**Clinical case 1**

Patient B, 56 years old, known to have diabetes mellitus, insulin-dependent, was admitted urgently with the following manifestations: confusion, feeling nauseous and vomiting, dizziness.

**On objective examination**: deep and accelerated breathing, low blood pressure, hot, sweaty skin.

**Blood biochemistry reveals**: Glucose - 206 mg/dL (norm 60 - 110 mg/dL), free fatty acids - 2.3 mmol/L (norm 0 - 0.70 mmol/L), Sodium - 158 mEqL (norm 135 - 145 mEq/L), Potassium - 6.1 mEq/L (norm 3.5 - 5,5 mEq/L), Calcium - 2,9 mmol/L (norm 2,1 - 2,6 mmol/L), Chloride - 90 mmol/L (norm 98 - 106 mmol/L), ketone bodies 3,8 mg/dL (norm below 1,0 mg/dL), lactic acid 0,6 mmol/L (norm < 2,0 mmol/L).

**Analysis of acid-base balance** reveals: pH - 7.31 (norm 7.35 - 7.45), Plasma bicarbonate - 18 mEq/L (norm 24 - 26 mEqL), PaCO2 - 32 mmol/L (norm 35 - 40 mmol/L), SaO2 - 85 %.

**Questions:**

1. What acid-base dyshomeostasis developed in the patient and what is the pathogenetic mechanism?

2. Which biochemical pathogenetic links are involved in the development of ketoacidosis in insulin deficiency?

3. Explain the pH changes in the described clinical situation?

4. Explain the bicarbonate changes in the clinical situation described?

5. Reveal the pathogenetic mechanisms underlying the development of hyperpnea (frequent and accelerated breathing) in the acid-base dyshomeostasis present in the patient?

6. List the clinical and biochemical changes that reveal the presence of compensatory reactions in the given patient?

7. By which pathogenetic mechanisms can the hypernatremia in this patient be explained?

8. By which pathogenetic mechanisms can hyperkalemia be explained in this patient?

9. By which pathogenetic mechanisms can hyperkalemia be explained in this patient?

10. By which pathogenetic mechanisms can hypocapnia be explained in this patient? What is the biological significance of this compensatory reaction?

11. By which pathogenetic mechanisms can hypochloraemia be explained in this patient?

12. How can you explain the change in SaO2 in the given clinical situation?

**Clinical case 2**

Patient B, 36 years old, was urgently hospitalized in deep coma after a benzodiazepine overdose.

**On objective examination**: shortness of breath (FR - 6/min), blood pressure 85/40 mmHg, tachycardia (FCC - 130/min).

**Blood biochemical analysis** reveals: Glucose - 106 mg/dL (norm 60 - 110 mg/dL) Sodium - 158 mEq/L (norm 135 - 145 mEq/L), Potassium - 6.1 mEq/L (norm 3.5 - 5.5 mEq/L), Calcium - 2.8 mmol/L (norm 2,1 - 2,6 mmol/L), Chloride - 90 mmol/L (norm 98 - 106 mmol/L), Ketone bodies 0,8 mg/dL (norm < 1,0 mg/dL), Lactic acid 0,9 mmol/L (norm < 2,0 mmol/L).

**Analysis of acid-base balance** reveals: pH - 7, 30 (norm 7, 35 - 7,45), Plasma bicarbonate - 32 mEq/L (norm 24 - 26 mEq/L), PaCO2 - 52 mmol/L (norm 35 - 40 mmol/L), SaO2 - 75 %.

**Questions:**

1. What acid-base dyshomeostasis developed in the patient and what is the pathogenetic mechanism?
2. Explain the pH changes in the described clinical situation?
3. Explain the serum bicarbonate changes in the described clinical situation?
4. Explain the mechanisms by which the kidney is involved in compensating for the acid-base dyshomeostasis present in this patient
5. By which pathogenetic mechanisms can the hypernatremia in this patient be explained?
6. By which pathogenetic mechanisms can hyperkalemia be explained in this patient?
7. By which pathogenetic mechanisms can hyperkalemia be explained in this patient?
8. By which pathogenetic mechanisms can the hypochloraemia in this patient be explained?
9. What clinical manifestations may be triggered by increased plasma CO2 (PaCO2) in the presence of this acid-base dyshomeostasis?
10. Explain the pathogenetic mechanisms underlying the decrease in blood pressure value in acid-base dyshomeostasis present in the patient
11. This acid-base dyshomeostasis is associated with osmolarity disturbances. What osmolarity disturbances may be present and how do they manifest?
12. Which biochemical or blood gas parameter allows us to differentiate respiratory acidosis from metabolic acidosis?

**Clinical case 3**

Patient A, 67 years old, was hospitalized with the following complaints: nausea and vomiting for 4 days, headache, dizziness, muscle cramps in the lower limbs.

**On objective examination**: low blood pressure, dry complexion, reduced skin turgor.

**Blood biochemical analysis** revealed: Glucose - 106 mg/dL (norm 60 - 110 mg/dL), Sodium - 128 mEq/L (norm 135 - 145 mEq/L), Potassium - 3.1 mEq/L (norm 3.5 - 5.5 mEq/L), Calcium - 1.9 mmol/L (norm 2.1 - 2.6 mmol/L), Chloride - 118 mmol/L (norm 98 - 106 mmol/L),

**Acid-base balance analysis** reveals: pH - 7,55 (norm 7,35- 7,45), Plasma bicarbonate - 32 mEqL (norm 24 - 26 mEqL), PaCO2 - 46 mmol/L (norm 35 - 40 mmol/L).

**Questions:**

1. What acid-base dyshomeostasis developed in the patient and what is the pathogenetic mechanism?

2. Explain the pH changes in the described clinical situation?

3. By which pathogenetic mechanisms can the hyponatremia in this patient be explained?

4. By which pathogenetic mechanisms can hypokalemia be explained in this patient?

5. By which pathogenetic mechanisms can hypocalcemia be explained in this patient?

6. By which pathogenetic mechanisms can hypercapnia be explained in this patient? What is the biological significance of this change?

7. By which pathogenetic mechanisms can hyperchloremia be explained in this patient?

8. 11. This acid-base dyshomeostasis is associated with osmolarity disturbances. What osmolarity dysregulations may be present and how do they manifest?

9. Which biochemical or blood gas parameter allows us to differentiate between metabolic and respiratory alkalosis?