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Blood

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Abstract. this article discusses the creation of blood, general and special properties, the chemical composition of blood, blood plasma proteins, blood plasma enzymes, blood plasma minerals, blood cells and post-cellular elements, blood coagulation system, hemocoagulation, antigens, blood coagulation systems, hemogram.

Keywords: hematology, hemopoiesis, red bone marrow, jaundice bag, hemogram, myelogram, hematocrit index, homeostasis, immunity, porphyria, thalassemia, hemocoagulation, A, B, C hemophilias

Hematology is the science of blood. Blood is a mobile connective tissue that constantly changes its composition. The change in blood composition is not irregular, but occurs in accordance with a certain functional state of the body. As I.A. Kassirsky said, "Blood is the mirror of the body, and all kinds of changes in organs and tissues are reflected in it." Blood consists of 2 parts liquid intercellular substance - plasma and cellular and post-cellular elements located in it. The ratio of plasma and form elements in a healthy person is 55:45, and this is called the Hematocrit index. Blood makes up approximately 7% of the body weight in an adult organism and is on average 5-5.5 liters.

Functions of blood:

- Transports gases during respiration. It transports oxygen from the lungs to the tissues, and carbon dioxide from the tissues to the lungs.
- Its trophic function includes transporting nutrients to organs and tissues.
- The excretory function removes the last products of metabolism from the tissues: uric acid, uric acid, and substances separated from the body by the excretory organs.
- Due to its communicative function, the blood ensures the transport of hormones from the place of formation to the target organs.
- As a thermoregulator, blood performs the correct distribution of thermal energy in the body.
- The blood keeps various buffer systems in its composition, and thanks to them, the acid-alkaline balance is normal.
- Blood protects the body from external and internal factors with the help of specific and non-specific immune system.
- Blood keeps the relative stability of the internal environment of the body - homeostasis.
- If the freshly collected blood is placed at room temperature, after a certain time a blood clot (thrombus) is formed and a yellow liquid - blood serum - is separated. The difference between serum and plasma is the absence of fibrinogen and some proteins of the blood coagulation system. Blood plasma 55%, blood cells (leukocytes) 44%, post-cellular elements (erythrocytes, platelets) 1%

Biochemical composition of blood plasma:	
Water	90-91%
Carbohydrates	4.22-5.6 mmol/l
Lipids:	
Total lipids	4-8 g/l
Total cholesterol	5.2 mmol/l
Free fatty acids	400-800 mkmol/l
Proteins:	
Total proteins	70-90 g/l = 7%
Albumins	54-62%
Globulins	33.5-43.5%
Low molecular weight organic compounds	
Lactate	0.99-1.75 mmol/l
Creatinine	50-115 mkmol/l
Urine	2.5-6.4 mmol/l
Uric acid	214-458 mkmol/l (men)
	149-404 mkmol/l (women)
Amino acids	48-68 mg/l
Total bilirubin	8.5-20.5 mkmol/l
Minerals	0.9%
Sodium	135-152 mkmol/l
Potassium	3.6-6.3 mmol/l
Calcium	2.2-2.75 mmol/l
Iron	8.95-28.65 mkmol/l (men)
	7.16-26.85 mkmol/l (women)
Chlorides	95-110 mmol/l

We divide enzymes present in blood plasma into 3 main groups.

1. Secretary. They are produced in the liver, vascular endothelium, and intestines. M: thrombin, plasmin.

2. Tissue or indicator enzymes. They bleed when cell wall permeability increases or tissue cells die. When certain tissue cells die, its enzymes enter the blood. through this the disease can be diagnosed.

M: in hepetite: alanine aminotransferase, ornithine carbomoyltransferase.

In infarction: aspartate aminotransferase, lactate dehydrogenase, creatine kinase.

In pancreatitis: the activity of trypsin, amylase and lipase increases.

3. Glands of the stomach-intestinal system. These include enzymes synthesized by the liver, pancreas, and salivary glands, and when these glands are damaged, these enzymes are found in the blood. The pH of the plasma environment is neutral, equal to 7.3-7.4 under normal physiological conditions. Its consistency is maintained thanks to buffer systems.

Formed elements of blood include cells (leukocytes) and cellular elements (erythrocytes and thrombocytes).

Erythrocytes: the most numerous shaped element of blood. There are 4-6 million in 1 ml of blood. It can reach 6.5 million in babies and people over 60 years old. An adult has an average of 25 trillion erythrocytes. Erythrocytes are in the form of a 2-sided concave disc and appear as a rounded circle on smear. Discocytes are the most abundant (80%), spherical (spherocytes), dome-shaped (stomatocytes), and thorn-like growths (echinocytes) are found in small amounts. In some diseases, irregularly shaped erythrocytes (oval, pear-shaped, sickle-shaped) are found.

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Erythrocytes consist of 60% water and 40% dry matter. Hemoglobin makes up 95% of dry matter. Erythrocytes are the main elements that transport gases. Erythrocytes live on average 90-120 days. 0.5-1.5% of total erythrocytes or 200-250 million die in 1 day. Their breakdown decreases in reticulo-endothelial cells. A mature erythrocyte does not have a nucleus, ribosome, mitochondria, or lysosomes. Normally, protein biosynthesis reaction does not occur in mature erythrocytes. Energy is produced only through glycolysis, the substrate is only glucose. Hemoglobin is the main protein of erythrocytes. Normal forms of hemoglobin:

HbR - primitive hemoglobin, which is found in 7-12 weeks of embryonic life.

HbF - fetal hemoglobin, it appears after 12 weeks of embryonic life and is considered the main after 3 months.

HbA is 98% of adult hemoglobin. appears after the 3rd month of fetal life and makes up 80% of the total hemoglobin by the time of birth.

HbA2- is 2% of adult hemoglobin.

HbO2- oxyhemoglobin is formed as a result of connection with oxygen in the lungs. Pulmonary veins store 94-98% of total hemoglobin.

HbCO2-carbohemoglobin is formed as a result of binding with carbon dioxide in tissues. Venous blood makes up 15-20% of the total amount of hemoglobin.

Pathological forms of hemoglobin:

HbS- sickle cell anemia hemoglobin.

MetHb-methemoglobin, a form of hemoglobin in which a 3-valent ion is inserted instead of a 2-valent iron ion. This is because hemoglobin has the property of attaching oxygen to itself. Therefore, tissue hypoxia occurs in a person with such hemoglobin. In the clinic, ascorbic acid or methyl blue is used to restore iron ions.

Hb-CO-carboxyhemoglobin is formed when there is carbon dioxide in the inhaled air.

HbA1S-glycosylated hemoglobin, its concentration increases in chronic hyperglycemia and is considered a good screening indicator of blood glucose levels for a long period of time.

Hemoglobin synthesis is disturbed as a result of genetic copies of enzymes involved in heme synthesis. This is caused by the accumulation of protoporphyrin precursors in the body, and this disease is called porphyria. In such patients, the urine is red. The skin is very sensitive to sunlight.

For thalassemia, a decrease in the synthesis of the alpha chain or beta chain of hemoglobin is characteristic. This leads to a violation of erythropoiesis, hemolysis and acute anemia.

The total amount of hemoglobin in the blood is 16 g/l.

Leukocytes: Leukos means whiteness. All leukocytes are divided into granulocytes (granular) and agronullocytes (non-granular) depending on the size of their cytoplasm. Granulocytes include neutrophils, eosinophils, and basophils. Agronocytes include lymphocytes and monocytes. Under normal physiological conditions, leukocytes are 3800-9000 in 1 ml of blood. Leukocytes perform trophic and protective functions. Ingestion of foreign particles produces special proteins (antibodies) against them, affects foreign cells and kills them.

Platelets: blood cells without a nucleus. Nucleated platelets are found in the blood of amphibians and birds and are called Recklenhausen cells. Normally there are 200,000-300,000 units in 1 ml of blood. The main function of platelets is to coagulate blood and repair damaged vessel walls.

Hemophilia is a recessive mutation on the A-X chromosome. It does not contain VIII (antihemophilic factor). This is the most common form of hemophilia, occurring in 80-85% of cases.

Hemophilia B is a recessive mutation on the X chromosome. In this case, there is no IX (Christmas factor) and coagulation plugs are formed.

Hemophilia C is an autosomal recessive or dominant disease with incomplete expression of heredity (penetration). This type of hemophilia occurs in both men and women. It lacks factor IX. This type of hemophilia is most common among Ashkenazi Jews (Central European Jews). In a physiological state, platelets do not stick to the vascular endothelium of a healthy person, so blood clots do not form inside the blood vessels of a healthy person. In atherosclerosis, the vascular endothelium is damaged and platelets stick to it, causing thrombosis. Thrombosis of heart and brain vessels is dangerous and causes myocardial infarction and stroke. With irritation of the sympathetic nervous system, with active physical work, with removal of the spleen, platelets increase, because platelets are mainly destroyed in the spleen.

Hemogram - includes the quantitative ratio of blood-forming elements, hemoglobin amount, erythrocyte

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sedimentation rate, etc. The ratio of different leukocytes in % amount is called leukocyte formula or Schilling formula. According to the currently adopted standard of WHO:

leukocytes 3800-9000 in 1 ml of blood,

neutrophils 65-70%

eosinophils 2-5%

basophils 0.5-1%

lymphocytes 20-35%

monocytes make up 6-8%.

Hematopoiesis. In the human fetus, blood is initially formed in the yolk sac. The formation of a blood cell can be expressed schematically as follows: stem cell - megaloblast - megalocyte. In the 4-5th week of embryonic development, the yolk sac atrophies and its blood-forming function is lost. It is from this time that the period of special embryonic blood formation begins. Erythrocytes and leukocytes are formed from the liver, spleen, salivary gland, red bone marrow, lymph nodes, and worm-like tumors of the cecum. In an adult organism, the red bone marrow, spleen, lymph nodes, salivary gland, and goiter are included in the blood-forming organs. Normally, the red bone marrow makes blood, but when a lot of blood is lost, the yellow marrow also becomes a blood-forming organ, and the lost blood cells are replaced. All blood cells are formed from blood stem cells. The existence of blood stem cells was proved by Canadian scientists McKulloch and Tillar in 1960. Hemopoiesis has erythrocytopoiesis, granulocytopoiesis, lymphocytopoiesis, monocytopoiesis, thrombocytopoiesis. Hematopoiesis is controlled by growth factors, transcription factors, vitamins and hormones. Iron, vitamin B12, folic acid, and proteins are needed for blood formation. Lack of these factors leads to hemopoiesis disorders. Myelogram is a representation of cell elements in bone marrow in % ratio. In medical practice, it is necessary to examine the bone marrow in the diagnosis and treatment of various blood diseases. Bone marrow is extracted from the sternum by puncturing it with a special needle.

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