory alkalosis

b. High anion gap metabolic acidosis and respiratory alkalosis

c. Respiratory alkalosis and hyperchloremic metabolic acidosis

d. Metabolic acidosis

e. Metabolic acidosis and respiratory alkalosis, as well as metabolic alkalosis

Comment

The patient clearly exhibited a high anion gap (26 mEq/L) metabolic acidosis (acidemia associated with reduced HCO_3^- levels). The expected PCO_2 is 23.2 mmHg (a decrease of PCO_2 by 1.2 mmHg for each decrease of HCO_3^- by 1 mEq/L). Since the patient's PCO_2 (20 mmHg) is less than expected, a superimposed respiratory alkalosis is suspected. In cases of hypoalbuminemia, the serum anion gap should be appropriately corrected for serum albumin levels: Each 1 g/dL reduction of serum albumin levels less than the average normal value of 4 g/dL will increase serum anion gap by approximately 2.5 mEq/L. Thus, in the present case the corrected serum anion gap is 31 mEq/L (26+2×2.5).

Interestingly, the change in anion gap is equal to the change in serum HCO_3^- levels. When the increase in anion gap exceeds the change of serum HCO_3^-, a coexistent metabolic alkalosis is suspected. In fact, in our patient the increase in anion gap from the average normal value of approximately 10 mEq/L (31–10=21 mEq/L) is substantially higher than the decrease of serum HCO_3^- from the mean normal value of 24 mEq/L (14 mEq/L), signifying the presence of an associated metabolic alkalosis.

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Diagnosis: *Metabolic acidosis and respiratory alkalosis, as well as metabolic alkalosis*