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CHANGES IN THE MORPHOFUNCTIONAL PROPERTIES OF THYMUS, SPLEEN AND LYMPHOID SYSTEMUNDER THE INFLUENCE OF MITES OF DIFFERENT ORIGINS

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RESUME

Present article is devoted to the peculiarities of the structure and function, morphometric parameters of the basic structures of the central and peripheral organs of the immune system. It discloses the patterns of the development of these organs at different stages of postnatal ontogenesis. The data of the domestic and foreign literature on the impact of environmental factors on the structural changes in the thymus and spleen on the organ, tissue and cellular levels was analyzed. Further study of the morphological and functional organization of organs of the immune system will allow to identify and analyze the patterns of their structural and functional changes influenced by the factors of different origin.

Keywords: morphology, organs of the immune system, thymus, spleen, the effect of environmental factors.

Introduction

The immune system of humans and animals is one of the most reactive systems of the body, reacting quickly 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

against foreign endo and exogenous influences [1]. It arose at 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]. Currently, there is strong 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 form and multiply, and the red bone marrow, where B-lymphocytes form and multiply. 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 using biologically active peptides [12]. The history of studying the structural organization and functions of the thymus gland (thymus, lymphatic, thymus, large thoracic node) goes back many decades [8]. In the structure of the immune system, the thymus provides maturation and differentiation of T-lymphocytes, including in peripheral immune organs, and stimulates the integration of various populations of T-lymphocytes and macrophages for the implementation of immune responses [10].

Until the end of the twentieth century, the theory of involution of the thymus in humans and animals was considered indisputable. According to the theory of involution of the thymus 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. The founders of this theory believed that the thymus gland reaches its maximum functional development in newborns.

However, there are substantiations for the morphological and functional significance of this gland in northern animals during all periods of individual development and age-related changes in the organ prior to biological death. In a 4-week-old embryo, the reticuloendothelial complex and its cellular elements are formed.

The thymus is the central organ of the immune defense, which is prone to age-related changes, in addition, it is extremely sensitive to stress... It is known that chronic stress causes involution of the thymopoietic component of the gland with subsequent structural rearrangement 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 [11].

The thymus is a combination of epithelial and mesenchymal reticules and, together with the capillary network, form the Reticulo-endothelial complex. Epithelial cells differentiate and different generations of thymocytes appear.

It has been proven that thymic T-lymphocytes 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 secret containing hormones of the thymositis family. These hormones regulate humoral immunity in animals and humans [9]. The development of T-lymphocytes is the result of the interaction of progenitor cells and immature thymocytes with components of the thymic stroma, which contains several types of cells that create a supporting framework and form a microenvironment for the development of thymocytes [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 neuroectodermal differentiation marker S-100, and with synaptophysin - neuroendocrine cells in the brain zone, which are classified 6 as cells of the DES series [17].

As a result of immunohistochemical studies [7], the presence of serotonin was found in the precursors of T-lymphocytes (CD4-CD8 -), in immature cortical cells (CD4 + CD8), in mature medullary cells (CD4 + CD8 -). , as well as in the epithelial cells that form Gass's little bodies.

Autopsy studies of the thymus of people of different age groups made it possible to check the expression of serotonin in human thymus cells at all stages of ontogenesis. There was a significant increase in the number of cells containing serotonin in the elderly and the preservation of this hormone in people of old age and longevity at the same level as at the initial stages of ontogenesis. The intensity of serotonin synthesis during ontogenesis does not change. 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 adults (54 people) who received chemotherapy for lymphoma for 12 months. The dynamics of thymic activity was analyzed by assessing the structural changes in the thymus using sequential computed tomography, correlating them with the results of the study of the thymus by simultaneous analysis of the circles of excision of T-cell receptors (sjTREC) and CD3i (+), recently emigrated istimus (recent thymus immigrants - RTE) in the peripheral blood. In addition, the regeneration processes in the thymus were assessed based on the recovery of peripheral CD4 (+) T cells after chemotherapy. An enlargement of the target organ after chemotherapy compared with baseline, called recurrent thymic hyperplasia, was found in 20 patients aged 18-53 years (average 33

years). Using general linear models of mathematical analysis, it was found that in patients with hyperplasia, sjTREC and CD3i (+) RTE levels after chemotherapy recovered faster than in patients of the same age, gender, diagnosis, disease stage, and initial thymic function. but without hyperplasia. These data indicate that the thymus gland in adults 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 in the thymus, that is, T-lymphopoiesis. Cytokines also coordinate cell-to-cell relationships. It was found that the main role in the formation of T cells belongs to IL-7, produced by epithelial cells of the thymus. This process also involves the products of the cell stroma (SCF-stem cell factor, cytokines of the IL-6 family, IL-15, pro-inflammatory cytokines) or thymocytes themselves (cytokines acting through y (C) -containing receptors-IL-4, IL-2 , IL-9) [4.16]. The effect of various immunomodulators on the immune system has been studied. Polyoxidonium, a derivative of heteroceptive polyamines containing high-polarity N-oxide groups, leads to an increase in the number of CD4-CD8 + thymocytes without changing the relationship to CD4 + CD8- cells [8].

In an experiment on white outbred male rats [13], which were injected intramuscularly with cyclophosphamide, imunofan and their combinations, it was found that the course administration of imunofan leads to a change in the morphology of the thymus and the functioning of its bioamine-containing structures.

. Imunofan significantly increases the width of the cortical layer, the diameter and area of the medulla of the thymus gland with a corresponding increase in the mass of the organ 7 and 14 days after the end of the course of injections. An increase in the number of luminescent granular cells of the cortical-medullary 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 the introduction of cyclophosphamide increases the mass of the thymus, the size of the cortex and medulla of the lobes and accelerates the restoration of the cytoarchitectonics of the thymus. Recovery processes begin within 1 day after the combined course. 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 to normalize the structure of the thymus. After the combined administration of imunofan and cyclophosphamide, the structure of the thymus and the supply of cells with bioamine differ significantly from that with the isolated administration of both drugs. It was found that an increase in the size of cortical and cerebral lobules with the introduction 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 nature. Modern immunohistochemical research methods create opportunities for elucidating stromal relationships in the organs under study. Further study of the morphofunctional organization of the organs of the immune system will reveal and analyze the patterns of structural and functional changes in immune organs when the body is exposed to factors of various origins.

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