Hematology (blood diseases and hematopoietic organs)

Methodical instructions
for 5-6 year students of medical faculties from the preparation for the licensed integrated exam "Step 2"
(based on the booklets "Step 2" in 2018)

МІНІСТЕРСТВО ОХОРОНИ ЗДОРОВ'Я УКРАЇНИ
Харківський національний медичний університет

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Гематологія
(захворювання крові і кровотворних органів)

Методичні вказівки
для студентів 5–6-х курсів медичних факультетів з підготовки до ліцензійного інтегрованого іспиту «Крок 2» (на базі буклетів «Крок 2» 2018 р.)

Затверджено
вченою радою ХНМУ.
Протокол № 3 від 14.03.2019.

Харків
ХНМУ
2019

Hematology (blood diseases and hematopoietic organs) : methodical instructions for 5–6 year students of medical faculties for the licensed integrated exam "Step 2" preparation (based on the booklets "Step 2" in 2018) / compil. T. V. Ascheulova, N. I. Pytetska. – Kharkiv : KhNMU, 2018. – 12 p.

Compilers T. V. Ascheulova
N. I. Pytetska

Гематології» (захворювання крові і кровотворних органів) : метод. вказівки для студентів 5–6-х курсів медичних факультетів з підготовки до ліцензійного інтегрованого іспиту «Крок 2» (на базі буклетів «Крок 2» 2018 р.) / упоряд. Т. В. Ащеулова, Н. І. Питецька. – Харків : ХНМУ, 2018. – 12 с.

Упорядники Т. В. Ащеулова
Н. І. Питецька

These guidelines are prepared for the independent work of the foreign students 5–6 courses of medical faculties for the licensed integrated exam "Step 2" preparation. The guidelines included hematology tests that were selected from the "Step 2" booklet for the 2018 academic year https://www.testcentr.org.ua/banks/med/E02t31_2018U.pdf.

"A"is the correct answer for all tasks. A brief justification and explanation is prepared for each task, according to the tasks and questions of the license integrated examination "Step 2".

Task	An example of solving the task	Literature
32-year-old welder complains of weakness and fever. His illness initially presented as tonsillitis one month earlier. On examination: temperature – 38.9 °C, respirations – 24/min, pulse – 100/min, blood pressure – 100/70 mm Hg, hemorrhages on the legs, enlargement of the lymphnodes. Complete blood counts hows Hb – 70g/L, RBC – 2.2×10^{12}/L,WBC – 3.0×10^{9}/L with 32 % of blasts,1 % of eosinophiles, 3 % of bands, 36 % of segments, 20% of lymphocytes, and 8 % of monocytes, ESR – 47 mm/hour. What is the cause of anemia in this case? *A. Acute leukemia.* *B. Chronic lympholeukemia.* *C. Aplastic anema.* *D. B_{12}-deficient anemia.* *E. Chronic hemolytic anemia*	**Correct answer:** Acute leukemia **Explanation.** Acute leukemia is a heterogeneous group of tumors developing from cells of the hematopoietic tissue with a primary lesion of the bone marrow. The tumor substrate is made up of blast cells that have lost their ability to differentiate. Weakness, shortness of breath, palpitations, hemorrhagic rashes of various nature, fever of the remitting or hectic type, chills, bone pain, headache, nausea, vomiting, cramps, stiff neck, hepato-splenomagaly can be detected depending on the clinical variant (acute lymphocytic leukemia – ALL, acute myelogenous leukemia – AML). Diagnosis of acute leukemia is based on the evaluation of clinical data, the results of blood test, bone marrow, extramedullary tissues. Blood test is characterized by changes in the number and morphology of leukocytes: – the number of leukocytes may be increased (leukemic variant), reduced or normal (aleukemic variant); – a large number of undifferentiated blast cells appears; – hiatus leucemicus can be determined; – there are no eosinophils and basophils; – severe anemia and thrombocytopenia is progressing; – ESR at the beginning of the disease may be in the normal range, later may be increase. Blast metaplasia, reduction of granulocyte, megakaryocytic, and erythroid sprouts are detected in the bone marrow punctate and trephinate of the Ilium. Leukemic cells can infiltrate various organs and sites, including the liver, spleen, lymph nodes, CNS, kidneys, and gonads.	Kovalyova O. Propedeutics to internal medicine, Part 2. / O. Kovalyova, S. Shapovalova, O. Nizhegorodtseva. – Вінниця : Нова книга, 2007. – 264 с. (P. 188)

Task	An example of solving the task	Literature
A 24-year-old patient visited a doctor complaining of enlargement of his submaxillary lymphnodes. Objectively: submaxillary, axillary and inguinal lymph nodes are enlarged. Chest X-rays hows: enlarged lymphnodes of mediastinum. Blood test: erythrocytes – 3.4×10^{12}/L, Hb – 100g/L, blood colour index – 0.88, platelets – 190×10^{9}/L, leucocytes – 7.5×10^{9}/L, eosinophiles – 8 %, bandneutrophiles –2 %, segmented neutrophils – 67 %, lymphocytes – 23 %, ESR – 22 mm/hour. What test must be prescribed to verify the cause of lymphadenopathy? *A. Open biopsy of the lymphnodes* *B. Abdominal US* *C. Mediastinum tomography* *D. Puncture biopsy of the lymphnodes* *E. Sternal puncture*	**Correct answer:** Open biopsy of the lymphnodes **Explanation.** Lymphogranulomatosis (Hodgkin's lymphoma) is a disease of the lymphatic system characterized by development of benign or malignant nodular swellings of lymph nodes in various parts of the body and by the presence of Berezovsky-Sternberg-Reed cells in the lymphoid tissue.This disease usually starts with an increase of lymph nodes but inflammation signs are absent. In 70–75 % of cases it's enlarged cervical or supraclavicular lymph nodes, in 15–20 % – armpit and lymph nodes mediastinum, in 10% – inguinal and lymph nodes of the abdominal cavity, etc. Unlike infectious diseases, enlarged lymph nodes are painless, elastic. Their size does not reduced during antibiotic therapy. Due to the frequent lymphatic lesion in the chest, the first symptoms of the disease may be difficulty breathing or coughing, due to compression of the lungs and bronchi by enlarged lymph nodes. Diagnosis. The main diagnostic criterion is the detection of giant Berezovsky-Sternberg-Reed cells in a biopsy from lymph nodes with subsequent histological verification of the diagnosis.	Kovalyova O. Propedeutics to internal medicine, Part 2. / O. Kovalyova, S. Shapovalova, O. Nizhegorodtseva. – Вінниця : Нова книга, 2007. – 264 с.

A 25-year-old woman complains of fatigue, dizziness, hemorrhagic rashes on the skin. She has been presenting with these signs for a month. Blood test: erythrocytes – 1.0×10^{12}/L, Hb – 37 g/L, colour index – 1.1, leukocytes – 1.2×10^{9}/L, platelets – 42×10^{9}/L. What analysis would be the most advisable for diagnosis-making in this case? *A. Sternal puncture (bone marrow biopsy)* *B. Splenic biopsy* *C. Liver biopsy* *D. Coagulation studies* *E. US of the gastrointestinal tract*	**Correct answer:** Sternal puncture (bone marrow **Explanation.** Aplastic anemia is a disease characterized by significant inhibition of bone marrow hematopoiesis, a maturation of erythroid, myeloid and megakaryocytic elements, and the development of pancytopenia Clinic. The disease manifests general anemic, hemorrhagic syndromes and infectious complications as a result of the defeat of three hematopoiesis sprouts. Diagnosis of aplastic anemia is carried out on the basis of changes in blood test, myelogram and trepanobioptata. The blood test is characterized by pancytopenia: anemia, leukopenia, thrombo-cytopenia. Anemia is more normochromic, at least it is hyperchromic. Erythrocytes are usually normochromic-normocytic, there may be insignificant macrocytosis. Reticulocytes may be a small number or complete absence. The amount of leukocytes is less than 1.5×10^{9}/l, due to granulocytopenia with relative lymphocytosis. In the severe form of aplastic anemia the number of granulocytes is less than 500, the platelet number is less than 20×10^{9}/l, the reticulocytes are less than 0.1 %. In the myelogram – decrease number of cellular elements, both granulocytic and erythrocytic is determined. Megacarocytes are rare or absent. With the progression of the disease there is a bone marrow devastation. There are only isolated bone marrow elements – plasma cells, lymphocytes, erythroblast. In severe cases, hemopoietic elements are replaced by fatty tissue. In trepanobioptata significantly reduced the number of megakaryocytic and myeloid cells, predominant fatty tissue with areas of preserved hemopoiesis.	Kovalyova O. Pro-pedeutics to internal medicine, Part 2. / O. Kovalyova, S. Sha-povalova, O. Nizhego-rodtseva. – Вінниця : Нова книга, 2007. – 264 с.

A 35-year-old man complainsofrapidly incresing fatigue, palpitations, "visualsnow", dizziness. He has a history of peptic ulcer of the stomach. Objectively: the skin is pale. Vesicular respiration is observed in the lungs. Systolic murmuris detected over the cardiac apex, heart rateis 100/min, BP is 100/70 mm Hg. The epigastrium is slightly tender on palpation. Blood test: erythrocytes – 3.2×10^{12}/L, Hb – 100 g/L, color index – 0.94. What type of anemia is the most likely present in this case? *A. Posthemorrhagic anemia* *B. Sideroblastic anemia* *C. Iron-deficiency anemia* *D. Hemolytic anemia* *E. Hypoplastic anemia*	**Correct answer:** Posthemorrhagic anemia **Explanation.** Posthemorrhagic anemia (PHA) is a complex of clinical and hematological changes as a result of acute or chronic blood loss. Acute PGA is a result of a single rapid massive blood loss. Violations are due to a decrease of circulating blood volume and hypoxia. Causes: mechanical damage of large blood vessels or cavities walls of the heart in various injuries and surgical operations, rupture of the heart chambers walls in the area of infarction, rupture of aortic aneurysm and pulmonary artery branches, rupture of the spleen, peptic ulcer and 12 duodenal ulcer, profuse uterine bleeding. Chronic PHA is the result of repeated small blood loss. The pathogenesis is iron deficient. Causes: gastrointestinal, hemorrhoidal, renal, nasal bleeding, disorders of blood coagulation mechanisms, tumor processes. Clinical characteristics of PHA: pale skin, weakness, shortness of breath, palpitations, pain in the region of the heart, dizziness, arterial hypotension, systolic murmur at all points, but most intense at the apex and projection point of the pulmonary artery. In severe cases, a lethargy, filamentous pulse, shock, loss of consciousness are detected. Diagnostics of PHA includes complaints, a history of illness and life, physical data (general examination, auscultation of the heart, palpation and percussion of the abdomen, pulse and blood pressure measurement) and laboratory tests (hematocrit, Hb, and erythrocytes to assess the severity of blood loss). To establish the source of bleeding conduct instrumental studies based on the alleged cause.	Kovalyova O. Propedeutics to internal medicine, Part 2. / O. Kovalyova, S. Shapovalova, O. Nizhegorodtseva. – Вінниця : Нова книга, 2007. – 264 с. (P. 172).

A 57-year-old woman complains of weakness, dyspnea, loss of appetite, and liquid feces. She has been suffering from this condition for 2 years. Objectively she presents with pale skin, subicteric sclera, and bright-red fissured tongue. Lymphnodes are not enlarged. Pulse – 100/min. BP – 105/70 mm Hg. Liver – +3 cm, the spleen can not be palpated. Blood test: erythrocytes – 1.2×10^{12}/L, Hb – 56 g/L, color index – 1.4, macrocytes, leukocytes – $2,5\times10^{9}$/L, eosinophils – 1 %, juvenile – 1 %, metamyelocytes – 1 %, band neutrophils – 8 %, segmented neutrophils – 47 %, lymphocytes – 38 %, monocytes – 4 %, reticulocytes – 0.1 %, platelets – 100×10^{9}/L, ESR – 30 mm/hour, indirect bilirubin – 26 mmol/L. What changes can be expected in the bone marrow punctur ematerial? *A. Prevalence of megaloblasts* *B. Increased number of sideroblasts* *C. Erythroidhyperplasia* *D. Presence of blast cells* *E. Prevalence of lymphoid tissue*	**Correct answer:** Prevalence of megaloblasts. **Explanation.** Megaloblastic anemia occurs as a result of the disruption of the erythrocyte maturation process, due to the disruption of RNA and DNA synthesis in the cell (in conditions of vitamin B_{12} and B_9 deficiency) and is accompanied by a large number of modified erythrocyte precursors in the bone marrow. Causes: insufficient food intake (vegetarianism, fasting), impaired intestinal adsorption (chronic gastritis A, partial or complete removal of the stomach, Zollinger-Ellison syndrome, enteropathy, small bowel resection, Crohn's disease), increased need for vitamin B_9 (breastfeeding, pregnancy), systemic diseases of the liver and pancreas. Clinical characteristics. There are three syndromes: anemic (weakness, palpitations, headaches, dizziness, shortness of breath, jaundice of the sclera, puffiness of the face); defeat of the digestive system (loss of appetite, abdominal pain, intermittent constipation and diarrhea, increased in size lacquered bright red tongue with ulcerations and aphthous changes, in 50 % of patients increase of the liver); neurological (characterized by development of the funicular myelosis of the lateral and/or posterior columns of the spinal cord). Diagnosis is based on the clinical triad. In the blood test: decrease of hemoglobin and red blood cells level, increase color index above 1.1, thrombo- and leukopenia, megaloblasts and macrocytes. Anisocytosis (changing cell size) and poikilocytosis (changing their shape) are characterized. Kebbot's rings, Jolly's calf, reticulocytopenia can be determined. In blood serum, a decrease of vitamins B_9 and/or B_{12} level, an increase of the free bilirubin level (as a result of the red blood cells hemolysis). In bone marrow punctate – megaloblasts.	Kovalyova O. Propedeutics to internal medicine, Part 2. / O. Kovalyova, S. Shapovalova, O. Nizhegorodtseva. – Вінниця : Нова книга, 2007. – 264 c. (P. 174).

A 28-year-old woman complains of skin hemorrhages after minor traumas and spontaneous appearance of hemorrhages on the front of her torso and extremities. On examination: the skin is variegated (old and new hemorrhages), bleeding gums. Blood platelets – 20×10^9/L; in the bone marrow there is increased number of megakaryocytes and no platelet production. Treatment with steroid hormones was effective. What is the likely diagnosis? *A. Idiopathic thrombocytopenic purpura* *B. Hemophilia* *C. Rendu-Osler-Weber disease (Hereditary hemorrhagic telangiectasia)* *D. Disseminated intravascular coagulation* *E. Acute vascular purpura*	**Correct answer:** Idiopathic thrombocytopenic purpura. **Explanation.** Autoimmune thrombocytopenic purpura is characterized as acute or chronic hemorrhagic diathesis with isolated platelet deficiency and microcirculatory type of bleeding. The disease is caused by enhanced and accelerated destruction of platelets due to the action of autoantibodies directed against its own platelets. Chronic forms of autoimmune thrombocytopenia (more than 6 months), the cause of autoaggression in which it is not possible to figure out is called idiopathic thrombocytopenic purpura (ITP). ITP trigger factors: infections (usually viral), pregnancy, stress, surgical manipulations, exercise and vaccinations. Clinical manifestations depend on the degree of thrombocytopenia: single or generalized petechial rash and ecchymosis, petechia and ecchymosis on the mucous membranes, nasal and gingival bleeding, meno- and metrorrhagia, less often of gastrointestinal bleeding and hematuria. Hemorrhages occur spontaneously (mostly at night) or as a result of minor bruises, compression. They are asymmetrical, somewhat more often located on the limbs and the front surface of the body, as well as on the forehead and at the injection sites. Diagnostics. Evaluation of complaints, anamnesis, clinical manifestations, positive results of tests on the resistance of capillaries (tourniquet, pinch). Evaluation of changes in laboratory parameters: a decrease of the platelets number in the blood test – less than 100×10^9/l (in the case of heavy blood loss, signs of posthemorrhagic anemia and reticulocytosis are detected). In the bone marrow normal or increased content of megakaryocytes (or decrease with long-term ongoing crises). Corticosteroids are standard first-line treatment in patients with primary diagnosed ITP.	Kovalyova O. Propedeutics to internal medicine, Part 2. / O. Kovalyova, S. Shapovalova, O. Nizhegorodtseva. – Вінниця : Нова книга, 2007. – 264 c. (P. 200).

A 38-year-old patient has been delivered by an ambulance to a surgical department with complaints of general weakness, in disposition, black stool. On examination the patient is pale, there are dotted hemorrhages on the skin of his torso and extremities. On digital investigation there are black feces on the glove. Bloodtest: Hb-108g/L, thrombocytopenia. Anamnesis states that similar condition was observed 1 year ago. Make the diagnosis: *A. Thrombocytopenic purpura* *B. Hemophilia* *C. Bleeding from an ulcer* *D. Rectal tumor* *E. Nonspecific ulcerative colitis*	**Correct answer:** Thrombocytopenic purpura. **Explanation.** Autoimmune thrombocytopenic purpura is characterized as acute or chronic hemorrhagic diathesis with isolated platelet deficiency and microcirculatory type of bleeding. The disease is caused by enhanced and accelerated destruction of platelets due to the action of autoantibodies directed against its own platelets. Chronic forms of autoimmune thrombocytopenia (more than 6 months), the cause of autoaggression in which it is not possible to figure out is called idiopathic thrombocytepenic purpura (ITP). ITP trigger factors: infections (usually viral), pregnancy, stress, surgical manipulations, exercise, vaccinations. Clinical manifestations depend on the degree of thrombocytopenia: single or generalized petechial rash and ecchymosis, petechia and ecchymosis on the mucous membranes, nasal and gingival bleeding, meno- and metrorrhagia, less often of gastrointestinal bleeding and hematuria. Hemorrhages occur spontaneously (mostly at night) or as a result of minor bruises, compression. They are asymmetrical, somewhat more often located on the limbs and the front surface of the body, as well as on the forehead and at the injection sites. Diagnostics. Evaluation of complaints, anamnesis, clinical manifestations, positive results of tests on the resistance of capillaries (tourniquet, pinch). Evaluation of changes in laboratory parameters: a decrease of the platelets number in the blood test – less than 100×10^9/l (in the case of heavy blood loss, signs of posthemorrhagic anemia and reticulocytosis are detected). In the bone marrow normal or increased content of megakaryocytes (or decrease with long-term ongoing crises). Corticosteroids are standard first-line treatment in patients with primary diagnosed ITP.	Kovalyova O. Propedeutics to internal medicine, Part 2. / O. Kovalyova, S. Shapovalova, O. Nizhegorodtseva – Вінниця : Нова книга, 2007. – 264 c. (P. 200).

A 5-year-old child has body temperature risen up to febrile numbers, suffers from inertness, weakness. Examination revealed hemorrhage on the skin of limbs and torso. Enlargement of cervical and axillary lymph nodes can be detected. The liver is 4 cm below the costal arch; the spleen is 6cm below the costal arch. Blood test: erythrocytes – 2.3×10^{12}/L, Hb – 60 g/L, platelets – 40×10^{9}/L, leukocytes – 32.8×10^{9}/L, eosinophiles – 1 %, band neutrophils – 1 %, segmentedneutrophiles – 12 %, lymphocytes – 46 %, monocytes –1 %, blasts – 40 %, Duke's bleeding time test resultis 9 min. What examination is necessary to make the diagnosis? *A. Myelogram (bone marrow biopsy)* *B. Lymphnodes biopsy* *C. Abdominal US* *D. Detection of hepatitis markers* *E. Analys is of dynamic platelet function*	**Correct answer:** Myelogram (bone marrow biopsy) **Explanation.** Acute leukemia is a heterogeneous group of tumors developing from cells of the hematopoietic tissue with a primary lesion of the bone marrow. The tumor substrate is made up of blast cells that have lost their ability to differentiate. Weakness, shortness of breath, palpitations, hemorrhagic rashes of various nature, fever of the remitting or hectic type, chills, bone pain, headache, nausea, vomiting, cramps, stiff neck, hepato-splenomagaly can be detected depending on the clinical variant (acute lymphocytic leukemia – ALL, acute myelogenous leukemia – AML). Diagnosis of acute leukemia is based on the evaluation of clinical data, the results of blood test, bone marrow, extramedullary tissues. Blood test is characterized by changes in the number and morphology of leukocytes: – the number of leukocytes may be increased (leukemic variant), reduced or normal (aleukemic variant); – a large number of undifferentiated blast cells appears; – hiatus leucemicus can be determined; – there are no eosinophils and basophils; – severe anemia and thrombocytopenia is progressing; – ESR at the beginning of the disease may be in the normal range, later may be increase. Blast metaplasia, reduction of granulocyte, megakaryocytic, and erythroid sprouts are detected in the bone marrow punctate and trephinate of the Ilium. Leukemic cells can infiltrate various organs and sites, including the liver, spleen, lymph nodes, CNS, kidneys, and gonads.	Kovalyova O. Propedeutics to internal medicine, Part 2. / O. Kovalyova, S. Shapovalova, O. Nizhegorodtseva. – Вінниця : Нова книга, 2007. – 264 c. (P. 194).

A 35-year-old man complains of persisting enlargement of his peripheral lymphnodes that cause him nodis comfort. The case history states that the first lymphnodes to enlarge were cervical, supraclavicular, and axillary; new groups of lymph nodes emerged. Objectively: the lymph nodes are soft and elastic on palpation, enlarged, painless, not fixed to the surrounding tissue. What examination method would be the most informative for early diagnostics off his disease? *A. Needle biopsy* *B. Magnetic resonance tomography* *C. Radioisotope scanning of the skeleton* *D. Ultrasound* *E. X-ray*	**Correct answer:** Needle biopsy **Explanation.** Lymphogranulomatosis (Hodgkin's lymphoma) is a disease of the lymphatic system characterized by development of benign or malignant nodular swellings of lymph nodes in various parts of the body and by the presence of Berezovsky-Sternberg-Reed cells in the lymphoid tissue. This disease usually starts with an increase of lymph nodes but inflammation signs are absent. In 70–75 % of cases it's enlarged cervical or supraclavicular lymph nodes, in 15–20 % – armpit and lymph nodes mediastinum, in 10 % – inguinal and lymph nodes of the abdominal cavity, etc. Unlike infectious diseases, enlarged lymph nodes are painless, elastic. Their size does not reduced during antibiotic therapy. Due to the frequent lymphatic lesion in the chest, the first symptoms of the disease may be difficulty breathing or coughing, due to compression of the lungs and bronchi by enlarged lymph nodes. Diagnosis. The main diagnostic criterion is the detection of giant Berezovsky-Sternberg-Reed cells in a biopsy from lymph nodes with subsequent histological verification of the diagnosis.	Kovalyova O. Propedeutics to internal medicine, Part 2. / O. Kovalyova, S. Shapovalova, O. Nizhegorodtseva. – Вінниця : Нова книга, 2007. – 264 c.

Навчальне видання

Гематологія (захворювання крові і кровотворних органів)

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Упорядники Ащеулова Тетяна Вадимівна
Питецька Наталя Іванівна

Відповідальний за випуск Т. В. Ащеулова

Комп'ютерна верстка О. Ю. Лавриненко

Формат А5. Ум. друк. арк. 0,8. Зам. № 19-33715.

Редакційно-видавничий відділ
ХНМУ, пр. Науки, 4, м. Харків, 61022
izdatknmurio@gmail.com

Свідоцтво про внесення суб'єкта видавничої справи до Державного реєстру видавництв, виготівників і розповсюджувачів видавничої продукції серії ДК № 3242 від 18.07.2008 р.