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The Participation of the Spleen in Immunogenesis

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Abstract: The role of the spleen in immunity is multifaceted. It undergoes the final differentiation of T -, B – lymphocytes, it is one of the main immunosecretory, macrophage-containing organs and thus is an active participant in immune-protective reactions of the body.

Keywords: spleen, immunity, T-lymphocytes, B-lymphocytes, splenocytes, stroma, parenchyma.

One of the most important links in immunogenesis is the spleen. The role of the spleen in immunogenesis is multifaceted, since T - and B – lymphocytes undergo their final differentiation in it, it is an important and immunosecretory organ, contains a large number of macrophages - splenocytes. There are many contradictory questions about the role of the spleen in general, in immunogenesis, in particular. Observation of the literature of the last 40-50 years shows that the spleen as a whole has not been studied enough. Although there is quite original scientific information on the anatomy, physiology and pathology of the spleen. However, there is little modern literary information concerning the morphology of the organ, about its changes under various exogenous and endogenous influences.

The immune system, which includes 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 [1,2,3,4]. The capsule and connective tissue trabeculae of the spleen contain smooth muscle cells, their number is concentrated mainly in the area 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 [1,2,5,6,7]. The lymphoid follicles of the spleen differ sharply in their structure and function from similar structures of lymph nodes. The main difference between follicles is the prevalence of B – lymphocyte zones in them. One of the main structural components of the spleen are macrophages with a variety of lysosomes and phagosomes involved in a specific immune response. In the light of modern data, the stromal cells of the spleen differ from other phagocytes in their origin and functional features.

"Non-phagocytic reticular cells" have oval, fusiform or stellate shapes. Their cytoplasm contains a well-developed endoplasmic reticulum and a Golgi lamellar complex. Such cells are in close contact with the fibers of the intercellular substance and participate in their production. Such cells are called their own reticular tissue cells, and are sometimes referred to as “reticular tissue fibroblasts" [8,9,10]. "Undifferentiated reticular cells" are characterized by the presence of underdeveloped organoids, do not have clear structural features. A.Frieb (1976) and other authors note that the cells of the third group have some structural and histogenetic properties of cells of both the macrophage and fibroblastic series and suggest distinguishing among them “dentritic" and “interdigitating” reticular cells[11,12]. According to most researchers, "dentridic reticular cells" are involved in various immune reactions and, obviously, perform some functions inherent in macrophages.They are characterized by the presence on their surface of receptors for the Fs fragment of immunoglobulins and the C3 component of the complement, the ability to adhere to glass or plastic. They also capture and hold immune

complexes on their surface and supply antigens to T-lymphocytes. Depending on the location and immunocytochemical properties, the following types of "dentritic" cells are distinguished: a) follicular “dendritic" cells found in the light centers of lymphoid follicles; b) lymphoid “dendritic” cells, unlike previous cells, do not have receptors for the Fc fragment of immunoglobulins and the C3 component of the complement; c) interlacing "dendritic" cells located only in the light centers and periarterial zone of the follicles and forming interlacing and contacts with lymphocytes and with each other. If "dendritic" cells are considered to be a cellular component of the stroma of the B-dependent zones of the immune system, then "interdigitating reticular cells" are concentrated in the T-dependent zones of the spleen. Like the interdigitating cells of the thymus, they are responsible for the differentiation of T lymphocytes.

Biochemical and electron microscopic studies have established that the reticular fibers of the spleen stroma do not differ from ordinary fibroblasts producing collagen fibers. Collagen fibers are electron microscopically composed of fibrils and an interfibrillary matrix. The fibrils of reticular fibers have a diameter from 40 to 54 nm and an axial periodicity from 61 to 64 nm.Some fibrils do not have transverse striation.It should be noted that the reticular fibers of all mammals have a similar structure. Fibroblasts are actually stromal cells of the spleen involved in the production of intercellular matter and the creation of a microenvironment. Among the fibroblasts of the spleen, there are 2 varieties that differ in structural, possibly histogenetic features. Some are called "light", have a variety of shapes, and are characterized by the presence of a large, lighter core with a diffuse chromatin distribution. Their endoplasmic network is developed in different ways, represented by densely arranged tubules, in others in the form of separate cisterns. Lysosomes in such cells are very rare. The second group includes fibroblasts with a more compact nucleus. The cytoplasm of these cells is relatively narrow and more electrically dense, and has a well-developed endoplasmic network. Such cells are called "dark" fibroblasts. The problem of fibroblast histogenesis is also very controversial and far from being understood. Based on numerous works devoted to this problem, it can be concluded that the “light” fibroblasts of the spleen are formed from local sources - mesenchymal tissue. The origin of “dark” fibroblasts, in all probability, has a hematogenic bone marrow character, since studies of the spleen in the dynamics of embryogenesis have established that such cells are most often located between the endothelial cells of arterioles, venules and hemocapillaries of the organ.

The analysis of the studied literature sources and on the basis of our own studies of the spleen under various exo-endogenous influences gives reason to draw the following conclusions: 1). The spleen of various representatives of mammals has certain specific organ and functional features. Taking into account these features, it is customary to distinguish spleens of the exchangeable and depositing types. 2). Spleens of the exchangeable type mainly perform a hematopoietic function, provide differentiation of T-, B-lymphocytes. The human spleen belongs to this type. 3). Spleens of the depositing type are characterized by abundant blood flow and the content of macrophages – splenocytes in the intersinusoidal tissue and, accordingly, their blood supply prevails. 4). Stromal mechanocytes of the spleen are responsible for the creation of a hematopoietic microenvironment and are characterized by different morphology. “Dentridic” cells are predominantly localized in the B-dependent zones of the white pulp, while “interdigitating” reticular cells prevail in the T-dependent periarterial zones.

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