**Clinical case 1**

The patient, 32 years old, presented with the following complaints: general weakness, drowsiness, dizziness. From the medical history, the patient had breast cancer and underwent a course of chemotherapy.

Objective findings: pronounced pallor, petechiae, ecchymoses, gingival and nasal bleeding.

She frequently experiences respiratory infections.

Patient’s blood test results:

|  |  |  |
| --- | --- | --- |
| **CBC** | **VALUES** | **REFERENCE RANGES** |
| **Hematocrit** | 29 | **Bărbaţi** 39-49%  **Femei** 35-45% |
| **Hemoglobin** | 9,0 | **Bărbaţi** 13,6-17,5 g/dL  **Femei** 12,0-15,5 g/dL |
| **Red blood cells (RBC)** | 3,1 | 4,7-6,1 million/cu mm |
| **Reticulocyte count** | 0 | 0,5-1,5% |
| **MCV** | 87 | 80 -100 fL |
| **MCH** | 29 | 26 – 34 pg |
| **MCHC** | 33 | 31 -36 g/dL |
| **White blood cell (WBC) count,** | 2,8 | 4,800–9,000/cumm |
| **Neutrophil count** | 30 | 60-62% |
| **Basophil count** | 0 | 0- 1,0%  10 -120/cu mm |
| **Eosinophil count** | 0 | 1-4%  4- -500 cu mm |
| **Lymphocyte count** | 39 | 25-35%  800 -3,500/cu mm |
| **Monocyte count** | 2 | 3-7%  200-800/cu mm |
| **Platelet count** | 108,000 | 150,000-450,000/cu mm |
| **Morphological changes of blood cells** |  |  |

**Questions:**

1. **What pathology of the erythrocyte system is present in this patient, and what is the etiological factor?**
2. **What is the pathogenic mechanism of this type of anemia?**
3. **What are the signs of agranulocytosis in the patient's blood count?**
4. **Determine if the patient's lab analysis shows pancytopenia, and if so, how is it characterized.**
5. **What is the pathogenesis of the clinical signs: petechiae, ecchymoses, gingival, and nasal bleeding?**
6. **What is the pathogenesis of the frequent respiratory infections in this patient?**

**Caz clinic N 4**

A 47-year-old patient was admitted with the following symptoms: weakness, irritability, unstable gait, headache, dizziness, paraesthesia, and diarrhea. From the patient’s history, he underwent gastric resection one year ago.

Objective findings: pale skin with fissures, and a bright red tongue (Hunter's glossitis).

|  |  |  |
| --- | --- | --- |
| **CBC** | **VALUES** | **REFERENCE RANGES** |
| **Hematocrit** | 35 | **Bărbați**  39-49%  **Femei** 35-45% |
| **Hemoglobin** | 11,7 | **Bărbați** 13,6-17,5 g/dL  **Femei**  12,0-15,5 g/dL |
| **Red blood cells (RBC)** | 3,6 | 4,7-6,1 million/mm3 |
| **Reticulocyte count** | 0,3 | 0,5-1,5% |
| **MCV** | 114 | 80 -100 fL |
| **MCH** | 38 | 26 – 34 pg |
| **MCHC** | 33 | 31 -36 g/dL |
| **White blood cell (WBC) count,** | 4,6 | 4,800–9,000/cumm |
| **Neutrophil count** | 61 | 60 -62% |
| Segmented mature neutrophils | 46 | 40-60% |
| Non-segmented neutrophils (band) | 5 | 1-6% |
| Metamyelocytes | 0 | 0% |
| Myelocytes | 0 | 0% |
| **Basophil count** | 1 | 0- 1,0%  10 -120/cu mm |
| **Eosinophil count** | 2 | 1-4%  4- -500 cu mm |
| **Lymphocyte count** | 32 | 25-35%  800 -3,500/cu mm |
| **Monocyte count** | 3 | 3-7%  200-800/cu mm |
| **Platelet count** | 143,000 | 150,000-450,000/cu mm |
| **Morphological changes of blood cells** | Anisocytosis, poikilocytosis, giant neutrophils with hypersegmented nuclei, erythrocytes with Cabot rings, and Jolly bodies. |  |

**Questions:**

1. **What pathology of the erythrocyte system is present in this patient, and what is the etiological factor?**
2. **What is the mechanism of vitamin B12 malabsorption in this patient?**
3. **What is the pathogenic mechanism of pale skin in this patient?**
4. **What is the pathogenic mechanism of this erythrocyte system pathology in this patient?**
5. **The blood count shows the values of MCV and MCH. What do these parameters indicate in this patient?**
6. **What is the pathogenic mechanism of Hunter's glossitis (bright red tongue)? (explain through the pathogenic chain)**
7. **What is the pathogenic mechanism of diarrhea in this patient? (explain through the pathogenic chain)**
8. **What is the pathogenic mechanism of the neurological signs?**

**Caz clinic 2**

The 37-year-old patient presented to the gynecologist with the following complaints: for several months, she has been suffering from intermenstrual bleeding, menorrhagia (heavy bleeding), extreme fatigue, and weakness. Objective findings: pronounced pallor, brittle nails and hair, labial commissures, and gustatory paresthesias. The patient's blood count:

|  |  |  |
| --- | --- | --- |
|  | **VALORILE** | **Valori DE REFERINȚĂ** |
| **Hematocrit** | **32** | **Bărbați 39-49%**  **Femei 35-45%** |
| **Hemoglobina** | **9,0** | **Bărbați 13,6-17,5 g/dL**  **Femei 12,0-15,5 g/dL** |
| **Eritrocite** | **4,2** | **4,7-6,1 mln/mm3** |
| **Numărul de reticulocite** | **3,5** | **0,5-1,5%** |
| **MCV** | **74** | **80 -100 fL** |
| **MCH** | **22** | **26 – 34 pg** |
| **MCHC** | **28** | **31 -36 g/dL** |
| **Leucocite** | **5,7** | **4,800–9,000/mm3** |
| **Neutrofile** | **60** | **60 -62%** |
| **Bazofile** | **0,5** | **0- 1,0%**  **10 -120/ mm3** |
| **Eozinofile** | **3** | **1-4%**  **4- -500 mm3** |
| **Limfocite** | **32** | **25-35%**  **800 -3,500/ mm3** |
| **Monocite** | **5** | **3-7%**  **200-800/ mm3** |
| **trombocite** | **258,000** | **150,000-450,000/ mm3** |
| **Modificări morfologice ale celulelor sanguine** | **Anizocitoză, poikilocitoză, anulocite.** |  |

1. **What type of pathological process in the erythrocyte system is present in the patient? Justify the changes in the blood count.**
2. **What is the pathogenic mechanism of iron-deficiency anemia in this patient?**
3. **What is the pathogenic mechanism of the clinical signs, such as brittle nails and hair, lip fissures, and taste paraesthesia?**
4. **How does the reticulocyte count change, and what is the mechanism of this change?**
5. **For diagnosing anemia, are other biochemical tests (serum iron, ferritin, transferrin, transferrin saturation) needed, and how do they change?**
6. **What is anulocytosis, and what is the mechanism of this morphological change?**
7. **What is the pathogenic mechanism of anemia in chronic infections?**

**Clinical case 3**

A 47-year-old patient was admitted with the following symptoms: general weakness, insomnia, headache, paresthesia in the fingers, visual disturbances, loss of work capacity, heartburn, and belching.

Objective findings: Skin is red-violet in color. The face is congested, with injected sclerae, and on fundoscopy, turgid veins are observed. Blood pressure is 160/85 mm Hg. Moderate hepatomegaly and increased blood viscosity.

|  |  |  |
| --- | --- | --- |
| **CBC** | **VALUES** | **REFERENCE RANGES** |
| **Hematocrit** | 54 | **Males** 39-49%  **Females** 35-45% |
| **Hemoglobin** | 19,9 | **Males** 13,6-17,5 g/dL  **Females** 12,0-15,5 g/dL |
| **Red blood cells (RBC)** | 9,4 | 4,7-6,1 million/cu mm |
| **Reticulocyte count** | 2,7 | 0,5-1,5% |
| **MCV** | 75 | 80 -100 fL |
| **MCH** | 24 | 26 – 34 pg |
| **MCHC** | 30 | 31 -36 g/dL |
| **White blood cell (WBC) count,** | 11,500 | 4,800–9,000/cumm |
| **Neutrophil count** | 68 | 60 -62% |
| **Basophilcount** | 2 | 0- 1,0%  10 -120/cu mm |
| **Eosinophilcount** | 6 | 1-4%  4- -500 cu mm |
| **Lymphocytecount** | 32 | 25-35%  800 -3,500/cu mm |
| **Monocytecount** | 11 | 3-7%  200-800/cu mm |
| **Plateletcount** | 576 | 150,000-450,000/cu mm |
| **Morphological changes of blood cells** | Anizocytosis, anulocytosis |  |
| **EPO** | 2,5 | 4,3 – 29 UI/L |

1. **What type of pathological process in the erythrocyte system is present in the patient? Justify the changes in the blood count.**
2. **Is the pathological process in the erythrocyte system absolute or relative? Justify the changes in the blood count.**
3. **Is the pathological process in the erythrocyte system absolute primary or secondary? Justify the changes in the blood count.**
4. **What is the pathogenesis of this pathological process in the patient?**
5. **The blood count shows the values of MCV, MCH, and MCHC. What do these parameters indicate in this patient?**
6. **The blood count shows the values of MCV, MCH, and MCHC. What is the pathogenic mechanism behind the changes in these parameters?**
7. **What is the pathogenic mechanism of neurological symptoms such as insomnia, headache, and visual disturbances?**
8. **How does blood pressure change, and what is the pathogenic mechanism (describe the pathogenic chain)?**
9. **What is the pathogenic mechanism of symptoms such as heartburn and belching?**
10. **What is the pathogenic mechanism of moderate hepatomegaly?**

**Clinical cases to Pathophysiology of WBC**

**Clinical Case 1**

A 32-year-old man was admitted with chronic appendicitis.

**Blood Count:**

* Erythrocytes: 4,600,000/μL
* Hemoglobin (Hb): 150 g/L
* Platelets: 390,000/μL
* Leukocytes: 17,000/μL

**Leukocyte formula:**

* Basophils: 1%
* Eosinophils: 1%
* Neutrophilic metamyelocytes: 8%
* Neutrophilic band cells: 10%
* Granular leukocytes: 57%
* Lymphocytes: 15%
* Monocytes: 8%

1. **Which type of white blood cell disorders has the patient?**
2. **What is the pathogenetic mechanism of this process?**

**Clinical case 2**

A 9-year-old patient was admitted with a presumptive diagnosis of whooping cough.

**Blood Count:**

* Erythrocytes: 4,100,000/μL
* Hemoglobin (Hb): 150 g/L
* Platelets: 390,000/μL
* Leukocytes: 14,000/μL

**Leucocytes formula:**

1. Basophils: 0%
2. Eosinophils: 0%
3. Neutrophilic metamyelocytes: 0%
4. Neutrophilic band cells: 2%
5. Granular neutrophils: 41%
6. Lymphocytes: 45%
7. Monocytes: 12%
8. **Which type of white blood cell disorders has the patient?**
9. **What is the pathogenetic mechanism of this process?**

**Clinical Case 3**

A 21-year-old patient was admitted to the Rheumatology department with the diagnosis of chronic nonspecific polyarthritis.

**Blood Cell Count:**

1. Erythrocytes: 3,900,000/μL
2. Hemoglobin (Hb): 120 g/L
3. Platelets: 390,000/μL
4. Leukocytes: 2,000/μL

**Leukocytes formula:**

1. Basophils: 0%
2. Eosinophils: 0%
3. Neutrophilic metamyelocytes: 0%
4. Neutrophilic band cells: 1%
5. Granular leukocytes: 10%
6. Lymphocytes: 70%
7. Monocytes: 9%
8. **Which type of white blood cell disorders has the patient?**
9. **What is the pathogenetic mechanism of this process?**

**Clinical Case 4**

A 16-year-old patient was admitted with the following symptoms: painful swallowing, gum bleeding, and fever.

Objective Examination: Hemorrhagic eruptions were discovered in the oral cavity, and the retrocervical and supraclavicular lymph nodes are enlarged.

**Blood Count:**

* Erythrocytes: 4,200,000/μL
* Hemoglobin (Hb): 130 g/L
* Platelets: 90,000/μL
* Leukocytes: 18,000/μL

**Leukocytes formula:**

* Basophils: 0%
* Eosinophils: 0%
* Neutrophilic band cells: 3%
* Granular leukocytes: 40%
* Lymphocytes: 28%
* Monocytes: 6%
* Myeloblasts: 20%

**Additional Findings:**

* The cytoplasm of the blast cells is vacuolated with azurophilic granules, and the peroxidase reaction is positive.
* Bone Marrow Examination: 78% blast cells, leukocyte/erythrocyte ratio is 36.8.
* Ultrasound: Enlarged mediastinal and retroperitoneal lymph nodes.
* **Which type of white blood cell disorders has the patient?**
* **What is the pathogenetic mechanism of this process?**
* **Is hiatus leukemicus present in this patient and what does represent?**
* **What is the mechanism of thrombocytopenia in this patient?**

**Clinical Case 5**

A 50-year-old patient was admitted with the following symptoms: fatigue, apathy, and pain in the neck region.

**Objective Examination:** The cervical and submandibular lymph nodes are enlarged.

**Blood Cell Count:**

* Erythrocytes: 3,500,000/μL
* Hemoglobin (Hb): 80 g/L
* Platelets: 50,000/μL
* Leukocytes: 33,000/μL

**Leukocytes formula:**

* Basophils: 0%
* Eosinophils: 1%
* Neutrophilic band cells: 2%
* Granular leukocytes: 17%
* Lymphocytes: 78%
* Monocytes: 2%
* High quantities of Botkin-Gomperz prints.

**Bone Marrow Examination:**

* Blast cells: 50%
* Lymphoid cells: 80%
* Leukocyte/erythrocyte ratio: 25.3

1. **Which type of white blood cell disorders has the patient?**
2. **What is the pathogenetic mechanism of this process?**
3. **What is the mechanism of thrombocytopenia in this patient?**
4. **What is the mechanism of anemia in this patient?**

**CLINICAL CASE**

E.W. is a 58-year-old male, who has had difficulty controlling his BP lately. The patient is an air traffic controller at the local airport. He smoked cigarettes for approximately 25 years. He drinks “several beers every evening to relax”. He does not pay particular attention to the sodium, fat, or carbohydrate content of the foods that he eats. He admits to “salting almost everything he eats, sometimes even before tasting it.” He denies ever having dieted. He takes an occasional walk but has no regular daily exercise program. The patient is an obese man in no apparent distress. He appears to be his stated age.

**Medical history**

• Weight has increased by approximately 20 pounds during the last year

• Denies shortness of breath at rest, headaches, nosebleeds, and hemoptysis

• Reports some shortness of breath and chest pain with activity, especially when climbing stairs, and that breathing difficulties are getting worse.

**BP** - 175/96 mm Hg (sitting), **HR -** 73 and regular, RR =15/min and unlabored

**ECG** - increased QRS voltage suggestive of LVH**: ECHO -** moderate LVH with EF = 46%

|  |  |  |
| --- | --- | --- |
| **CBC** | **VALUES** | **REFERENCE RANGES** |
| **Hematocrit** | 52 | **Males** 39-49%  **Females** 35-45% |
| **Hemoglobin** | 18,5 | **Males** 13,6-17,5 g/dL  **Females** 12,0-15,5 g/dL |
| **Red blood cells (RBC)** | 7,1 | 4,7-6,1 million/cu mm |
| **Reticulocyte count** | 2,5 | 0,5-1,5% |
| **White blood cell (WBC) count** | 8,200 | 4,800–9,000/cu mm |
| **Neutrophil count** | 60 | 60 -62% |
| **Basophil count** | 0,5 | 0- 1,0% |
| **Eosinophil count** | 3 | 1-4% |
| **Lymphocyte count** | 26 | 25-35% |
| **Monocyte count** | 4 | 3-7% |
| **Platelet count** | 399,000 | 150,000-450,000/cu mm |

|  |  |  |
| --- | --- | --- |
| **Protein total** | **7,6** | 6,0 – 8,0 g/dL |
| **Fibrinogen** | **208** | 160 – 450 mgd/L |
| **Prothrombin** | **105** | 80 – 130% |
| **Glycosylated hemoglobin** | **7,0** | 3,9 – 6,9% |
| **Glucose , serum fasting** | **112** | 60 – 110 mg/dL |
| **Triglyceride** | **290** | <165 mg/dL |
| **Cholesterol** | **275** | Desirable: < 200 mg/dL  Borderline: 200–239 mg/dL  High risk: >240 mg/dL |
| **HDL** | **31** | Desirable: > 40 mg/dL in men  >50 mg/dL  in women |
| **LDL** | **178** | <100 mg/dL  Very high risk (has both cardiovascular disease and  diabetes mellitus) >160 mg/dL |
| **Blood urea nitrogen (BUN)** | **37** | 8 – 20 mg/dL |
| **Creatinine** | **1,4** | 0,6-1,2 mg/dL |
| **Bilirubin total** | **0,9** | 0,1 – 1,2 mg/dL |
| **Alanine aminotransferase (ALT)** | **48** | 7-56 IU/L |
| **Aspartate aminotransferase (AST)** | **17** | 0 – 35 IU/L |
| **C- reactive protein** | **0,1** | 0 – 0,5 mg/dL |
| **Erythropoietin** | **47,9** | 5,4-31,0 UI/L |
| **Na+** | **151** | 135-145 meq/L |
| **K+** | **3,6** | 3,5 – 5,0 mEq/L |

1. **What are risk factors for development of arterial hypertension in this patient?**
2. **What is the type of arterial hypertension according to etiology and pathophysiological mechanism?**
3. **What is the neurogenic mechanisms of arterial hypertension?**
4. **What is the hemodynamic mechanisms of arterial hypertension?**
5. **What is the humoral mechanisms of arterial hypertension?**
6. **What is the role of genetic factor in development of arterial hypertension?**
7. **What does represent and which are the mechanisms of hypertensive vascular remodeling?**
8. **Identify all changes in laboratory analysis of the patient and explain them in the pathophysiological context?**
9. **What is the likely pathophysiologic mechanism for LVH in this patient?**
10. **What does the patient’s EF (ejection fraction) suggest?**

**CLINICAL CASE 1**

Mr. W.G. is a 53-year-old man in very severe state was admitted in the department of Intensive Care.

**Patient’s Chief Complaints**

“While playing tennis suddenly I am having pain in my chest and it goes up into my left shoulder and down the inside of my left arm”.

The patient was transported to the ED of the nearest hospital and arrived within 30 minutes of the onset of chest pain. On admittance, patient was anxious, BP- 165/105 mmHg, HR – 108/min, breathing rate – 22/min. Shortly after this the state of the patient suddenly aggravated: was attested a state of inhibition, BP – 60/30 mmHg, HR – 125 /min, arrhythmic pulse, breathing becomes shallow and frequently, BR-33/min. Skin was cold, acrocyanosis.

**Cardiac echo-doppler: EDV -168 ml, ESV – 68 ml, EF – 45%**

**On ECG –** signs of myocardial infarction at the level of the anterior wall of the left ventricle.

**Chest X-Ray** - bilateral mild pulmonary edema (<10% of lung fields) without pleural disease or widening of the mediastinum.

**COMPLETE BLOOD COUNT**

|  |  |  |
| --- | --- | --- |
| **CBC** | **VALUES** | **REFERENCE RANGES** |
| **Hematocrit** | **45** | **Males 39-49%**  **Females 35-45%** |
| **Hemoglobin** | **16,5** | **Males 13,6-17,5 g/dL**  **Females 12,0-15,5 g/dL** |
| **Red blood cells (RBC)** | **5,6** | **4,7-6,1 million/cu mm** |
| **Reticulocyte count** | **1,0** | **0,5-1,5%** |
| **White blood cell (WBC) count** | **7,800** | **4,800–9,000/cumm** |
| **Neutrophil count** | **60** | **60 -62%** |
| **Segmented mature neutrophils** | **56** | **40-60%** |
| **Non-segmented neutrophils (band)** | **4** | **1-6%** |
| **Metamyelocytes** | **0** | **0%** |
| **Myelocytes** | **0** | **0%** |
| **Basophil count** | **0,5** | **0-1,0%**  **10 -120/cu mm** |
| **Eosinophil count** | **3** | **1-4%**  **4- -500 cu mm** |
| **Lymphocyte count** | **32** | **25-35%**  **800 -3,500/cu mm** |
| **Monocyte count** | **5** | **3-7%**  **200-800/cu mm** |
| **Platelet count** | **346,000** | **150,000-450,000/cu mm** |

**BIOCHEMICAL BLOOD ANALYSIS**

|  |  |  |
| --- | --- | --- |
| **Protein total** | 7,1 | 6,0 – 8,0 g/dL |
| **Albumin** | 4,2 | 3,4 – 4,7 g/dL |
| **Fibrinogen** | 569 | 160 – 450 mgd/L |
| **Triglyceride** | 203 | <165 mg/dL |
| **Cholesterol** | 298 | Desirable: < 200 mg/dL  Borderline: 200–239 mg/dL  High risk: >240 mg/dL |
| **HDL** | 24 | Desirable: > 40 mg/dL in men  >50 mg/dL  in women |
| **LDL** | 214 | <100 mg/dL  Very high risk (has both cardiovascular disease and  diabetes mellitus) >160 mg/dL |
| **Blood urea nitrogen (BUN)** | 31 | 8 – 20 mg/dL |
| **Creatinine** | 2,1 | 0,6-1,2 mg/dL |
| **Bilirubin total** | 0,8 | 0,1 – 1,2 mg/dL |
| **Direct or conjugated bilirubin** | 0,4 | 0,1 - 0,5 mg/dL |
| **Indirect or unconjugated bilirubin** | 0,4 | 0,1 – 0,7 mg/dL |
| **Alanine aminotransferase (ALT)** | 52 | 7-56 IU/L |
| **Aspartate aminotransferase (AST)** | 65 | 0 – 35 IU/L |
| **Creatine kinase (CK), total** | 509 | 32 – 267 UI/L |
| **Creatine kinase MB (CK-MB)** | 47 | <16 IU/L |
| **Troponin I** | 2,0 | <0,05 ng/mL |
| **Myoglobin** | 224 | 0-85 ng/ml |
| **SERCA 2a** | +++ | - |
| **Lactate** | 4.2 | < 2mg/dL |
| **C- reactive protein** | 2,4 | 0 – 0,5 mg/dL |
| **Erythropoietin** | 23,5 | 5,4-31,0 UI/L3 |
| **Na+** | 140 | 135-145 meq/L |
| **K+** | 5,7 | 3,5 – 5,0 mEq/L |

**Arterial Blood Gases**

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Value** | **Reference ranges** |
| **pH** | 7,32 | 7,35-7,45 |
| **PaO2** | 80 | 98 mmHg |
| **PaCO2** | 32 | 35-40 mmHg |
| **SaO2** | 85 | >95% |
| **Bicarbonate** | 19 | 21 – 28 mEq/L |

**Question:**

1. **What is the etiological factor of the pathological process?**
2. **Which type of heart failure has patient?**
3. **What the pathophysiological mechanism of these heart failure?**
4. **What are the pathophysiological mechanisms of cardiomyocyte injury?**
5. **What are the emergent compensatory mechanisms are attested in this patient?**
6. **What are the pathophysiological mechanisms of breathing changes in this patient?**
7. **What are the pathophysiological mechanisms of heart rate changes in this patient?**
8. **What are the specific markers that indicate cardiomyocyte injury?**
9. **What are the non-specific markers that indicate cardiomyocyte injury?**
10. **What are signs of activated inflammatory reaction and what is the pathogenesis of it?**
11. **What are the changes of pH imbalance and what are the mechanisms?**
12. **What is the biochemical marker of tissular hypoperfusion in this patient and what is the pathophysiological mechanism?**
13. **What is the mechanism of reduced oxyhemoglobin saturation of this patient?**
14. **What is the mechanism of pulmonary congestion (edema)?**
15. **What clinical signs reflect centralization of circulation, and what are the mechanisms?**
16. **What are the intracardiac hemodinamic changes attested in this patient?**

**Clinical case 2**

Patient Y, a 69-year-old female, who has been experiencing marked swelling of the ankles and feet during the past three weeks, pain at the level of the right hypochondrium and less daily urine output, dyspnea. She feels very weak and tired most of the time.

On physical examination was attested: pitting edema in feet and ankles extending bilaterally to mid-calf region, yellowish discoloration of the skin, enlarged liver (3 cm lower than inferior rib edge), and presence of fluid in the peritoneal cavity. BP – 90/60 mmHg, HR – 115/min, breathing rate – 28/min. Cervical vena are turgescent.

ECG: Sinus tachycardia and signs of right ventricular hypertrophy.

Heart echocardiography: stenosis of pulmonary valve.

Cardiac echo-doppler: EDV -150 ml, ESV – 55 ml, EF – 60%

**COMPLETE BLOOD COUNT**

|  |  |  |
| --- | --- | --- |
| **CBC** | **VALUES** | **REFERENCE RANGES** |
| **Hematocrit** | 56 | **Males** 39-49%  **Females** 35-45% |
| **Hemoglobin** | 17,8 | **Males** 13,6-17,5 g/dL  **Females** 12,0-15,5 g/dL |
| **Red blood cells (RBC)** | 7,1 | 4,7-6,1 million/cu mm |
| **Reticulocyte count** | 2,5 | 0,5-1,5% |
| **White blood cell (WBC) count** | 8,200 | 4,800–9,000/cu mm |
| **Neutrophil count** | 61 | 60 -62% |
| Segmented mature neutrophils | 56 | 40-60% |
| Non-segmented neutrophils (band) | 3 | 1-6% |
| Metamyelocytes | 0 | 0% |
| Myelocytes | 0 | 0% |
| **Basophil count** | 0 | 0- 1,0%  10 -120/cu mm |
| **Eosinophil count** | 2 | 1-4%  4- -500 cu mm |
| **Lymphocyte count** | 27 | 25-35%  800 -3,500/cu mm |
| **Monocyte count** | 5 | 3-7%  200-800/cu mm |
| **Platelet count** | 289,000 | 150,000-450,000/cu mm |

**BIOCHEMICAL BLOOD ANALYSIS**

|  |  |  |
| --- | --- | --- |
| **Protein total** | **4,6** | 6,0 – 8,0 g/dL |
| **Albumin** | **2,3** | 3,4 – 4,7 g/dL |
| **Fibrinogen** | **98** | 160 – 450 mgd/L |
| **Prothrombin** | **65** | 80 – 130% |
| **Glycosylated hemoglobin** | **5,2** | 3,9 – 6,9% |
| **Glucose , serum fasting** | **108** | 60 – 110 mg/dL |
| **Triglyceride** | **125** | <165 mg/dL |
| **Cholesterol** | **189** | Desirable: < 200 mg/dL  Borderline: 200–239 mg/dL  High risk: >240 mg/dL |
| **HDL** | **45** | Desirable: > 40 mg/dL in men  >50 mg/dL  in women |
| **LDL** | **107** | <100 mg/dL  Very high risk (has both cardiovascular disease and  diabetes mellitus) >160 mg/dL |
| **Blood urea nitrogen (BUN)** | **34** | 8 – 20 mg/dL |
| **Creatinine** | **2,6** | 0,6-1,2 mg/dL |
| **Bilirubin total** | **2,4** | 0,1 – 1,2 mg/dL |
| **Direct or conjugated bilirubin** | **1,7** | 0,1 - 0,5 mg/dL |
| **Indirect or unconjugated bilirubin** | **0,7** | 0,1 – 0,7 mg/dL |
| **Alanine aminotransferase (ALT)** | **88** | 7-56 IU/L |
| **Aspartate aminotransferase (AST)** | **107** | 0 – 35 IU/L |
| **Creatine kinase (CK), total** | **202** | 32 – 267 UI/L |
| **Creatine kinase MB (CK-MB)** | **8** | <16 IU/L |
| **Troponin I** | **0,001** | <0,05 ng/mL |
| **Myoglobin** | **21** | 0-85 ng/ml |
| **SERCA 2a** | **-** | - |
| **C- reactive protein** | **0,1** | 0 – 0,5 mg/dL |
| **Erythropoietin** | **77,9** | 5,4-31,0 UI/L3 |
| **Na+** | **159** | 135-145 meq/L |
| **K+** | **3,0** | 3,5 – 5,0 mEq/L |

**Question:**

1. **What is the etiological factor of the pathological process?**
2. **Which type of heart failure has patient?**
3. **What the pathophysiological mechanism of these heart failure?**
4. **What are the emergent compensatory mechanisms are attested in this patient?**
5. **What are the pathophysiological mechanisms of breathing changes in this patient?**
6. **What are the pathophysiological mechanisms of heart rate changes in this patient?**
7. **What are the delayed compensatory mechanisms are attested in this patient?**
8. **What is the mechanism of heart hypertrophy?**
9. **What are the changes of complete blood cells count and what are the pathophysiological mechanisms of it?**
10. **What is the mechanism of erythropoietin changes?**
11. **What is the hydro- electrolytic changes in this patient and what are the pathophysiological mechanisms?**
12. **What are the pathophysiological mechanisms of edema?**
13. **What are the mechanism of liver dysfunction?**
14. **What are the clinical and biochemical signs of liver dysfunction?**
15. **What are the intracardiac hemodinamic changes attested in this patient?**

**Clinical case 1**

Patient H. 63 years old. He complains of dyspnea and cough with expectoration for about 10 years, edema of the legs in the region of the talocrural joints. He is a smoker for 35 years.

Objective: cyanotic nails, BP - 160 /60 mm Hg, pulse - 110 /min, RR - 25 /min, prolonged expiratory breathing, "wheezing", inflated chest “barrel chest”, percussion - tympanic sound, Ht – 60%, Hb - 192 gL, WBC – normal, the liver 4 cm below the costal border, dull heart sounds, ECG – deviation of the electrical axis to the right.

Spirometry:

FEV1 - 1.67 L (45% of expected)

FVC - 4.10 L (85% of expected)

FEV1/FVC - 0.41 (expected - 0.77)

RV – 2500 ml

ERV – 800 ml

FRC – 3300 ml

VC – 4400 ml

TLC – 6900 ml,

R-graphy: hyperinflation of the lungs.

**Arterial Blood Gases**

|  |  |
| --- | --- |
|  |  |
| PaO2, mm Hg | 52 |
| HbO2 mm Hg | 80 |
| PaCO2 mm Hg | 67 |
| PH | 7,31 |
| [HCO3-] mMol L | 33 |

1. Which type of respiratory disorders has patient (obstructive or restrictive)?
2. What is etiology of the patient’s disease?
3. What is the role of smoking in this pathology?
4. What changes are attested in the blood of the patients and argument the pathophysiology of them.
5. Which type of dyspnea has this patient and explain the mechanism of it?
6. Explain the mechanisms of hypoxemia and hypercapnia.
7. How is changed BP and what is the pathogenetic mechanisms of these changes?
8. What is pathophysiology of barrel chest?
9. Argument the changes in spirogram.
10. Explain the changes attested in arterial blood gases.

**Clinical case 2.**

Mr. R.I. is a 69-year-old man, who has been referred to the Pulmonary Disease Clinic by his nurse practitioner. He presents with the following chief complaints: “difficulty catching my breath and it is getting worse; a persistent, dry, and hacking cough; and a tight feeling in my chest.” Currently complains of dyspnoea on physical exertion (absent at rest). He is a retired worker of 45 years, who was working in break factory, was making breaks composed some part from asbestos material.

Objective: BP (sitting, both arms) - 131/75 mm Hg; Pulse 69 beats per minute; Respiratory rate - 29 breaths per minute and slightly laboured.

X-Ray of the lungs: interstitial infiltration (fibrosis).

Functional respiratory test:

Vital capacity, 3200 ml

Inspiratory reserve volume, 1700 ml

Expiratory reserve volume, 1000 ml

Tidal volume, 500 ml

Total lung capacity, 4500 ml

FEV1/FVC – 77% (0,77)

**Arterial blood gases:**

|  |  |
| --- | --- |
| Parameters | Physical effort |
| PaO2 | 65 mm HG |
| PaCO2 | 37 mm Hg |
| PH | 7,38 |
| HCO3 | 22 mMol / L |
| % HbO2 | 92% |

1. Which type of respiratory disorders has patient (obstructive or restrictive)?
2. What is etiology of the patient’s disease?
3. What is the pathogenesis of this respiratory disorders?
4. Explain the disturbance of diffusion capacity of the lungs and find the signs related with this.
5. What has patient: hypoxemia, hypercapnia, hypocapnia, hyperoxia and why?
6. What changes are attested of respiratory rate and why?
7. Argument the changes of functional tests.
8. Explain the changes attested in arterial blood gases and what acid-base imbalance is attested in this patient?