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Histological Analysis of the Spleen of White Rats in Postnatal Ontogenesis

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Abstract

This article was study the regularities of the age dynamics of the features of the histological structure of the white pulp of the spleen of white mongrel rats in postnatal ontogenesis from birth to 12 months of age. In an experiment on 40 white mongrel male rats of 5 age groups using histological and morphometric methods followed by statistical analysis, data on the morphometric parameters of the spleen of white rats in postnatal ontogenesis are presented. To accurately represent the reactions of the lymphoid structures of the spleen to any external stimuli or foreign elements, it is necessary to know the morphology of the limophid structures of the spleen normally.

Keywords: rats, immune system, spleen, white pulp, age-related changes, morphometric parameters.

Relevance. The immune system of humans and animals is one of the most sensitive systems of the body, which quickly reacts to external influences [6].

The largest peripheral organ of the immune system is the spleen [2; 5; 9], one of the main functions of which is the formation of a generalized immune response to the effects of various pathogenic agents, which ensures the maintenance of immune homeostasis and, consequently, the necessary level of adaptive potential of the body (APO) [3; 5,14,15].

The immunocompetent compartment of the spleen parenchyma is represented by its white pulp (BP), where two main B- and T-dependent zones are formed, that is, areas of localization of mainly B- and T-lymphocytes. These are, respectively, lymphoid follicles (LF) and periarterial lymphoid couplings (PALM) [2; 4; 5; 8].

A large number of scientific studies based on the study of this organ as a person have been devoted to the study of reactive changes of the spleen, in particular the structural elements of BP [4;5;8;12,17], and various agricultural and laboratory animals [1;3;4;7,16].

This article is devoted to an urgent problem – the development of the spleen as an organ of the

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immune system at the stages of postnatal ontogenesis.

Despite the existence of numerous modern studies on the structure of the spleen under the influence of external factors [6], the issues of morph functional changes in the lymphoid formations of the spleen in the age aspect remain insufficiently studied. To accurately represent the reactions of the lymphoid structures of the spleen to any external stimuli or foreign elements, it is necessary to know the morphology of the limophid structures of the spleen normally.

The aim of the study. To study the regularities of the age dynamics of the features of the histological structure of the white pulp of the spleen of white mongrel rats in postnatal ontogenesis from birth to 12 months of age.

Materials and methods: The study was conducted on 40 white male mongrel rats, weighing from 20 to 280 g., which were kept in vivarium conditions with a standard diet, free access to water, and the usual mode of purification. The slaughter of rats was carried out under ether anesthesia at the ages of newborns, 90, 180, 270 and 360 days from the beginning of the experiment. The rats were divided into five age groups, 8 individuals each: group 1 - newborns, group 2 - 90-day-old rats, group 3 - 180-day-old rats, group 4 - 270-day-old rats, group 5 - 360-day-old rats. The studies were carried out in compliance with the rules of humane treatment of animals, which are regulated by the "Rules for carrying out work using experimental animals" approved by the Ethics Committee of the Bukhara State Medical Institute named after Abu Ali ibn Sino (No. 18 of 16.01.2018), and were also based on the provisions of the Helsinki Declaration of the World Medical Association of 1964, amended in 1975, 1983, 1989, 1996, 2000, 2002, 2004, 2008, 2013 years .

To conduct a morphological study, the splenic fragments were fixed in a 10% formalin solution, passed through a battery of alcohols and poured into paraffin blocks according to generally accepted methods. Paraffin sections 5-8 microns thick were stained with hematoxylin – eosin. Histological and morphometric examination was performed using a Leica CME microscope, with a Leica Microsistems CH-9435 digital camera. At the same time, the relative area of the white pulp (in%), the diameters of lymphoid nodules (in microns), germinative centers (in microns), the width of the mantle zone (in microns), the marginal zone (in microns) of lymph nodes were determined on the sections of the tear.

Mathematical processing was performed directly from the general data matrix "Excel 7.0" with the involvement of the capabilities of the program "STTGRAPH 5.1", the standard deviation and representativeness errors were determined.

Results and their discussion: In newborn white rats, the spleen is covered from the outside with a thin connective tissue capsule, from which trabeculae extend deep into the organ. The white pulp of the spleen in newborn white rats is just beginning to form. It is quite difficult to distinguish between

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periarterial lymphatic couplings and lymphoid nodules, mantle and marginal zones can be determined in the formed nodules.

The study of histological preparations of other age groups of the spleen of white rats allowed us to establish certain relationships between its structural and functional zones. The spleen of white rats has a well-defined connective tissue capsule and trabeculae containing blood vessels.

The parenchyma of the spleen of white rats is represented by red and white pulp. The composition of the red pulp includes sinusoidal capillaries and splenic cords. The white pulp consists of numerous lymph nodes and periarterial lymphoid couplings.

The lymphoid tissue of the spleen, which forms a white pulp, on the sections represents rounded or elongated gray areas among the red pulp filled with erythrocytes. The white pulp is a cluster of lymphocytes around an eccentrically located arterial canal.

The relative area of the white pulp of the spleen of newborn white rats was 17.16 ± 1.06%, the greatest increase in this indicator was observed at 3 months of age (22.2 ± 1.72%,), and the largest at 12 months of age (12.32 ± 1.08%.). After 3 months of age, there is a decrease in this indicator. The diameter of lymph nodes increases by 1.92 times before the age of 3 months. After 3 months of age, this indicator also gradually decreases, where at 12 months of age it is equal to 407.98 ± 8.18 microns.

Germinative centers of lymph nodes in newborn white rats with histological sections have not been detected, the greatest increase in this indicator is observed at 3 months of age (147.8 ±7.66 microns), and the largest at 12 months (120.02±5.36 microns). The width of the mantle zone increases by 1.32 times before the age of 6 months. After 6 months of age, this indicator also gradually decreases, where at 12 months of age it is equal to 41.32 ± 1.12 microns. The width of the marginal zone and the periarterial zone from newborn age in accordance with age aspects began to increase to 6 months of age, starting from 6 months to one year of age decreased slightly.

The white pulp of the spleen of 3-month-old white rats is represented by well-defined lymph nodes and periarterialnymi lymphoid couplings, among the lymph nodes are dominated by nodules with germinative centers. In 3-month-old white rats, the width of the periarterial zone prevails over other indicators. In 9 and 12-month-old white rats, invasive changes prevail in lymph nodes and periarterial lymphatic couplings.

The percentage of white pulp in newborn white rats is quite low. According to our data, the proportion of white pulp increased markedly in subsequent age groups. The largest values of the white pulp area were observed in the spleen of white rats at 3 months of age, in other age groups, the size of the white pulp steadily decreased, confirming the fact of age-related organ involution.

In terms of the area of the white pulp, the diameter of the lymph nodes and the diameter of the

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germinal centers, the greatest growth is observed at 3 months of age, and in terms of the width of the mantle zone, the width of the marginal zone and the width of the periarterial zone, the greatest growth is observed at 180 days of age.

With age, all the studied morphometric parameters gradually decrease and the lowest indicator is noted at 12 months of age.

Conclusions: In the process of postnatal ontogenesis, the spleen of a white rat undergoes several morphological changes reflecting the processes of white pulp formation. In newborn white rats, the spleen is functionally immature, with hard-to-reach areas and poorly formed lymph nodes. At the age of three to nine months, the spleen has the maximum potential for immunogenesis. At the age of one year, the processes of age-related organ involution begin, manifested in a change in the embryonic centers of lymph nodes, a decrease in the number and area of lymph nodes, and then in the expansion of the mantle, edge, periarterial zone in the white pulp of the spleen.

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