

## CHAPTER 28. ACID-BASE DISTURBANCES, SELF-ASSESSMENT QUESTIONS

Case for Questions 1–3. A 70-year-old woman with multiple recent admissions for congestive heart failure and medical noncompliance presents to the ED with progressive dyspnea and bilateral leg swelling. She is in significant respiratory distress with markedly labored respirations. Laboratory data immediately before intubation are as follows: pH 7.24, PaCO<sub>2</sub> 60 mm Hg (8.0 kPa), HCO<sub>3</sub><sup>-</sup> 26 mEq/L (26 mmol/L).

1. The clinical scenario and laboratory findings suggest which of the following?
  - A. Pulmonary edema with acute respiratory acidosis
  - B. Exacerbation of chronic obstructive pulmonary disease with chronic respiratory acidosis
  - C. Excessive diuresis with chronic metabolic alkalosis
  - D. New-onset diabetic ketoacidosis
2. Is the observed compensation appropriate?
  - A. No, the HCO<sub>3</sub><sup>-</sup> has increased by 2 mEq/L (2 mmol/L)
  - B. Yes, the HCO<sub>3</sub><sup>-</sup> has increased by 2 mEq/L (2 mmol/L)
  - C. Yes, the PaCO<sub>2</sub> has increased by 20 mm Hg (2.7 kPa)
  - D. No, the PaCO<sub>2</sub> has increased by 20 mm Hg (2.7 kPa)
3. This patient had a difficult airway and during efforts to establish an artificial airway the PaCO<sub>2</sub> increased by an additional 10 mm Hg (1.3 kPa). What would you expect the pH to be?
  - A. 7.32
  - B. 7.24
  - C. 7.16
  - D. 7.14

Case for Questions 4–6. A 20-year-old insulin-dependent diabetic is admitted for excessive thirst and polyuria. She has not taken her insulin therapy for “several days” because she could not afford her medications. Her laboratory test results reveal pH 7.26, PaCO<sub>2</sub> 16 mm Hg (2.1 kPa), HCO<sub>3</sub><sup>-</sup> 10 mEq/L (10 mmol/L), sodium 136 mEq/L (136 mmol/L), potassium 4.8 mEq/L (4.8 mmol/L), chloride 101 mEq/L (101 mmol/L).

4. What is this patient’s anion gap?
  - A. 9

- B. 19
  - C. 25
  - D. 30
5. Which of the following acid–base disturbances is consistent with the patient’s arterial blood gas?
- A. Normal anion gap metabolic acidosis
  - B. Anion gap metabolic acidosis
  - C. Respiratory acidosis
  - D. Metabolic alkalosis
6. What is the likely cause of the patient’s acid–base disorder?
- A. Hyperventilation
  - B. Water intoxication
  - C. Diabetic ketoacidosis
  - D. Surreptitious diuretic abuse
7. Which of the following would be expected in a 55-year-old woman with a partial small bowel obstruction who has been NPO (nothing by mouth) with a nasogastric tube in place for the past 5 days?
- A. Decreased pH, increased PaCO<sub>2</sub>, decreased HCO<sub>3</sub><sup>-</sup>
  - B. Decreased pH, decreased PaCO<sub>2</sub>, decreased HCO<sub>3</sub><sup>-</sup>
  - C. Increased pH, increased PaCO<sub>2</sub>, increased HCO<sub>3</sub><sup>-</sup>
  - D. Increased pH, decreased PaCO<sub>2</sub>, decreased HCO<sub>3</sub><sup>-</sup>
8. A 62-year-old man is sent to the emergency department from a local nursing home after he was noted to be “acting funny” by the staff. Shortly after arrival the patient’s mental status rapidly deteriorated and he was intubated for airway protection. During transfer to the intensive care unit (ICU) the patient is hand-ventilated by the respiratory therapist using an Ambu bag. The following arterial blood gas is obtained on arrival to the ICU: pH 7.53, PaCO<sub>2</sub> 25 mm Hg (3.3 kPa), and HCO<sub>3</sub><sup>-</sup> 22 mEq/L (22 mmol/L). Which of the following is the most likely explanation for the observed blood gas values?
- A. Narcotic overdose
  - B. Diuretic therapy

- C. Hypoventilation secondary to an acute stroke
- D. Iatrogenic hyperventilation

Case for Questions 9 and 10. You are seeing an obtunded patient in the emergency room. The patient is a homeless alcoholic who is well known to the emergency room staff. His laboratory data are as follows: pH 7.52, PaCO<sub>2</sub> 18 mm Hg (2.4 kPa), HCO<sub>3</sub><sup>-</sup> 14 mEq/L (14 mmol/L), sodium 145 mEq/L (145 mmol/L), and chloride 100 mEq/L (100 mmol/L).

9. Characterize this patient's acid-base disorder.
- A. Respiratory alkalosis, anion gap metabolic acidosis, metabolic alkalosis
  - B. Respiratory alkalosis, metabolic alkalosis
  - C. Anion gap metabolic acidosis, metabolic alkalosis
  - D. Respiratory acidosis, anion gap metabolic acidosis, metabolic alkalosis
10. Which of the following comorbid conditions could account for the observed derangements in his arterial blood gasses and chemistries?
- A. Salicylate overdose
  - B. Alcoholic ketoacidosis, persistent vomiting, and aspiration pneumonia with hyperventilation
  - C. Noncompliance with hemodialysis and infectious diarrhea
  - D. Diabetic ketoacidosis and heroin overdose

Case for Questions 11–13. A 60-year-old woman has been hospitalized in the intensive care unit for several weeks. Her hospital course has been complicated by aspiration pneumonia and sepsis requiring prolonged use of antibiotics. Over the last few days, she has started spiking fevers and has had profuse watery diarrhea. Her laboratory test results reveal pH 7.32, PaCO<sub>2</sub> 30 mm Hg (4.0 kPa), HCO<sub>3</sub><sup>-</sup> 15 mEq/L (15 mmol/L), sodium 138 mEq/L (138 mmol/L), potassium 3.5 mEq/L (3.5 mmol/L), chloride 115 mEq/L (115 mmol/L).

11. What is this patient's anion gap?
- A. 8
  - B. 10
  - C. 15
  - D. 17

12. Which of the following acid–base disturbances is consistent with the patient’s arterial blood gas?
- A. Anion gap metabolic acidosis
  - B. Normal anion gap metabolic acidosis
  - C. Respiratory acidosis
  - D. Metabolic alkalosis
13. What is the likely cause of the patient’s acid–base disorder?
- A. Lactic acidosis
  - B. Septic shock
  - C. *Clostridium difficile*–associated diarrhea
  - D. Uremia
14. A 22-year-old man with known schizophrenia was brought to the emergency room by family members for progressive confusion. Earlier he had told a neighbor that the “radio waves” were telling him to poison himself. Although his arterial blood gas is not available yet, his other laboratory data include sodium 140 mEq/L (140 mmol/L), potassium 3.2 mEq/L (3.2 mmol/L), chloride 103 mEq/L (103 mmol/L),  $\text{HCO}_3^-$  16 mEq/L (16 mmol/L). Based on nothing other than these chemistries, which of the following intoxications is improbable?
- A. Ethylene glycol
  - B. Methanol
  - C. Salicylates
  - D. Lithium
15. In a patient with metabolic alkalosis, the lungs attempt to compensate by \_\_\_\_\_ to \_\_\_\_\_ the carbon dioxide level?
- A. Hypoventilating, increase
  - B. Hypoventilating, decrease
  - C. Hyperventilating, increase
  - D. Hyperventilating, decrease

## ANSWERS

1. A
2. B
3. C
4. C
5. B
6. C
7. C
8. D
9. A
10. B
11. A
12. B
13. C
14. D
15. A