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Acid-Base Balance-Electrolyte Quiz – Case 19

M. Elisaf,
T. Filippatos

Department of Internal Medicine, Medical School, University of Ioannina, Ioannina, Greece

A 68-year-old patient with chronic obstructive lung disease (COPD) was admitted with a febrile exacerbation of his symptoms. Laboratory investigation showed: Arterial pH 7.21, PCO_2 60 mmHg and HCO_3^- 24 mEq/L.

Which is the underlying acid-base disorder?

a. Respiratory acidosis

b. Respiratory acidosis and metabolic alkalosis

c. Respiratory acidosis and metabolic acidosis

d. Metabolic acidosis and respiratory alkalosis

Answer c: The patient exhibited respiratory acidosis (acidemia due hypercapnia) owing to the underlying COPD. The expected HCO_3^- concentration in this patient with chronic respiratory acidosis is 31 mEq/L (every increase in PCO_2 by 10 mmHg is followed by an increase in serum HCO_3^- by 3.5 mEq/L). However, the measured HCO_3^- concentration (24 mEq/L) is lower than expected. Thus, a coexistent metabolic acidosis is present (i.e. lactic acidosis due to hypoxemia).

A 48-year-old patient was admitted to the hospital with febrile gastroenteritis. Laboratory investigation showed: Arterial pH 7.40, PCO_2 40 mmHg, HCO_3^- 21 mEq/L, Na^+ 144 mEq/L, K^+ 2.9 mEq/L, Cl^- 88 mEq/L.

Which are acid-base abnormalities of the patient?

a. The patient did not exhibit an acid-base disorder

b. The patient exhibited a normal anion gap metabolic acidosis and respiratory acidosis

c. The patient exhibited a wide anion gap metabolic acidosis and metabolic alkalosis

d. The patient exhibited a hyperchloremic metabolic acidosis and respiratory alkalosis

Comment

The arterial pH is normal. However, the serum anion gap is increased [35 mEq/L] suggesting the presence of metabolic acidosis. In patients with a wide gap metabolic acidosis, the increase in anion gap is equal to the decrease in the serum HCO_3^-. Thus, the ratio $\Delta AG/\Delta HCO_3$ is equal to 1. When the increase in anion gap significantly exceeds the decrease in HCO_3^- as it is in the case in our patient $\Delta AG/\Delta HCO_3^- =$

$$\left\{\frac{35-10}{24-21}\right\}$$

a superimposed hypochloremic metabolic alkalosis is anticipated (possibly due to vomiting).

Corresponding author:

M. Elisaf, Department of Internal Medicine, Medical School, University of Ioannina, GR-451 10 Ioannina, Greece

Diagnosis: *Wide anion gap metabolic acidosis and metabolic alkalosis*