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MORPHOLOGICAL AND IMMUNOHISTOCHEMICAL CHARACTERISTICS OF THE SPLEEN HUMAN

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Resume: A fundamental approach to assessing and understanding the features of the structure of the spleen, the size of its functional zones and the distribution of immunocompetent cells in the norm was the recalculation of morphometric indicators taking into account the mass of the organ. As a result of histological, immunohistochemical and morphometric studies of spleen samples of persons who had no history of diseases of the hematopoietic system and other pathology, the minimum and maximum values of relative (%) and absolute values of the mass (g) of white pulp and its compartments, the value of red pulp, as well as the content of cellular elements in these functional zones were determined. It was found that the characteristics of the parameters of white and red pulp depend on the migration properties of immunocompetent cells, the degree of activity of immune processes occurring in various compartments of these zones. According to the data obtained, it seems possible to distinguish three stages of the course of immunoreactive processes in the functional zones of the spleen.

Key words: morphogenesis, spleen, structural and functional characteristics.

Relevance. The spleen develops from the mesenchyma of the peripheral part of the dorsal mesentery of the future large omentum. In the human fetus, it appears on the 4th week of development in the form of a cluster of mesenchymal cells located on the stomach wall.
At week 5-6, single macrophages and reticular cells appear among the mesenchymal cells, and a network of reticular fibers is formed. The vessels are few in number, and their lumens are barely discernible[3,5]. At the 9th-10th week of development, large vessels grow into the gates of the organ, which quickly branch to form numerous thin-walled vessels such as sinusoids. Blood enters the spleen, there is a physiological hemorrhage into the tissue of the forming organ, and outflow There is no blood. A 9-10-week-old fetus has very small and rarely located foci of erythroid hematopoiesis and megakaryocytes. There is a massive breakdown of red blood cells[4] There are no lymphocytes and lymphoid follicles in the organ yet, the function of blood deposition prevails. On the 11th-12th week, trabeculae form around the vessels, B-lymphocytes appear. On the 13th-14th week, clusters of lymphocytes appear around the arteries, T - dependent zone. Among the vessels, trabecular, pulpar, and central ones can be distinguished[1].

A reticular backbone is formed, reticular cells and fibers are arranged circularly around the central artery. Since that time, the pulp can be divided into white and red. On the 17th week, a marginal sinus is formed. It increases dramatically from the 20th to the 22nd week. the number of lymphocytes and lymph nodes appear (B-dependent zones)[2].
The nodules are located to the side of the central artery. By the 22nd week, the size of the T-dependent zones in the fetal spleen increases dramatically, by the 29th to 30th week, the mass

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of the organ and the size of the lymph nodes,which are located more rarely, increase. A significant number of blast forms are identified in the center of the primary nodules, and germinal centers are formed[3].
The zones of location of T and B lymphocytes approach those in definitive structures. The processes of myelopoiesis in the human spleen reach their maximum development at the 5th month of the intrauterine period, after which their activity decreases and
stops completely by the time of birth. On the contrary, the processes of lymphocytopoiesis increase by the time of birth.

The purpose of the study. To establish morphometric features of the human spleen structure in comparison with the main stages of the immune response.

Materials and methods of research. The work was performed on autopsy material of spleens taken from 20 people (12 men, 8 women) aged from 27 to 65 years (median age - 39 years).

The results of the study. The immune system of the human spleen, called the white pulp, is represented by successive transitions into each other by periarterial lymphoid clutches, lymphoid nodules, and macrophage-lymphoid clutches. Periarterial lymphoid clutches, which occupy 40-90% of the total area of the white pulp on histological sections, are located around the pulpar arteries, regardless of the order of their division and diameter. The branches of the pulpary arteries always occupy a central position relative to the periarterial the lymphoid clutch. The density of its cellular elements near the walls of the pulpary arteries is 1.11-1.25 times greater than in the peripheral zone of the periarterial lymphoid couplings.
Lymphoid nodules are thickenings of the periarterial lymphoid clutches, which are constantly found in the areas of branch separation from the pulpary arteries. The artery of the lymphoid nodule has an eccentric position in relation to it, as well as their centers of reproduction., having different shapes on the organ sections. Location density
There are 1.1-1.3 times more lymphoid cells in the mantle of lymphoid nodules compared to their marginal zone.
Macrophage-lymphoid clutches (ellipsoid), consisting of 3-4 rows of cells (macrophages, lymphocytes, reticulocytes) are located around the non-muscular arterioles (terminal branches of the pulpal arteries), up to their separation into terminal capillaries flowing into the venous sinuses of the spleen. The length of the macrophage-lymphoid couplings varies from 45 to 75 microns, and the thickness ranges from 15 to 30 microns. The lymphoid (immune) apparatus of the spleen also includes numerous lymphocytes and plasma cells of the red pulp, separated from the structures of the white pulp by a boundary (intermediate, marginal) zone. On histological sections of the spleen, the fascial pulp occupies an area from 71.4% (in children) to 83.6% (in old age). Lymphocytes in the red pulp are located singly, as well as in groups (3-5 cells).
Macrophages and shaped blood elements are present in large numbers in the red pulp. The stroma of the red pulp is formed by reticular cells and reticular fibers, continuing into the reticular framework of periarterial lymphoid couplings, lymphoid nodules, ellipsoids, connective tissue trabeculae, as well as into the reticular structures surrounding the venous sinuses.
The venous sinuses (spleens), located in the red pulp in various directions, are surrounded by sparse reticular fibers., single reticular and smooth muscle cells.

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Numerous macrophages, lymphocytes, as well as erythrocytes and leukocytes are present near the walls of the venous sinuses. Macrophages are always present in the lumen of the venous sinuses, along with blood cells. In the process of postnatal During ontogenesis, the venous sinuses expand 2.32.5 times, from 18.5 microns in early childhood to 42.5 microns in the elderly.

All structural components of the white pulp of the spleen have a similar cellular composition, represented by small, medium lymphocytes, and reticular cells (70-85% of all cells). The composition of the white pulp always includes blast forms, large lymphocytes, plasmocytes, cells with a pattern of mitosis, and degeneratively altered cells. Their total number is 15-18% in periarterial lymphoid clutches and lymphoid nodules, and 20-24% in ellipsoids. The non-permanent cellular elements of the white pulp of the spleen are mast cells and eosinophils.

In the white pulp of the spleen there are always certain microtopographic intercellular associations. Periarterial lymphoid couplings, regardless of age, gender, and regional characteristics of the organ, have lymphocyte-macrophage complexes (5-10 small lymphocytes around a macrophage), lymphocyte- plasmocyte-macrophage complexes (small and medium lymphocytes around a plasmocyte or macrophage), paired and grouped (3-5 cells) arrangement of small and medium lymphocytes, rows of 3-4 reticular cells.

In the lymphoid nodules of the spleen, especially in their reproduction centers, there are always lymphocyte-macrophage complexes and a paired arrangement of small lymphocytes. In the marginal zone Radially arranged rows consisting of 5-7 small and medium lymphocytes are constantly present in lymphoid nodules. In the ellipsoids of the spleen, macrophage-lymphocyte complexes consist of 5-8 small and medium-sized lymphocytes surrounding the macrophage, as well as paired and grouped arrangement of small and medium-sized lymphocytes.

The white pulp of the spleen in newborns is characterized by morphological maturity. It occupies 15.6% of the total area of the spleen on histological sections, is characterized by complete structural formation of periarterial lymphoid clutches, lymphoid nodules (30-35% of them have reproduction centers), ellipsoids, and the presence of all types of intercellular associations characteristic of these structural components of white pulp.

The maximum morphological development of the white pulp of the spleen is observed in children aged 1-3 years, when its percentage in 1.5 times more than in newborns. In early childhood, the thickness of the periarterial lymphoid couplings is maximal in postnatal ontogenesis, and the size of the lymphoid nodules and their centers of reproduction, the maximum thickness and length of ellipsoids. At this age, the highest rates of the absolute number of lymphoid cells, the percentage of small lymphocytes, blasts and cells with a pattern of mitosis in all structural components of the white pulp are noted.

The involution of the white pulp of the spleen is morphologically most pronounced in old age, at which time there is 3.2 times less lymphoid tissue in this organ than in early childhood. In old age, the thickness of periarterial lymphoid couplings is 2.1 times less than in children, the size of lymphoid nodules decreases, in most of them the centers of reproduction disappear, the length and thickness of ellipsoids decrease, the specific gravity of the reticular stroma of all structural components of the white pulp increases.

The involutive changes in the cellular composition of the white pulp of the human spleen are manifested in a decrease in the amount of macrophage-lymphocytic and other cellular complexes, a decrease in the absolute number of lymphoid cells (by 1.25-4.0 times, compared with early childhood) decreases the percentage of small lymphocytes, blasts, cells with a pattern of mitosis, while increasing the number of degeneratively altered cells and

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macrophages. During the period of longevity, compared with old age, there are significant changes in the size and cellular composition of white There is no pulp of the spleen.
Sexual differences in the structure of the white pulp of the spleen begin to appear in adolescence, are most pronounced in the reproductive period (22-35 years of age) and are absent in childhood and old age. Women have a higher absolute number of lymphoid cells in their reproduction centers than men. lymphoid nodules (1.3-2.1 times) and ellipsoids (1.1-1.6 times), increased content of small lymphocytes, cells with a pattern of mitosis. In women, the structural components of the white pulp have a lower percentage of medium-sized lymphocytes and cells with signs of degeneration.

Periarterial lymphoid clutches and lymphoid nodules have pronounced regional morphological differences. In the are of the spleen gate, the thickness of lymphoid couplings, the size of lymphoid nodules, and the density of cells in them are 1,21,4 times greater than in the peripheral parts of the organ. However, there were no differences in the percentage of lymphoid and other cells in the peripheral and central parts of the white pulp. All structural components of the white pulp of the human spleen in postnatal ontogenesis differ in different levels individual variability. Differences between the maximum and minimum individual indicators of the size of periarterial lymphoid clutches, lymphoid nodules, ellipsoids, and the absolute and percentage of lymphoid cells in the elderly, senile age, and during longevity are more pronounced than in childhood.

Conclusion. Consequently, ICC populations normally have strict distribution mechanisms in the functional areas of the spleen. Such patterns expand the understanding of the immunomorphological features of this important secondary lymphoid organ. For studying the histoarchitectonics of the spleen requires understanding the phenomena of migration of cellular elements, their redistribution in BP and KP, taking into account the stages of the immune response.

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