CHANGES IN THE MORPHOFUNCTIONAL PROPERTIES OF THE FORK, SLENOSIS AND LYMPHID SYSTEM UNDER THE INFLUENCE OF TICKS OF DIFFERENT ORIGIN

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Abstract: The article is devoted to the structural and functional features, morphometric indicators of the main structures of the central and peripheral organs of the immune system. The patterns of development of these organs at different stages of postnatal ontogenesis are revealed. Data from domestic and foreign literature on the influence of environmental factors on structural changes in the thymus and spleen at the organ, tissue and cellular levels were analyzed. Further study of the morphofunctional organization of the immune system organs will make it possible to identify and analyze the patterns of their structural and functional changes under the influence of factors of various origins.

Key words: morphology, immune system organs, thymus, spleen, action of environmental factors.

The immune system of humans and animals is one of the most reactive systems of the body, quickly responding to the effects of damaging factors at the earliest stages. The immune system is formed by a complex of organs and tissues that create protection from foreign endo and exogenous influences [1]. It arose in the early stages of evolution, and its activity is based on the recognition of foreign antigens, their destruction and removal, which is absolutely necessary for the survival of the organism [2]. There is now convincing evidence that the immune system largely determines the body's resistance to chemical factors. The central organs of mammalian immunogenesis are the thymus, where T-lymphocytes are formed and multiply, and the red bone marrow, where B-lymphocytes are formed and multiply.[5] Peripheral lymphoid organs are lymph nodes, spleen, tonsils and intestinal lymphoid follicles [7].

Lymphoid tissue, which is the main site for the development of specific immunological reactions, contains numerous populations of cells involved in ensuring the genetic constancy of the internal environment of the body [3]. In this case, the thymus is considered as an immune organ in which acquired and natural immunity is formed with the help of biologically active peptides [12]. The history of studying the structural organization and functions of the thymus gland (thymic, lymphatic, thymus, major thoracic node) goes back many decades [8]. In the structure of the immune system, the thymus ensures the maturation and differentiation of T-lymphocytes, including in peripheral immune organs, and stimulates the integration of various populations of T-lymphocytes and macrophages to implement immune responses [10].

Until the end of the twentieth century, the theory of involution of the thymus of humans and animals was considered undeniable. According to the theory of thymus involution in adolescents 14-15 years old and animals aged 8-9 months . upon reaching puberty, the organ under study undergoes complete involution in the body and loses its functional purpose. [8]The founders of this theory believed that the thymus gland reaches its maximum functional development in newborns. However, there are justifications for the morphofunctional significance of this gland in northern animals during all periods of individual development and age-related changes in the organ before the onset of biological death.[7] In a 4-week embryo, the reticuloendothelial complex and its cellular elements are formed.

The thymus is the central organ of immune defense, which is subject to age-related changes, in addition, it is extremely sensitive to stress. [4] It is known that chronic stress causes involution of the thymopoietic component of the gland, followed by structural restructuring of the organ and its atrophy, while changes in the gland are similar to age-related involution, but occur much faster [14]. Surgical stress also has short-term but reversible negative effects on the thymus gland [11].

The thymus is a combination of epithelial and mesenchymal reticula and, together with the capillary network, form the Reti - culo -endothelial complex. Epithelial cells differentiate and different generations of thymocytes appear . It has been proven that T-lymphocytes of the thymus regulate cellular immunity in the body and form thymus-dependent organs (spleen, lymph nodes, etc.). The epithelial islands of the thymus gland of young adult animals secrete into the blood a secretion containing hormones of the thymositis family . These hormones regulate humoral immunity in animals and humans [9]. T cell development results from the interaction of progenitor cells and immature thymocytes with components of the thymic stroma, which contains several cell types that provide a supportive scaffold and microenvironment for thymocyte development [6].

It is known that in the thymus, medullary dendritic cells and some populations of epithelial cells included in the perivascular spaces of the medullary zone give a positive reaction with the marker of neuroectodermal differentiation S-100, and with synaptophysin - neuroendocrine cells of the medullary zone, which are classified as cells of the DES series [6, 17].

As a result of immunohistochemical studies [7], the presence of serotonin was detected in the precursors of T lymphocytes (CD4-CD8 -), in immature cortical cells (CD4 + CD8), in mature medullary cells (CD4 + CD8 -). , as well as in epithelial cells that form Gass bodies . Studies of the thymus of people of different age groups, carried out at autopsy, made it possible to verify the expression of serotonin in human thymus cells at all stages of ontogenesis. [20]There was a significant increase in the number of cells containing serotonin in elderly people and the preservation of this hormone in people of old age and longevity at the same level as in the initial stages of ontogenesis. The intensity of serotonin synthesis does not change during ontogenesis. The data obtained convincingly indicate the preservation of the endocrine function of the gland during aging [13].

The regenerative potential of the thymus gland was studied in 54 adults who received chemotherapy for lymphoma for 12 months . [25] The dynamics of thymic activity were analyzed by assessing structural changes in the thymus using sequential computed tomography, correlating them with the results of thymic examination by simultaneous analysis of T-cell receptor excision circles (sjTREC) and CD3i (+) recently emigrated from thymus (recent thymic immigrants - RTE) in the peripheral blood. In addition, regeneration processes in the thymus were assessed based on the recovery of peripheral CD4 (+) T cells after chemotherapy. Enlargement of the target organ after chemotherapy compared with baseline, called recurrent thymic hyperplasia, was found in 20 patients aged 18-53 years (mean 33 years). Using general linear models of mathematical analysis, it was found that patients with hyperplasia recovered sjTREC and CD3i(+)RTE levels more quickly after chemotherapy than patients of the same age, sex, diagnosis, disease stage, and baseline thymic function . equal , but without hyperplasia. These data indicate that the adult thymus retains the ability to regenerate after chemotherapy, especially in younger adults. The presence of hyperplasia may contribute to the renewal of thymopoiesis and replenishment of the pool of peripheral CD4 (+) T cells after chemotherapy in adults [15].

The main function of the thymus gland is to ensure the development of T-lymphocytes. The role of cytokines produced in the thymus is mainly to support the main processes carried out in the thymus, that is, T- lymphopoiesis . Cytokines also coordinate intercellular relationships. It was found that the main role in the formation of T cells belongs to IL-7, produced by thymic epithelial cells. This process also involves products of the cellular stroma (SCF-stem cell factor, cytokines of the IL-6, IL-15 family, pro-inflammatory cytokines) or thymocytes themselves (cytokines acting through y (C)-containing receptors - IL-4, IL-2 ,IL-9)[4,16].

The influence of various immunomodulators on the immune system has been studied. Polyoxidonium - derivative heteroceptive polyamines containing highly polar N -oxide groups lead to an increase in the number of CD 4 - CD 8 + - thymocytes without changing their relationship to CD 4 + CD 8 - cells [8].

In an experiment on outbred male rats [13], which were intramuscularly injected with cyclophosphamide , imunofan and their combinations, it was found that a course of imunofan leads to changes in the morphology of the thymus and the functioning of its bioamine-containing structures. [22] Imunofan significantly increases the width of the cortical layer, diameter and area of the medulla of the thymus with a corresponding increase in the weight of the organ 7 and 14 days after the end of the course of injections.[21] An increase in the number of luminescent granular cells of the corticomedullary and subcapsular zones is detected after 1 and 14 days. After 14 days, the cells of both the cortical and subcapsular zones become larger and densely filled with granules. It has been shown that the use of Imunofan against the background of cyclophosphamide administration increases the mass of the thymus, the size of the cortical and medulla lobes and accelerates the restoration of the cytoarchitecture of the thymus. [20] Recovery processes begin within 1 day after the combined course. [24]After 7 days, the weight of the thymus and the size of the cortical and cerebral substance in rats with isolated administration of cyclophosphamide and in the group with combined administration of cyclophosphamide and immunophan differ little, but there is a tendency towards normalization of the structure of the thymus. After the combined administration of imunofan and cyclophosphamide, the structure of the thymus and the supply of bioamine to cells differs significantly from that with the isolated administration of both drugs. It was found that an increase in the size of the cortical and medullary lobules with the administration of Imunofan occurs due to the activation of proliferation and differentiation of thymocytes , which may be mediated by the inclusion of various factors that control the growth and development of lymphocytes.

Conclusion

Morphological studies of the central and peripheral organs of the immune system make it possible to assess age-related changes in the functioning of the immune system in response to factors of various natures. Modern immunohistochemical research methods create opportunities for elucidating stromal relationships in the organs under study. Further study of the morphofunctional organization of the immune system organs will make it possible to identify and analyze the patterns of structural and functional changes in the immune organs when the body is exposed to factors of various origins.

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