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Blood Pathology

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Abstract:

This article describeschange the total amount of blood, hypervolemia, hypovolemia, normovolemia, their types and mechanism of formation, types of blood transfusion, blood transfusion shock, changes in the biochemical sotava and physico-chemical properties of blood

Introduction

Under conditions of pathology on the part of the blood system, there are various combinations of changes in circulating blood volume and the relationship between the formed elements and plasma, quantitative and qualitative changes in blood cells, blood formation and blood destruction disorders.

Changes in the volume of circulating blood and the ratio between the formed elements and plasma. The total amount of blood in an adult animal is 8–14% of body weight, and the volume of circulating blood (BCC) is 55–57%. The rest of the blood is in the depot. The ratio of the volume of formed elements to the total blood volume is characterized by a hematocrit number (indicator), which ranges from 36–48% (according to the SI system - 0.36–0.48).

Normovolemia is a term for the normal amount of blood in the body. However, three options are possible for this condition: 1) ordinary (or simple) normolemia, when the hematocrit value is normal, 2) polycythemic normolemia - the volume of the formed elements is increased while the plasma volume is reduced and the hematocrit value is 45%. In this form, thickening of the blood is noted, the viscosity increases, hemodynamics slows down, 3) oligocythemic normovolemia - the volume of the formed elements is reduced, the plasma is increased and, accordingly, the hematocrit index falls below 35%.

Hypervolemia - an increase in circulating blood volume. It also distinguishes simple (or ordinary) hypervolemia, in which an increase in circulating blood volume is not accompanied by a change in the hematocrit index. It is observed as a temporary phenomenon during the transfusion of a large amount of whole blood, as well as during intensive physical work as a result of admission to the bloodstream of the deposited blood.

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Among the qualitative pathologies of erythrocytes, there are: changes in the content of hemoglobin in them, the appearance of immature forms of erythrocytes, representing individual stages of their development, or atypical erythrocytes (a sign of bone marrow dysfunction).

From the quantitative changes in the composition of red blood are known: an increase in the content of red blood cells - polycythemia, or polyglobulia, and a decrease in their total number - oligocythemia, or anemia.

An increase in the number of erythrocytes - erythrocytosis is sometimes accompanied by a number of diseases or pathological conditions. There are absolute and relative erythrocytosis.

Absolute erythrocytosis occurs as a result of activation of erythropoiesis. The cause of it most often are various forms of hypoxia. For example, in the pathology of the lungs (emphysema, tuberculosis), lack of oxygen in the environment (in the mountains), heart failure, these erythrocytosis are compensatory in nature.

Activation of erythropoiesis during hypoxia is due to the accumulation of humoral stimulants - erythropoietins, which are produced by the juxtaglomerular apparatus of the kidneys. Erythropoietins are also found in saliva and in gastric juice in anemic dogs. In renal tumors, hyperproduction of erythropoietin occurs and absolute erythrocytosis is found. It can also occur with endocrinopathy as a result of impaired neuro-endocrine regulation of blood formation. For example, erythrocytosis (absolute) is noted in hypothalamus, pituitary, adrenal tumors (since ACTH and glucocorticoids stimulate erythropoiesis).

Erythropenia is a decrease in the number of erythrocytes per unit volume of blood relative to their normal content, typical of animals of each species. Erythropenia is not an independent disease, it reflects the processes occurring in the blood-forming organs and circulating blood. Reducing the number of red blood cells is always accompanied by hypohemoglobinemia.

Anemia is a complex symptom complex that is observed in various diseases and develops as a result of exposure to harmful factors either on the hematopoietic organs or directly on peripheral blood. Due to the fact that the body constantly occurs, on the one hand, intensive formation of red blood cells, and on the other hand, their disintegration, we can speak of anemia as a condition characterized by an imbalance of red blood cells, i.e. the discrepancy between the pace and intensity of education and the intensity and rate of their decay.

The life span of red blood cells averages 120 days.

The history of hematology knows a large number of the most diverse classifications of anemias, but in the end, most hematologists concluded that it is advisable to use a pathogenetic classification. According to this classification, anemia is divided into hemolytic, post-hemorrhagic and due to impaired blood formation.

All anemias are characterized not only by a decrease in the total hemoglobin content in the blood and the number of red blood cells, but also by the appearance of the pathological forms of the latter that are unusual for normal blood. These qualitative changes in erythrocytes are very diverse and relate to their size, shape, structure, as well as the relationship to various paints. These are mainly the following changes:

Hypochromic erythrocytes, hyperchromic erythrocytes, anisocytosis, poikilocytosis forms.

With areal regenerative anemia, a red bone marrow is reborn and turns into yellow; reticulocytes disappear from the blood. Such anemias are inherent in severe forms of equine infectious anemia, tuberculosis (cavernous form), some severe toxicoses, and chronic bleeding.

The most common are regenerative anemia, accompanied by regenerative processes in the blood-forming organs, and much less often regenerative anemia, in which the bone marrow has lost the ability to produce and release into the bloodstream young forms of erythrocytes.

Post-hemorrhagic anemias (acute and chronic) occur due to blood loss as a result of external injuries (injuries) or during bleeding of internal organs (usually gastrointestinal bleeding, bleeding into the abdominal cavity, renal, pulmonary, uterine bleeding).

Anemias due to impaired blood formation resulting from defects in erythropoiesis processes. Among such anemias, there should be noted deficit anemias resulting from the lack of substances necessary for the implementation of normal erythropoiesis: microelements (iron, cobalt), vitamins (B2, B6, B12, folic acid) and protein.

Hypo-and aplastic anemias are a very heterogeneous group of erythropoiesis disorders. The basis of the pathogenesis is the reduction of the proliferative activity and differentiation of the partially named stem cell - CFU-GEMM) or its descendants.

Aplastic anemia can be the result of direct chemical damage to erythroid cells of chemical and medicinal substances (benzene, mercury vapor, dyes, sulfonamides, antibiotics, cytostatic drugs, as well as arsenic, bismuth, etc.), ionizing radiation, with a number of infections and autoimmune pathology .

Hemolytic anemia - anemia as a result of increased blood destruction. They are characterized by a reduction in the life span of red blood cells. This may be due to two reasons: 1 - with the effect on erythrocytes of external factors that either directly damage cells or alter their properties in such a way that erythrocytes quickly deteriorate (acquired hemolytic anemia). 2 - with hereditary defects of erythrocytes (hereditary hemolytic anemia).

Infectious anemia of horses, which is also found in other monocultures (mules, donkeys, mules), is caused by a filtering virus and is characterized by lesions of the blood-forming organs, a change in the pattern of peripheral blood, a prolonged fever, and often depletion of the animal. Red blood cells are significantly reduced in quantity and change morphologically. Most researchers recognize that the virus of infectious anemia is hemotropic: it destroys red blood cells, the decay products of which are perceived by the cells of the reticuloendothelial system, and, moreover, leads to hypofunction of the bone marrow, reducing red blood cell production.

Erythrocytosis - an increase in the content of erythrocytes in peripheral blood. Erythrocytosis is relative and absolute.

Relative erythrocytosis is not associated with activation of hemopoiesis, but with thickening of the blood as a result of loss of large amounts of fluid (uncontrollable vomiting, diarrhea, excessive sweating, etc.), or with an increase in the mass of circulating erythrocytes due to their release from the depot organs.

Absolute erythrocytosis - can occur with the introduction of an additional number of erythrocytes from the outside (blood transfusion or erythrocyte mass) and with the activation of erythropoiesis. The latter takes place with increased production of erythropoiesis stimulator - erythropoietin or increased formation of erythrocyte breakdown products. Absolute erythrocytosis occurs in erythremia (true polycythemia or Vaquez disease) - a tumor whose main substrate is erythroid cells. A pronounced erythrocytosis in the absence of erythropoietin in the blood can serve as a differential sign in such patients

Leukocytosis, leukopenia.

Leukocytes. The white blood system is fundamentally different from the red blood system. If erythrocytes are blood cells, where they spend most of their life and perform all their functions, then leukocytes are tissue cells. In special cytomorphological studies of various organs and tissues, it was found that the number of granulocytes in tissues is tens and hundreds of times higher than their number in circulating blood. Thus, in their functional activity, granulocytes are not blood cells, but cells of tissues and belonging to blood cells are obliged only by their origin. Peripheral blood is

considered as a transporter for organs and tissues. The life of granulocytes is 6–12 days, while their time in circulating blood does not exceed 2-3 hours.

Since leukocytes are tissue cells, many processes are accompanied by increased migration into the tissues of leukocytes and their increased entry into the peripheral blood from the depot or bone marrow.

As in the case of red blood cells, the imbalance between the formation and elimination of leukocytes from the body leads either to an increase or decrease in their concentration in the peripheral blood. The increase in the index is called leukocytosis. Leukocytosis can develop in both physiological conditions and in various pathological conditions. The first group of leukocytosis includes;

1. Leukocytosis of newborns (first two weeks of life).

2. Digestive - 2–3 hours after feeding with monogastric animals. It can be called re-distribution. In ruminants is not observed.

3. Myogenic - with intensive muscular work (redistributive).

4. Leukocytosis in pregnancy

If the increase in the number of leukocytes is achieved by leaving them from the depot and is not associated with the activation of bone marrow hematopoiesis, they are talking about redistributive leukocytosis. If the number of leukocytes in peripheral blood is increased mainly due to bone marrow production, they speak about true leukocytosis. Since leukocytes are a very heterogeneous population, an increase in their number in the blood can be associated with different cells. In particular, leukocytosis in infections, purulent diseases is determined by neutrophils, in allergic and parasitic diseases - by eosinophils, and in chronic infections - such as tuberculosis - by lymphocytes, in protozoal diseases (infectious mononucleosis).

These types of leukocytosis are often called pathological leukocytosis, which is wrong, since in this case leukocytosis is a protective reaction, and a protective reaction cannot be pathological as long as it is adequate to the stimulus. Therefore, it is correct to call them leukocytosis in pathological conditions.

We can talk about pathological leukocytosis only when, in response to a stimulus, the body responds with an ultra-large increase in the number of leukocytes in peripheral blood. This condition can be observed in the so-called leukemoid reactions.

Leukemoid reactions are characterized by a significant increase in the number of leukocytes in the blood with the advent of a large number of young forms (the appearance of myeloid forms, monocytic and lymphatic cells). Pathological forms of leukocytes are divided into regenerative, found normally in the bone marrow, and degenerative, i.e. destructively modified. Signs of degeneration include: 1) toxogenic granularity in the cytoplasm of neutrophils due to coagulation under the action of an infectious or toxic agent of proteins, 2) vacuolation of the cytoplasm and nucleus as a result of fatty cell degeneration (for example, radiation sickness, abscess, severe forms of sepsis), 3) hypochromatosis is the loss of the ability of the nucleus to stain normally, 4) karyolysis or karyorrhexis (disintegration into separate fragments) of the nucleus, 5) hypersegmentation of the nucleus (stimulation of the granulocytic germ, radiation sickness, 6) fragmentation I ep.

Pathological leukocytosis can manifest itself predominantly by an increase in any one type of white blood cell. In accordance with this, neutrophilic, eosinophilic, basophilic leukocytosis, lymphocytosis and monocytosis are distinguished.

Neutrophilic leukocytosis (neutrophilia) is observed in many acute infectious diseases. The blood increases the content of stab and also young neutrophils, sometimes myelocytes appear. The buildup in the leukocyte formula of young neutrophils is called the nuclear left shift. The appearance in the peripheral blood of young people, an increase in the number of stab-nuclei with an increased total number of leukocytes indicate an increased activity of the bone marrow. Such changes in the composition of leukocytes are called the regenerative shift.

If the total number of leukocytes in the blood decreases with an increase in the number of stabs, they are said to have a degenerative shift, the presence of which is a reflection of the inhibition

of bone marrow function. If the shift to the left is combined with degenerative changes in leukocytes (toxic granularity, vacuolation of the cytoplasm and nucleus, wrinkling of leukocytes, leukolysis), they speak of a regenerative-degenerative shift. Degenerative changes occur not only in neutrophils, but also in other leukocytes.

Eosinophilic leukocytosis (eosinophilia) is characterized by a high content in the blood of eosinophils. Eosinophilia: a typical blood picture in invasive diseases, as well as diseases of allergic origin. When pigs are erysipelas, the number of eosinophils in the blood can reach, for example, 45% of all leukocytes. However, in most diseases, the content of eosinophils in the blood is reduced, and only in the stage of recovery does insignificant eosinophilia occur. The number of eosinophils in the blood increases with the treatment of penicillin, streptomycin, liver and some other drugs (drug eosinophilia).

Basophilic leukocytosis (basophilia) - elevated levels of basophils in the blood, rarely occurs in animals.

A more pronounced increase in the number of basophils in the blood occurs in myeloid leukemia, as well as in hemophilia.

Lymphocytosis is an absolute or relative increase in the number of lymphocytes in the blood. In cattle, a high content of lymphocytes in the blood is a specific feature of these animals. With relative lymphocytosis, the percentage of lymphocytes is increased with normal or even reduced total leukocyte count in the blood. Lymphocytosis is a typical blood picture in chronic diseases, such as tuberculosis, as well as some endocrine disorders (acromegaly, hypothyroidism).

Monocytosis is an absolute or relative increase in the number of monocytes. Monocytosis is considered as one of the indicators of increasing the function of the reticuloendothelial system. An increase in the number of monocytes is characteristic of chronic infectious and protozoal diseases; it is also observed in the stage of recovery from acute infectious diseases and during immunization.

In chronic diseases, histiocytes may appear in the blood. These are large cells with a large number of weakly basophilic cytoplasm, which have much in common with blood monocytes. Often the cytoplasm of histiocytes is vacuolized. The appearance of histiocytes in the blood indicates irritation of the reticuloendothelial system.

Leukopenia. The term "leukopenia" means a decrease in the number of leukocytes in the peripheral blood. In itself, leukopenia, like anemia, is not an independent disease, but only a symptom of numerous conditions and diseases that manifest themselves at one or another stage of leukopenia.

The mechanism of the onset of various leukopenias is complex and diverse. However, regardless of the etiological factor, one or another disturbance in the life cycle of leukocytes and their normal kinetics is always the basis for the development of leukopenia.

The causes of the disturbance of blood formation leading to leukopenia and agranulocytosis (i.e., the complete absence of granulocytes in the blood) can be:

a) aplasia of the bone marrow with the almost complete disappearance of myeloid elements from bone marrow tissue due to the displacement of myeloid elements by another growing tissue (osteosclerosis, tumor metastasis to the bone marrow);

b) toxic and toxic-allergic effects on the bone marrow;

- chemicals (benzene, arsenic, etc.),
- radiation (causes primarily the death of stem cells).
- drugs (salicylates, sulfonamides, antibiotics

c) hereditary and congenital neutropenias:

- deficiency of amino acids, defects of sulfhydryl groups, lack of leukopoetins. , etc.)

g) deficient leukopenia

- Leukopenia with iron, B12 and folic acid deficiency anemia. The fact is that when these substances are deficient, white blood is the first to suffer, but not red blood. The genesis of leukopenia arising from iron deficiency is associated with both the “switching” of blood formation to erythropoiesis and endogenous deficiency of proteins and vitamins.

At the same time, iron deficiency in the body causes a decrease in the total number of iron-containing enzymes necessary for redox reactions and a pronounced metabolic disturbance of leukocyte precursors;

I. Leukopenia associated with delayed release of neutrophils (elimination) from the bone marrow:

- leukopenic form of acute leukemia,
- hypersplenism (increased function of the spleen).

2. Leukopenia associated with increased leukocyte destruction:

- immune leukopenia.
- leukopenia in infections and extensive inflammatory processes (extensive destruction of leukocytes in the focus of inflammation).

Leukopenia with a predominant decrease in individual forms of leukocytes is divided into: neutropenia, eosinopenia, lymphocytopenia, monocytopenia.

Neutropenia - a decrease in the blood of neutrophilic leukocytes results from the inhibition of the hematopoietic function of the bone marrow under the influence of infectious and toxic agents. A sharp decrease in the blood of granular leukocytes is called agranulocytosis. It can occur as a result of avitaminosis, especially B1 and other feeding disorders. With agranulocytosis, erythropoiesis is also greatly impaired.

The decrease in the number of eosinophils in the blood (eosinopenia) is in the stage of full development of many infectious diseases. The complete absence of eosinophils in the blood (aneosinopenia) is an unfavorable indicator of the course of the disease. On the contrary, the appearance of eosinophils in the blood at the height of the disease process indicates a favorable outcome of the disease.

A decrease in the number of lymphocytes in the blood (lymphocytopenia) is more often relative due to an increase in the cells of the neutrophilic series. Absolute lymphocytopenia is an indicator of inhibition of the lymphatic system. The latter is sensitive to the effects of ionizing radiation. The content of lymphocytes in the blood begins to decrease immediately after irradiation.

Monocytopenia - a decrease in the number of monocytes in the blood - is difficult to detect due to their small amount in the blood. Monocytopenia is considered as an indicator of inhibition of the reticuloendothelial system. Strong leukopenia is an indicator of low body resistance.

Platelets. Normally, the number of platelets in the peripheral blood is. Their life span in peripheral blood is 9–11 days. A significant part of platelets is deposited in the spleen, liver, lungs and, if necessary, enters the circulating blood.

Reception of food usually causes an increase in the number of plates, similarly act and physical activity. An increase in the concentration of platelets in the circulating blood is observed during a stress reaction.

During physiological sleep, an increase in the number of platelets occurs with an increase in the number of large forms and an increase in the size of hyaloplasm. Quantitative changes in platelets, like erythrocytes, leukocytes, consist in increasing or decreasing their concentration in circulating blood.

Thrombocytosis (thrombocythemia) - an increase in the concentration of platelets in the peripheral blood above normal. It is customary to use the term “thrombocytosis” in the event that an increase in the concentration of blood platelets is secondary in relation to the disease, and “thrombocythemia” is used to designate a primary lesion of a megakaryocytic germ. An increase in the number of platelets in the blood is indicated if their concentration exceeds.

Thrombocytosis occurs in inflammatory reactions (fever, arthritis, tuberculosis, cirrhosis of the liver); with blood diseases (acute blood loss, iron deficiency anemia, hemolytic anemia); tumor diseases (carcinoma); postoperative conditions.

Thrombocythemia accompanies tumor and leukemic processes.

Thrombocytopenia - a decrease in the number of platelets in the blood, as well as anemia, leukopenia can result from impaired platelet production (hypoplasia, leukemia, ineffective thrombocytopoiesis due to vitamin B12 deficiency or folic acid, increased platelet intake, consumption of coagulopathy, Ipodopaemia). deprives the vessel wall of protection or makes it impossible to implement the thrombotic process.

Different cells in the form of cells can simultaneously be in the circulating blood - a phenomenon called poikilocytosis. In addition, cells that differ in size from each other, anisocytiosis, can simultaneously circulate. Those of them that are much larger than the average are usually called macrocytes, and those having a much smaller value are called microcytes. This condition is called thromboblastemia.

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