A 72-year-old man was admitted to the hospital with symptoms of congestive heart failure: Arterial pH 7.62, PO₂ 48 mmHg, PCO₂ 25 mmHg, HCO₃⁻ 21 mEq/L, Na⁺ 128 mEq/L, Cl⁻ 78 mEq/L.

Which are the acid-base disorders of the patient?

a. Respiratory alkalosis
b. Respiratory alkalosis and metabolic alkalosis
c. Respiratory alkalosis and metabolic acidosis
d. Metabolic alkalosis and respiratory acidosis
e. Respiratory alkalosis and metabolic acidosis, as well as metabolic alkalosis

Comment

Hypoxemia-induced respiratory alkalosis is the dominant acid-base disorder (alkalemia due to decreased PCO₂). In this case the expected HCO₃⁻ concentration is between 18 mEq/L and 21 mEq/L (a 2–4 mEq/L decrease of serum HCO₃⁻ levels for each decrease of PCO₂ by 10 mEq/L). Thus, there is no obvious superimposed metabolic disorder. However, the serum anion gap is elevated (29 mEq/L), suggesting the presence of a coexisting wide gap metabolic acidosis (possibly due to lactic acidosis). Even though other causes of an elevated anion gap should be carefully excluded, a very wide anion gap virtually establishes the presence of an increased anion gap metabolic acidosis. In an increased anion metabolic acidosis the decrease in HCO₃⁻ is equal to the increase in the anion gap. However, in the present case the decrease of serum HCO₃⁻ concentration (3 mEq/L) was substantially lower than the increase in serum anion gap (29–10=19 mEq/L), a finding that implied the presence of an additional acid-base disorder (metabolic alkalosis) due to the previous furosemide administration.