**Case Study 1**

Patient N., a 32-year-old, complains of intense nose itching, violent sneezing, excessive tearing, watery nasal discharge, sore throat, cough and headache. According to the medical history, these symptoms have appeared every spring for the past three years. The patient’s condition worsens when in the forest or public gardens.

**Examination Findings**: The sclera is hyperaemic, with eyelid erythema and edema, tearing, seromucous nasal discharge, and laboured breathing. Swelling of the nasopharyngeal mucosa with abundant mucus secretion is noted.

**Hemogramm**: Leukocytes - 10.5 × 10⁹/L (N= 4.8–10.8 × 10⁹/L); Lymphocytes - 22% (N= 25–33%); Neutrophils: band - 2% (N=1-5%), segmented - 56% (N=40–70%); Monocytes - 7% (N= 3–7%); Eosinophils - 10% (N= 0–6%)

**Immunogram**: CD4+ T-cells - 1400/mm³ (N= 500–1200/mm³); T-helper cells - 58.5%; B-lymphocytes: 62%; IgA - 2.00 g/L (N= 0.70–3.50 g/L); IgM- 2.1 g/L (N= 0.50–3.0 g/L); IgG - 13.0 mg/dL (N= 7.0–17.0 g/L); Serum IgE level - 500 IU/mL (N= 0–100 IU/mL)

During a **percutaneous test** with plant allergens (flower pollen), a papule surrounded by erythema without induration formed in response to maple pollen.

**Questions:**

1. What type of allergic reaction has developed in the patient? Explain using the medical history, clinical signs, and laboratory data.
2. Deduce the pathogenic chain of active sensitization in Type I (Anaphylactic) allergic reaction. Describe the role of B and T lymphocytes.
3. Which pre-synthesized cellular mediators (and their sources) contribute to the development of erythema, edema, tearing, and mucus secretion?
4. Which de novo synthesized mediators contribute to the clinical signs of an anaphylactic reaction? Outline the synthesis pathway of prostaglandins and leukotrienes.
5. What is the pathogenesis of blood pressure reduction in anaphylactic shock? What are the mechanisms of bronchial obstruction in anaphylactic shock?
6. Interpret the pathogenic increase in the percentage of B and T lymphocytes in an anaphylactic reaction. Explain the prevalence of B lymphocytes in the immunogram.
7. Explain the increase in eosinophil percentage in the complete blood count. List the mediators and their functions synthesized by eosinophils.

**Case Study 2**

Patient G, 48 years old, presents with asthenia, vertigo, nausea, and drowsiness. From the medical history: the patient had salmonellosis and was treated with levomycetin for three months.

**Objective:** The skin appears pale, cold, and dry. Respiratory rate is 20 breaths per minute, vesicular breath sounds on auscultation, pulse rate is 86 beats per minute, blood pressure is 110/65 mm Hg.

**In the hemogram**: Erythrocytes - 2.4 × 1012/L (N= 4.0 - 5.2 × 1012/L); Hemoglobin - 110 g/L (N= 120–158 g/L); Hematocrit - 30% (N= 35.4–44.4%); Leukocytes - 10.5 × 10⁹/L (N= 4.8 – 10.8 × 10⁹/L); Lymphocytes - 25% (N= 25–33%); non-segmented neutrophils - 4% (N= 0-5%); Segmented neutrophils - 58% (N= 40–70%); Monocytes - 4% (N= 3-7%); Eosinophils - 12% (N= 0–6%); ESR - 15 mm/hour (N= 2-15 mm/hour)

**Immunogram:** CD4+ - 1400/mm³ (N= 500 to 1200/mm³)**;** CD8+ - 300/mm³ (N= 150 to 1000/mm³)**;** T-helper - 58.5%**;** B lymphocytes - 62%**;** IgA - 1.0 g/L (N= 0.70–3.50 g/L)**;** IgM - 3.4 g/L (N= 0.50–3.0 g/L)**;** IgG - 28.1 g/L (N= 7.0–17.0 g/L)

**Anti-erythrocytes antibodies were detected in the blood.**

**Questions:**

1. What type of allergic reaction has developed in the patient? Justify based on the medical history, clinical signs, and laboratory data.
2. What does haptens represent? What is their role in the etiology of allergic reactions? Differentiate between a complete allergen and a hapten.
3. Deduce the pathogenetic chain of active sensitization in the type II cytotoxic allergic reaction. What is the role of B and T lymphocytes?
4. What pathogenetic mechanisms contribute to the hemolysis of erythrocytes in this patient?
5. Which components of the complement system induce hemolysis of erythrocytes, and through what mechanisms?
6. Deduce the pathogenetic chain of complement activation via the classical and alternative pathways.
7. Interpret the pathogenetic increase in the percentage of B lymphocytes and T lymphocytes in the cytotoxic reaction. Justify the prevalence of B lymphocytes in the immunogram.

**Situation Problem 3**

Patient D, 9 years old, received 3000 IU of hyperimmune horse antitoxin serum prophylactically due to a leg injury. On the 9th day after the serum was administered, the child developed severe pain and swelling in the brachial and knee joints, generalized skin rashes, and general weakness.

**Objective:** The injection site of the serum is swollen and painful, the morning body temperature is 38.8 °C, and the heart sounds are muffled with blood pressure at 80/50 mm Hg. The child was hospitalized.

**Immunogram:** CD4+ - 1300/mm³ (N= 500 to 1200/mm³), T-helper - 52%, B lymphocytes - 56%, IgA - 1.8 g/L (N= 0.70–3.50 g/L), IgM - 3.2 g/L (N= 0.50–3.0 g/L), IgG - 31.3 g/L (N= 7.0–17.0 g/L).

**The complement fractions in the blood serum are decreased.**

**Questions:**

1. What type of allergic reaction has developed in the patient? Justify your answer based on the medical history, clinical signs, and laboratory test results.
2. Deduce the pathogenic chain of active sensitization in the context of a type III allergic reaction. The role of B and T lymphocytes.
3. What mediators contributed to the injury and inflammation of the brachial and knee joints in the patient?
4. Explain the mechanism of circulation and sedimentation of circulating immune complexes in the context of a type III allergic reaction.
5. What plasma mediators are involved in the pathogenesis of type III allergic reactions? Justify your answer based on the effects of these mediators.
6. Interpret the pathogenic increase in the percentage of B and T lymphocytes in the context of a type III allergic reaction. Justify the prevalence of B lymphocytes in the immunogram.
7. Explain the essence of the decrease in complement system fractions in the blood serum in the context of a type III allergic reaction.

**Case Study 4**

Patient R, 18 years old, presented to the family doctor with the following complaints: itching, redness, rashes, and ulcers on the skin in the area of the left arm.
From the medical history: one month ago, she purchased a yellow metal alloy bracelet, and regular wearing of it, over two weeks, caused the aforementioned manifestations.

**Hemogram:** leukocytes - 9.5 × 10^9/L (N = 4.8 – 10.8 × 10^9/L), lymphocytes - 40% (N = 25–33%), bend neutrophils - 3% (N = 0-5%), segmented neutrophils - 46% (N = 40–70%), monocytes - 7% (N = 3-7%), eosinophils - 4% (N = 0–6%).

**Immunogram:** CD4+ - 1600/mm³ (N = 500 to 1200/mm³), CD8+ - 1300/mm³ (N = 150 to 1000/mm³), T-lymphocytes - 68%, B-lymphocytes - 32%. IgA - 1.4 g/L (N = 0.70–3.50 g/L), IgM - 1.8 g/L (N = 0.50–3.0 g/L), IgG - 12.5 g/L (N = 7.0–17.0 g/L).

**Questions:**

1. What type of allergic reaction has developed in the patient? Justify your answer based on the medical history, clinical signs, and laboratory test results.
2. Deduce the pathogenic chain of active sensitization in the context of type IV allergic reaction. What is the pathogenic role of T lymphocytes?
3. What mediators contributed to the injury and inflammation associated with contact dermatitis?
4. What cellular mediators are involved in the pathogenesis of type IV allergic reactions? Justify your answer by discussing the effects of these mediators.
5. Interpret the pathogenic increase in the percentage of T lymphocytes in the context of type IV allergic reaction. Justify the prevalence of T lymphocytes in the immunogram.
6. Explain the functions of CD4+ and CD8+ lymphocytes in the pathogenesis of type IV allergic reaction.
7. What types of cytokines mediate type IV allergic reactions? What are their effects in the context of type IV allergic reaction?