Acid-Base Balance-Electrolyte Quiz – Case 19

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, PCO₂ 60 mmHg and HCO₃⁻ 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: The patient exhibited respiratory acidosis (acidemia due hypercapnia) owing to the underlying COPD. The expected HCO₃⁻ concentration in this patient with chronic respiratory acidosis is 31 mEq/L (every increase in PCO₂ by 10 mmHg is followed by an increase in serum HCO₃⁻ by 3.5 mEq/L). However, the measured HCO₃⁻ 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, PCO₂ 40 mmHg, HCO₃⁻ 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 HCO₃⁻. Thus, the ratio ΔAG/ΔHCO₃⁻ is equal to 1. When the increase in anion gap significantly exceeds the decrease in HCO₃⁻ as it is in the case in our patient ΔAG/ΔHCO₃⁻ = \[
\frac{35-10}{24-21}
\]
a superimposed hypochloremic metabolic alkalosis is anticipated (possibly due to vomiting).

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