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Pathomorphological Changes Occurring in the Spleen as a Result of External and Internal Factors

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Abstract: The immune system is one of the most complex autonomous regulatory systems of the body, therefore, a violation of its functionality leads to severe autoimmune and infectious complications. The role of the spleen in the human body, starting from the antenatal period, the spleen performs various functions. It participates in the implementation of the initial period of the stress reaction, in the regulation of blood circulation and blood deposition, hemolysis of erythrocytes, neutralization of toxic substances. The spleen performs both hematological and immunological functions. However, the importance of the spleen in protecting against infection was ignored, and it was believed that other lymphatic organs of the body could take over its functions.

Keywords: spleen, immune system is vascularized, lymphoid couplings, hypergravity, splenectomy.

Currently, the spleen is considered the main organ of immunogenesis; blood is attached to its sinuses, red blood cells are split and exchanged with iron associated with it, while the spleen is considered a bacterial blood filter that plays an important role in fighting infection. It is also known that the spleen participates in the process of blood clotting, causing a clotting factor [25].

Embryologically, the spleen appears in the sixth week of embryonic life as a localized thickening of the coelomic epithelium of the dorsal mesogastrium near its cranial end. Proliferating cells penetrate into the underlying angiogenic mesenchyma, which is compacted and vascularized. The process occurs simultaneously in several adjacent areas, which soon merge to form a lobular spleen. In the later period of embryonic life, the earlier lobular character disappears, but it is indicated by the presence of notches on its upper border in an adult.[37].

The phylogeny of the spleen is very complex. It was proposed from the primitive type with closed circulation, characteristic of monotremes, insectivores and arboreal shrews, to the archetypal type with open circulation, characteristic of mice, gerbils, bats and marsupials. Later evolved into blood-feeding spleens (ungulates and carnivores) and protective spleens (old World monkeys and rodents).Xenathra is a group of placental mammals that are represented by anteaters, sloths, Armadillos have hematopoiesis with open blood circulation. With the advent of hematopoietic bone marrow, erythropoiesis of the spleen was no longer necessary. This led to the fact that the spleen became more actively involved in immunological processes and developed a specialized white pulp. In the mammalian spleen, the white pulp has reached the highest degree of specialization among all vertebrates. Thus, the spleen further evolved in humans to the protective and sinus type. The defensive type was characterized by a predominance of white pulp compared to red pulp [38].

The immune system is one of the most complex autonomous regulatory systems of the body, therefore, a violation of its functionality leads to severe autoimmune and infectious complications. In this regard, in recent years, the issues of preserving homeostasis in the immune system have become particularly relevant and have been reflected in the studies of domestic and foreign authors [11, 25, 32]. After splenectomy, according to the authors, various complications, in particular, mortality,

reach 50%, in particular, infection develops, which is accompanied by itching from post-splenectomy [22].

Immune homeostasis is ensured due to the fact that the spleen provides the formation of a general immune response to the effects of various pathogenic agents and, consequently, the necessary level of adaptive potential of the body (apo [3, 5, 18, 63]. The morphological basis of this function of the spleen is mainly the immunocompetent components of the organ, that is, the white pulp (BP), where two main B- and T-dependent zones are formed, that is, mainly the localization areas of b- and t-lymphocytes, respectively, lymphoid follicles (LF) and periarterial lymphoid couplings (palma) [5, 25, 29,43].

The role of the spleen in the human body, starting from the antenatal period, the spleen performs various functions. It participates in the implementation of the initial period of the stress reaction, in the regulation of blood circulation and blood deposition, hemolysis of erythrocytes, neutralization of toxic substances [5, 16, 20], in addition, the spleen is a depot of iron, which is then consumed for the synthesis of hemoglobin and iron-containing enzymes, erythropoietin is formed in it, and hematopoiesis occurs in the embryonic period, at the same time, the potency for the formation of erythromyeloid foci persists even after birth [12].

The spleen is the most vascular organ in the human body, which is involved in regulating the volume of circulating blood. Approximately 350 liters of blood a day passes through it. The spleen receives approximately 5% of the cardiac output and 40% of the blood source in the portal circulation. The spleen contains about one unit of blood at a given time, 25% of the total number of lymphocytes in the body, 30-40 ml of mature red blood cells and one-fourth of circulating platelets. The size of the spleen is used as an indicator of the activity of the disease in various organs of the reticuloendothelial system. Measuring the length of the spleen in normal clinical practice is a very good indicator of the actual size of the spleen. The spleen performs both hematological and immunological functions. However, the importance of the spleen in protecting against infection was ignored, and it was believed that other lymphatic organs of the body could take over its functions. But a series of animal experiments and subsequent patient studies have shown that its real importance lies in protecting against sepsis caused by blood, where its role as a blood filter has proved to be very significant.Currently, surgeons are replacing total splenectomy with partial splenectomy.Therefore, this study is conducted to study the morphology of the spleen and its variations.[41].

At the same time, the spleen is one of the secondary organs of immunogenesis, which begins to function already in the fetus, and in it, as in the adult body, the antibody-forming function prevails. The rudiment of the spleen appears at 5-6 weeks of intrauterine development in the form of a small cluster of mesenchymal cells in the thickness of the dorsal mesentery. Soon, lymphoid cells appear in the mesenchymal germ, and gaps are formed - future vessels of the spleen, around which tissue differentiation of the organ is carried out. At the 12th week of embryonic development, B-lymphocytes appear. At 2-4 months of intrauterine ontogenesis, venous sinuses and other blood vessels are formed. At the same time, strands of cells grow from the capsule into the spleen - future trabeculae. Foci of hematopoiesis appear around the venous sinuses, and after 4 months and 5 months, clusters of lymphocytes are already detected in the spleen - future periarterial lymphoid couplings and lymphoid nodules. Gradually, the number of lymphoid nodules in the spleen increases, and breeding centers appear in them. By the 8th month - hematopoiesis in the spleen decreases, and then stops, and the intensity of lymphopoiesis on the contrary increases. In fetuses of different age groups, the spleen has clearly distinguishable edges, surfaces and gates [14, 18, 25]. Its morphometric parameters increase - length, thickness, transverse size and the nature of the location in the upper floor of the abdominal cavity. In a newborn, the spleen is rounded, has a lobular structure. The spleen weighs approximately 9.5 g [21].

The spleen is not one of the vital organs, but it is the largest collector of lymphoid tissue in the body [11, 18, 29, 37].

According to the researchers, the immune system of the spleen has a more complex structure than other peripheral organs of the immune system. In the spleen, this apparatus should include areas of

white pulp, i.e. periarterial lymphatic vaginas (PALVS) surrounding all pulp arteries, lymph nodes (LU), as well as venous sinuses [25, 43]. •

The spleen contains red pulp from 70 to 80% of the mass of the organ and white pulp from 6 to 20% of the mass of the spleen. The red pulp is represented by venous sinuses and pulpous cords. In it, the destruction of red blood cells and their absorption by macrophages occurs. Lymphocytes predominate in the white pulp of the spleen. They accumulate around the arterioles in a form called periarterios, X-shaped junctions. The T-shaped ligament zone directly surrounds the arteriole, and the B-cell follicles are located closer to the edge of the ligament [33, 41].

Specific binding of the immunoglobulin receptor to b lymphocytes, followed by a significant slowdown in the movement of all b cells in the outer zone of periarteriolar lymphoid couplings. In the absence of interaction with t cells necessary for the immune response to thymus-dependent antigens, activated b lymphocytes die. In the presence of cooperation with T cells, simple B cells mainly enter follicles that undergo differentiation in microbial centers during primary immune reactions [29,33].

In thymus-dependent antigen-secondary immune B cells, pronounced proliferation of b cells and differentiation of plasma cells in the outer zone of periarteriolar lymphoid compounds is observed; proliferation of follicular B cells is somewhat weaker than the primary responses [29,42].

In addition, there is a special population of cells in the spleen that separates the white pulp from the red one.. This area is called the marginal or marginal zone, where T and B cells are located with a relative predominance of the latter [29].

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