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Inter-Organ Relationships of the Thymus and Spleen in the Dynamics of Temperature Exposure

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Abstract: The central (thymus, bone marrow) and peripheral (spleen, mesenteric lymph nodes) organs of the immune system in the dynamics of temperature exposure have been studied by complex morphological methods. Separate periods of immunomorphological adaptive rearrangements of the organs of the immune system in response to antigenic effects were established: early changes (3-24 hours of the experiment), pronounced immunomorphological rearrangements (from 3 to 14 days of the experiment) and reconvalescence (from 14 to 21 days of the experiment). Each of these periods is characterized by the dynamics of morphological and functional changes that ensure immune homeostasis in response to temperature exposure.

Key words: immunity, morphology, spleen, T, B lymphocytes, macrophages.

Relevance. Due to the rapid development of theoretical and applied immunology, the understanding of the structural foundations of immunity has significantly expanded. The cellular and subcellular foundations of immunity and the main mechanisms of cooperative interactions of immunocompetent cells - T -, B –lymphocytes and macrophages have been clarified. However, to date, the structural and functional basis of the reaction of the immune system under various antigenic influences has not been sufficiently clarified. The works available in this plan are mainly devoted to the quantitative characterization of immunocompetent cells and they are performed mainly in cellular suspensions and do not reflect the essence of intercellular interactions at the tissue and organ levels (1,2,3,4,5,6).

Meanwhile, the study of various structural and functional zones of the thymus and spleen, as representatives of the central and peripheral organs of the immune system, is an urgent problem. This reaction is especially evident under conditions of temperature exposure, which can be modeled by various experimental infections (7,8,10,11,13,15).

This work is part of a comprehensive study of the immune system organs under temperature exposure.

The aim of the work was to elucidate the morpho-functional foundations of inter-organ interactions of the thymus and spleen in the dynamics of temperature exposure.

The experiments were conducted on white mongrel male rats with an initial weight of 150-170 g, who were on a regular laboratory diet. The experimental animals were divided into three groups. The first group consisted of 32 intact rats. The second group was experimental (218 rats), they had reproduced experimental salmonellosis. The third group consisted of 100 control rats,

which we put all the experienced rats in direct sunlight in June and July. Experimental and control animals were slaughtered by decapitation in the dynamics of experiments. Pieces of the organs of the immune system (thymus, spleen) were studied (9,12,14,15).

The results of general morphological, histochemical, morphometric and electron microscopic methods under temperature exposure allowed to reveal the dynamics of structural and functional rearrangements of the organs of the immune system, divided into the following periods:

- early changes (3- 24 hours of experiment);
- pronounced immunomorphological rearrangements (from 3 to 14 days. experiment);
- reconvalescence (from 14 to 21 days)

Each of these periods is characterized by structural, functional and quantitative features, which together determine the essence of the adaptive response of the immune system in response to salmonella exposure.

The period of early changes is characterized mainly by changes in the microcirculatory bed, manifested in the form of a significant expansion of capillaries filled with hemolysis erythrocytes and destructively altered leukocytes. Electron microscopic studies have revealed subcellular changes in almost all types of cellular components, manifested in the form of vacuolization of mitochondria, lysis of granular endoplasmic reticulum structures and expansion of the perinuclear space of lymphoid-plasm cells, macrophages, fibroblasts, endothelial and reticular cells. At the same time, during 24 hours of experiments, signs of functional tension of immunocompetent cells begin to appear in the form of an increase in the number of lysosomes in macrophages, close contacts between macrophages, lymphocytes and plasma cells.

One of the characteristic features of this period is a decrease in the areas of T-dependent zones of peripheral organs of immunity. In our opinion, this reaction is explained by the mobilization of T lymphocytes to recognize the incoming antigen and their accelerated migration from T-dependent zones into the circulatory system. This assumption is also explained to a certain extent by the oppressive effect of temperature.

The most pronounced structural and functional rearrangements, covering various zones of the immune system, were observed on days 3-14. an experiment. This period is conventionally called the period of pronounced immunomorphological rearrangements.

Starting from the 3rd day of experiments, the content of plasma cells and cells of the mononuclear phagocyte system significantly increases in all B-dependent zones of the peripheral organs of immunity. Quantitatively, they reach their maximum by 5 days of experiments. Moreover, an increase in the number of plasma cells is accompanied by a significant decrease in the relative number of lymphocytes. Based on this, it can be assumed that the decrease in the number of lymphocytes at the height of the temperature effect is due to their transformation into plasma cells. Along with an increase in the number of plasma cells, a high RNA content in them and the functional tension of their organelles – mitochondria, granular endoplasmic reticulum and Golgi complex - are revealed.

It is characteristic that the temperature effect in the peak period is accompanied by an increase in the areas of not only B-dependent, but also T-dependent zones of the spleen and lymph nodes. This trend has been observed since day 3 and exceeds the control indicators by day 5 of the experiment.

Hypertrophy of T-dependent zones is based, to a certain extent, on an increase in the number of profiling cells. This is confirmed by our morphological and electron microscopic studies, which revealed numerous lymphoblasts, plasmoblasts, and proplasmocytes at various stages of mitotic division. The trigger mechanism of hypertrophy and hyperplasia of T- and B-

dependent zones of the immune system in this period of experiments is the antigenic composition of salmonella, characterized by both T- and B– mitogenic effects.

Hypertrophy and hyperplasia of T–dependent zones of peripheral immune organs is also accompanied by functional tension of their "interdigitating" cells and similar thymus cells.

In the long term (14-21 days) of the experiment, the intensity of the immunogenesis processes gradually decreases. However, in some immunocompetent cells, signs of tension of subcellular structures still persist, intercellular cooperation consisting of macrophages and surrounding lymphocytes and plasma cells are often found.

Thus, our comprehensive studies of the organs of the immune system have allowed us to establish the cellular and subcellular mechanisms of their adaptive reactions under temperature exposure. This reaction is characterized by a certain dynamics, ultimately providing immune homeostasis in response to temperature exposure.

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