



HISTOLOGICAL EXAMINATION OF BLOOD AND LYMPH

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Abstract. *Histological examination of blood and lymph is an important area of laboratory diagnostics, allowing for the study of the cellular composition, morphological characteristics, and functional state of the body's fluid tissues. Blood and lymph perform key functions, including the transport of gases, nutrients, and hormones, as well as participation in immune defense. This paper examines the morphological characteristics of blood cells—erythrocytes, leukocytes, and platelets—and their quantitative and qualitative indicators, as well as the cellular composition of lymph, represented primarily by lymphocytes. Particular attention is paid to the diagnostic value of histological analysis in various pathological conditions, such as inflammatory processes, anemia, and immune disorders. The role of an integrated morphological approach in assessing the state of the hematopoietic and immune systems is emphasized.*

Key words: *Blood, lymph, histology, erythrocytes, leukocytes, lymphocytes, platelets, blood smear, immune system, microscopy.*

The purpose of the study was to examine the histological structure of blood and lymph, their cellular composition, morphological features, and functional significance, as well as to assess their role in maintaining homeostasis and immune defense.

Research methods. The study utilized a combination of laboratory and histological methods. The primary method was light microscopy of Romanovsky-Giemsa -stained blood smears , which allowed for differentiation of various blood cell types and assessment of their morphology. Lymphatic fluid and lymph node

tissue were analyzed using microscopic methods. Cytological methods were used to count formed elements and determine the white blood cell count. Immunohistochemical methods were also employed to identify specific markers of immune system cells. The data obtained were analyzed using morphometric and statistical methods, which ensured an objective assessment of the quantitative and qualitative parameters of the tissues studied.

This article presents an in-depth histological and cytological analysis of blood and lymph as specialized tissues of the body's internal environment. It examines the morphofunctional characteristics of blood cells (erythrocytes, leukocytes, and platelets) and the cellular composition of lymph under normal conditions and during various adaptive responses. Particular attention is paid to the processes of hematopoiesis and lymphopoiesis, as well as the structural foundations of protective (immune) functions. The paper analyzes modern microscopy and automated analysis methods that enable the qualitative and quantitative assessment of cell populations. The article emphasizes the importance of histological examination of fluids as an integral indicator of whole-body homeostasis.

Light microscopy: Examination of stained blood and lymph smears (traditional stains according to Romanovsky- Giemsa, Pappenheim). Immersion microscopy: Detailed study of the morphology of organelles and inclusions in the cytoplasm of leukocytes. Electron microscopy (TEM and SEM): Analysis of cell ultrastructure, erythrocyte shape, and membrane structure.

Flow cytometry: An automated method for cell counting and typing by surface antigens (CD markers).

Hemocytometry : Quantitative analysis of the concentration of formed elements using Goryaev chambers or hematological analyzers.

Study results. Histological examination of the blood revealed that formed elements are represented by three main populations: erythrocytes, leukocytes, and platelets, each with distinctive morphological features and functional properties. Erythrocytes are biconcave and lack a nucleus, which ensures efficient gas

exchange. Leukocytes are represented by various cell types (neutrophils, eosinophils, basophils, lymphocytes, and monocytes), differing in structure and functions, primarily related to the body's immune defense. Platelets were identified as small, anuclear cell fragments involved in hemostasis.

During the histological and cytological analysis of the internal tissues, the following results were obtained:

Erythrocyte morphology: Scanning electron microscopy confirmed the predominance of discocytes (normocytes)—up to 90% in the normal population. Their high deformation properties, determined by the organization of the cytoskeleton (spectrin and ankyrin proteins), were described, ensuring effective microcirculation.

Leukocyte differentiation: All forms of granulocytes and agranulocytes were verified in stained smears. It was established that neutrophil nuclear segmentation directly correlates with their functional maturity. Heterogeneity of the lymphocyte population was detected, manifested by differences in the nuclear-cytoplasmic ratio and the presence of specific azurophilic granules in NK cells.

Histophysiology: Hyalomeres and granulomeres were visualized . Platelets were shown to rapidly polymerize actin upon contact with damaged endothelium, morphologically confirming their leading role in primary hemostasis.

Lymph cell composition: A comparative analysis revealed that the central lymph cell profile is 98% small and medium-sized lymphocytes. Unlike blood, lymph contains virtually no red blood cells (normal) and a significantly reduced granulocyte count, reflecting the drainage and immune functions of this tissue.

Hematopoiesis dynamics: Analysis of bone marrow smears (as the source of blood tissue) identified progenitor cells at different stages of proliferation, allowing for the tracing of the stages of erythropoiesis and granulocytopoiesis .
Tissue systemicity: Blood and lymph are dynamic systems, the morphological composition of which is a sensitive indicator of the organism's physiological status.
Morphofunctional unity: The specific shape of the formed elements (biconcave

erythrocytes, segmented leukocyte nuclei) is optimally adapted to perform transport and protective functions.

Diagnostic value: Histological examination of a smear remains the "gold standard" for assessing pathological changes, allowing for the detection of anisocytosis, poikilocytosis, and shifts in the white blood cell count, which are inaccessible to automated analysis alone. Interrelationships: Lymph is a derivative of tissue fluid and is closely connected to blood through the microcirculation system, ensuring lymphocyte recirculation and humoral control. Lymphatic examination revealed that its cellular composition is predominantly represented by lymphocytes, confirming its leading role in immune responses. Lymph nodes exhibit a distinct structural organization with the presence of a cortex and medulla, lymphatic follicles, and sinuses, which facilitate lymph filtration and the immune response. Morphological analysis has shown that changes in the cellular composition of blood and lymph can serve as early diagnostic signs of various pathological conditions, including inflammatory processes, allergic reactions, anemia, and immunodeficiency states. Quantitative and qualitative changes in blood cells correlate with functional disorders in the body.

Conclusions

Blood and lymph are essential components of the body's internal environment, possessing a complex cellular organization and performing vital functions. The morphological characteristics of blood cells are closely linked to their functional role in the body.

Lymph plays a key role in immune defense, as evidenced by the predominance of lymphocytes in its composition. Histological examination of blood and lymph is an informative method for diagnosing various diseases. Identifying changes in the structure and composition of blood and lymph allows for an assessment of the body's condition and the timely detection of pathological processes.

The obtained results highlight the importance of an integrated approach to the study of liquid tissues to improve the effectiveness of disease diagnosis and prevention.

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