AJPMHS GLOBAL RESEARCH NETWORK

AMERICAN Journal of Pediatric Medicine and Health Sciences
Volume 2, Issue 6, 2024 ISSN (E): 2993-2149

The Morphological Role of the Spleen under Temperature Influences

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Abstract: The spleen is an important organ of the immune system responsible for blood filtration, involved in the development of lymphocytes and the formation of antibodies. The main functions of the spleen in the immune response, its influence on the processes of formation and activation of immunity are analyzed. The article also presents data on the influence of the spleen on the formation of memory of the immune system and its ability to adapt to new pathogens. The study of the biological role of the spleen in the processes of immunogenesis allows us to better understand the mechanisms of functioning of the immune system and unlock the potential for developing new approaches to strengthening the immune response.

Keywords: spleen, immunity, cellular memory, temperature.

Although the spleen is not an inherently necessary organ for survival, it is an important peripheral lymphoid organ. The spleen plays a key role in the concentration of suppressor, helper, and part of effector cells, and is also the site of an active antibody formation process and the production of humoral mediators [1]. The spleen contains approximately 25% of type T lymphocytes and about 60% of type B lymphocytes [2]. This organ plays a role in both stages of differentiation of antibody-forming cells from bone marrow precursors, while for T-lymphocytes, the antigen-independent stage of differentiation occurs in the thymus, and the antigen-independent stage is carried out in the spleen [3]. The synthesis of a non-specific biologically active tetrapeptide Taftsin occurs in the spleen, which is obtained by cleavage from IgG by trypsinolysis and was named after Tufts University [5]. Taftsin is present in the IgG Fd fragment in small concentrations and contributes to the enhancement of phagocytosis and other functional properties of macrophages and leukocytes. This tetrapeptide stimulates natural killer cells through interaction with the neuramic acid of the cell membrane. In addition, Taftsin activates the hexosamonophosphate shunt, which enhances the bactericidal and anti-tumor properties of macrophage cells. Studies have shown that Taftsin stimulates the release of peroxide anions, hydrogen peroxide and thromboxane B2 by macrophages, which increases their toxicity [7]. It is important to note that the spleen performs the function of a filter and actively absorbs toxins. One gram of spleen tissue is able to absorb 20 times fewer toxins than one gram of liver tissue [2].

In addition to these functions, the spleen contains a large number of lymphoreticular cells, about 150 grams [4]. Removal of this organ leads to a reduction of the reticuloendothelial system by 1/4 - 1/6, which increases the risk of infections, especially in children. In addition, the spleen performs the function of a natural filter, which is able to capture particles about 1 micron in size with the help of reticuloendothelial cells [8]. These cells are also involved in the production of antibodies [6]. The use of the spleen as a filter is widely used in the treatment of various destructive diseases and severe injuries, which helps to reduce the number of enzymes and

increase the phagocytic activity of macrophages. The spleen also contains a significant amount of properdin, and it also plays an active role in the opsonization process - changing the cell surface of pathogens or other particles to improve their capture by phagocytes. According to K. Okita and colleagues [3], opsonization is associated with the presence of immunoglobulins, and IgG opsonates most effectively. In the spleen, the complement system performs this function practically only component C3b. After removal of the spleen, there is an immediate and long-term decrease in the level of Taftsin in the blood, as well as a defect in the activation of complement through the properdin pathway and the level of neutrophil leukocytes. However, after a few months, these changes are often resolved and everything is restored to normal [10]. Studies show that the spleen plays an important role in the formation of immunological memory and maintaining the body's immune response. The spleen plays a role in the formation of cellular memory in lymphocytes. Cellular memory helps to instantly activate the immune response upon repeated contact with the pathogen. Therefore, the spleen is considered an important organ for the formation and maintenance of immunological memory. When the spleen is removed, this process may be disrupted, which may affect the body's ability to effectively fight infections and form a stable immune response in the future.

Materials and methods: Our research has shown that experimental temperature exposure is accompanied by a certain dynamics of structural and functional rearrangements in various areas of the spleen. These rearrangements, identified using a set of morphological research methods, are adaptive in nature and can be conditionally divided into the following periods: -early changes (from 1 to 24 hours after infection) characterized by a high content of antigenic products in the spleen tissue and microcirculatory disorders; -pronounced immunomorphological rearrangements (from 3 to 4 days after infection), which is characterized by hypertrophy and hyperplasia of the lymphoid follicles of the spleen, a high degree of their plasmatization; -reconvalescence (21 days of experiments), in which organ rearrangements tend to normalize. In the early stages of the experiments, the blood vessels of the white and red pulp were significantly expanded. Especially pronounced vascular dilatation is observed in the sinusoidal capillaries of the red pulp, which are filled with a large number of destructively altered erythrocytes and leukocytes. Starting from 12 hours after infection, there was a tendency to hypertrophy of lymphoid follicles, in which the reactive centers noticeably expanded. The reactive centers are dominated by lymphoblasts, which were often at various stages of mitosis, and are characterized by high pyroninophilia. Based on the antigenic composition of salmonella, stimulation of both T- and B-dependent zones of the spleen in the initial stages of salmonellosis should be expected. However, this does not actually happen. In the period of early changes, a decrease in the area of T-zones is accompanied by the mobilization of lymphocytes into the blood. This seems to be related to the processes of recognition of antigenic effects by T-lymphocytes. These immunomorphological changes become more pronounced in the second period at the temperature of infection, a period of pronounced immunomorphological rearrangements. Starting from the 4th day of the study, they cover both thymus-dependent and thymus-independent areas of the organ.

The results of the study: The immune system, which includes the central (thymus gland, bone marrow) and peripheral (spleen, lymph nodes, all lymphoid tissue) organs, as well as effector cells - T, -B lymphocytes macrophages in unity and in interaction with each other, provides immune homeostasis of the body. Initially, one of the main components of the macrophage system and immunosecretory lymphoid organs of the immune system is the spleen Capsule and connective tissue trabeculae of the spleen contain smooth muscle cells, their number is concentrated mainly in the areas of the spleen gate. The capsule, trabeculae with blood vessels and elements of nervous tissue embedded in them form the musculoskeletal apparatus of the spleen, which is developed differently in different representatives of mammals. The parenchyma of the spleen is represented by white and red pulps, its stroma is made up of reticular tissue, in the network of which there are clusters of lymphocytes-lymphoid follicles. The ratios of white and red pulp have specific and age-specific features. The lymphoid follicles of the spleen differ

sharply in their structure and function from similar structures of lymph nodes. One of the main structurally diverse lysosomes and phagosomes and participation in a specific immune response. In the light of modern data, phagocytes differ from other phagocytes in their origin and functional features [11,12,13].

To date, the structural and functional bases of the immune system response under various antigenic influences have not been sufficiently clarified. The works available in this plan are mainly devoted to the quantitative characteristics of an organ of a given system and they are performed mainly on cellular suspensions and therefore cannot reflect the essence of intercellular interactions at the tissue, organ and inter-organ levels The most pronounced changes in the areas of T- and B-dependent zones are observed on days 4-14 of the experiments and reach their peak on day 6 of the study, when the total area of lymphoid follicles increases three-fold. Moreover, the increase in areas is accompanied, in particular, by hypertrophy of the area of the T-dependent periarterial zone. On the 21st day of the experiments, the indicators of the areas of T, B-dependent zones of the spleen are relatively normalized [14,15]. The white pulp of the organ is represented by lymphoid follicles, in which the light center, marginal (marginal) and peri-arterial zones are distinguished, in which the cellular composition has a different character. The red pulp consists of a large number of pulpary vessels, sinusoidal capillaries and intersinusoid tissues, where cells of the mononuclear phagocyte system, megakaryocytes and plasma cells are predominantly located.

Conclusions: Thus, the spleen of rats has the same structural and functional zones as the spleen of other mammals. At the same time, this organ in rats has certain specific features. As quantitative and morphological studies of the spleen of control and intact rats have shown, they do not have significant differences, and therefore we took the indicators of control animals as a control in the dynamics of experiments.

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