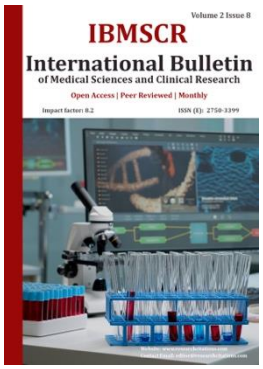

HISTOLOGICAL FEATURES OF THE STRUCTURE OF THE CENTRAL HEMATOPOIETIC ORGANS

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Annotation. Hematopoietic organs (hematopoietic organs) are organs that are involved in the formation, development and destruction of blood cells. They can be divided into central and peripheral hematopoietic organs. Let's consider their structure and functions.

The histological structure of the bone marrow reflects its main function — the formation of blood cells. There are two types of bone marrow: red and yellow, but the main hematopoietic organ is the red bone marrow.

Key words: Epithelioreticulocytes, Hassalian corpuscles, Cortical matter, Medulla, Trabeculae, Sinusoidal capillaries, Cell differentiation, Immunity, thymus involution, Reticular tissue

Red bone marrow: histological structure

1. Stroma

This is the basis of the bone marrow, which consists of connective tissue and performs a supporting function.

• Stroma cells:

Reticular cells: form a network that supports hematopoietic cells.

Fibroblasts: synthesize collagen and other components of the intercellular substance.

Adipocytes: fat cells that accumulate lipids.

Endothelial cells: line sinusoidal capillaries.

• Intercellular substance: contains reticular fibers consisting of type III collagen.

2. Hematopoietic cells

Hematopoietic tissue consists of cells at different stages of differentiation.

• Hematopoietic stem cells:

The main source of all the shaped elements of the blood (pluripotent cells).

• Descendants of stem cells:

Progenitor cells of the myeloid and lymphoid series.

Progenitor cells (blast forms): erythroblasts, myeloblasts, megakaryoblasts, etc.

• Mature cells:

Erythrocytes, granulocytes, platelets, lymphocytes.

3. Sinusoidal capillaries

• These are special blood vessels through which shaped blood elements enter the general bloodstream.

• Structure:

Endothelium: a thin layer of endothelial cells with gaps for mature cells to exit.

Basement membrane: discrete or absent, which facilitates cell transport.

Pericytes: surround capillaries and are involved in the regulation of blood flow.

Yellow bone marrow: histological structure

• Mainly consists of adipose tissue, has significantly fewer hematopoietic cells.
• Stroma: similar to the red bone marrow.
• Cells: mainly adipocytes, which gradually replace hematopoietic cells.
Histological features of the red bone marrow
• Mosaic structure: cells are in close interaction, but are distributed in sections:
Erythroid islets: areas where red blood cells develop.
Granulocyte "nests": zones of granulocyte formation.
Megakaryocytes: located next to the sinuses for the release of platelets into the blood.
• High vascularization: a dense network of capillaries provides blood supply and cell transport.
The histological structure of the thymus (thymus gland) reflects its key role in the differentiation and "training" of T-lymphocytes, as well as in the formation of the immune system. The thymus has a characteristic structure consisting of lobules with two zones — cortical and cerebral.
The general structure of the thymus
1. Capsule:
The thymus is covered with a connective tissue capsule.
Partitions (trabeculae) extend from the capsule into the organ, which divide it into lobules.
2. Thymus lobules:
Each lobule consists of a cortical substance (outer part) and a medulla (inner part).
Histological structure of the thymus lobules
1. Cortical substance:
• Located on the outside, darker when stained with hematoxylin-eosin due to the large number of lymphocytes.
• Main elements:
Lymphocytes (T-lymphocytes):
Immature cells undergoing the processes of proliferation and differentiation.
A high density of lymphocytes creates a dark color.
Epithelioreticulocytes:
They form a three-dimensional network supporting lymphocytes.
They perform the functions of antigenic presentation, cytokine production and form a barrier to isolate T-lymphocytes.
Macrophages:
They are involved in phagocytosis of dead and defective lymphocytes.
Capillaries:
They form a hemato-thymus barrier that prevents antigens from entering the cortical substance from the blood.
The barrier includes the capillary endothelium, the basement membrane, and epithelial cells.
2. Brain matter:
• Located in the center of the lobule, lighter when stained due to the lower density of lymphocytes.
• Main elements:
Mature T lymphocytes:
Differentiated cells ready to leave the thymus.
Epithelioreticulocytes:

They form a network that supports cells.

They produce thymic hormones (thymosin, thymopoietin), which regulate the maturation of T-lymphocytes.

Gassal's corpuscles:

A characteristic feature of the brain substance.

They are concentric structures made up of layers of squamous epithelial cells, often with degenerative changes.

Their functions are not fully understood, but it is assumed that they are involved in the destruction of defective T cells or in the production of cytokines.

Macrophages and dendritic cells:

Provide phagocytosis and antigenic presentation.

Blood supply to the thymus

• The arteries enter through the trabeculae and branch into the capillary networks of the cortical and medulla.

• Hemato-thymus barrier:

Exists only in the cortical substance.

Protects developing T lymphocytes from the effects of antigens.

Age-related changes in the thymus

The thymus reaches its maximum size and activity during childhood.

With age, its involution occurs:

o The number of lymphocytes decreases.

The cortical and cerebral matter is replaced by adipose tissue.

Despite this, the thymus retains residual foci of hematopoietic and immune activity.

Functional aspects

• The thymus is the central organ of lymphopoiesis, where:

Stem cells coming from the bone marrow turn into T-lymphocytes.

T cells are "trained" (removal of autoreactive cells and formation of cells capable of reacting to foreign antigens).

Conclusion

The thymus is a key organ of hematopoiesis and the immune system, ensuring the development and maturation of T-lymphocytes necessary for the implementation of adaptive immunity. Its unique histological structure — a combination of cortical and cerebral matter, as well as the presence of specific elements such as Gassal cells and the hemato-thymus barrier — emphasizes the importance of a strictly controlled environment for the "training" of immune cells.

Although the thymus undergoes involution with age, its role in the formation of immune tolerance and protection of the body from foreign antigens remains fundamental. A deep understanding of the histological structure of the thymus makes it possible not only to evaluate its functions, but also to develop approaches to restoring its activity in immune disorders.

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