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Age-related comparative morphological and morphometric indicators of the spleen of healthy rats and its lymphoid structures

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ABSTRACT

The spleen is an organ that not only effectively uses its own immune cells, but also mobilizes the body's immune cells to monitor immunity and protect other important organs, including the heart, kidneys and brain. Spleen generates a generalized immune response to antigen, inflammatory process and various pathogenic factors, which ensures the necessary level of the body's immune homeostasis, as well as flexibility.

Keywords: spleen, inflammation, morphologic and morphometric indicator.

INTRODUCTION

The spleen is located between the bottom of the stomach and the diaphragm in the left hypochondria region of the abdomen. In humans, it is about 12 cm long, 7 cm wide and 3 cm thick and weighs around 150-250 G. The spleen artery, spleen vein, efferent lymph vessels and spleen nerve plexus pass through the hilus, a depressed area in the capsule [1, 2, 3].

In humans, the spleen is formed from the dorsal intestinal tract at 5-6 weeks of embryonic development. At first, the spleen will consist of the sum of primary blood vessels and mesenchymal cells. Later, part of the cells is stratified into reticular tissue, which is made up of cells.

At the time of birth, the histogenesis of the spleen will be incomplete. Trabeculae and capsule composed of reticular cells are loose, the number of primary lymphatic nodules is low, while secondary nodules do not exist [Steiniger B.S., 2015].

The specific gravity of spleen white pulp in newborns is on average 1/7 of the size of the member. In infancy, it will be possible to distinguish between periarterial lymphoid couplings and lymphatic nodules in the white pulp. Lymphoid nodules are unevenly distributed in different parts of the organ.

They are more abundant in the peripheral part of the spleen, and in small numbers in the central part, where periarterial lymphatic couplings are abundant.

Neonatal spleen lymphatic nodules do not have reproductive centers. They are formed by the end of the 1st year. Then the amount of lymphatic nodules increases and reaches its maximum at 10 years of age.

In postnatal ontogenesis, a decrease in the overall immune function of the spleen is associated with a decrease in the humoral type, i.e., V-cell immune response, from multiple gixat. In addition, it is of particular importance that the spleen weakens the cellular immune response associated with the reduction of T-lymphocytes. In general, the decrease in the immune activity of the spleen depends on the state of V - and T-cell immunity and age-related observed sclerotic processes.

The spleen is an organ that not only effectively uses its own immune cells, but also mobilizes the body's immune cells to monitor immunity and protect other important organs, including the heart, kidneys and brain [4, 5, 6, 7]. Cells that play an important role in spleen functions are macrophages, monocytes, natural killer (TK) cells, and B - and T cells. The spleen is susceptible to physical injury, infections, and various immunological conditions, including cancer. Spleen enlargement or splenomegaly can be caused by anemia, infections, inflammation, cancer, metabolic disorders, and liver disease. The spleen has four important structures, namely, the capsule, the red pulp (KP), the white pulp (op), and the marginal zone (MZ) each region shows a distinct morphological structure and participates in specific physiological functions. The capsule contains sympathetic nerve fibers consisting of dense connective tissue, elastic and smooth muscle fibers, and the spleen nerve plexus. KP contains many sinuses filled with platelet-rich blood. Spongy cellular cords (Billrot cords) composed of reticular fibers and reticular cells mixed with a number of immune cells, such as macrophages, monocytes, granulocytes, B cells, T cells, and plasma cells, have been found among the sinuses. In the spleen, several KP function to produce specific functions, including blood filtration, antigenic stimulation, and proliferation of B and T cells, and antibodies with different properties. KP accounts for about 70% of the spleen volume in adults. Op is a bulib consisting of a periarterial lymph shell (Palm) that contains a lymphocyte-rich area, around which the arterial vessels are especially around the central artery and the central arterioles, follicles and loose lymphatic tissue are blurred. Palm is the shell of mainly SD4+ and T-cell lymphocytes that envelop the central arterial vessels. Follicles contain not only B - cells, but also T-cells located next to the Palm. Between important immunological activity and cell destruction and different immune cells, cross-Aloca occurs. The marginal zone (MZ) bordering the Palm and follicles has few lymphocytes, but consists of many macrophages and antigen-producing cells (Aich). B cells immunological activation go to Mz as a result of antigenic meeting [9]. Many lymphocytes in MZ migrate to the corresponding t - and B areas. MZ contains the highest concentration of blood antigens than other areas in the spleen, as arterial blood in the spleen is released into MZ. Marginal Zone B cells show somatic hypermutation, clonal expansion [10], and positive selection of B cells [11]. B-cell clonal expansion also occurs in the germinal center of the B-cell follicle after antigenic stimulation.

The spleen generates a generalized immune response to antigen, inflammatory process and various pathogenic factors, which ensures the necessary level of the body's immune homeostasis, as well as flexibility.

When blood flow in the body is disrupted, the spleen enlarges and, according to some researchers, can act as a depot and accumulate a large amount of blood. Due to its contraction, the spleen releases the blood collected in it into the vascular stream, as a result of which its volume becomes smaller, the amount of erythrocytes in the blood increases.

In chronic immune inflammation, proliferative processes occur in the white pulp of the spleen. The volume of white pulp, the density of cell elements in lymphatic nodules and periarterial lymphatic mucosa increases. Apoptosis and macrophagal reaction are enhanced in spleen lymphoid structures.

The purpose of the study. to study the normative morphological and morphometric indicators of the White Rat spleen in postnatal ontogenesis.

MATERIALS AND METHODS

for striking morphological and morphometric indicators in the talok, an experiment was carried out on 10 newborn, 3, 6, 9, 12-month-old OK randomized rats in the stationary conditions of the vivarium of the Bukhara State Medical Institute. All animal experiments are carried out in accordance with the international principles of the European Convention for the protection of vertebrates, which is used for experimental and other scientific purposes, as well as in accordance with the "rules for performing work using experimental animals".

The object of research will be histological material from various parts of the spleen of experimental animals. The study used techniques such as staining of micro-preparations with hematoxylin-eosin, staining of micro-preparations according to Van Gizon, general blood test, method of variational statistics using Strelkov tables.

RESULOTS AND DISCUSSION

The study found that the weight of newborns ranged from 4.2 g to 5.6 G, with an average of 5.16±0.14 g. The absolute weight of the spleen is 0.02 - 0.03 g, with an average of 0.032±0.002 g. The weight index ranged from 0.535% to 0.684% with an average of 0.607±0.02%.

The newborn white squid spleen was 5.2 mm to 8.3 mm long and averaged 7.2±0.22 mm. The width of the spleen is 1.4-2.7 mm, and on average - 2.2±0.16 mm. The width of the spleen was from 0.8 mm to 1.5 mm, and on average - 1.2±0.11 mm.

The relative area of the white pulp was 14.5 to 20.1%, with an average of -17.26±0.64%. The relative area of connective tissue elements is 5.2% - 6.6%, with an average of 5.74±0.16% (relative to the total area of the spleen incision).

The Palm was 91.2 µm to 107.2 µm in diameter, averaging - 101.2±2.05 µm. The Lt is 216.4 - 252.2 µm in diameter, with an average of -232.76±3.65 µm. In a third of the total number of lymphatic nodules, it is possible to identify the areas of the mantle and Border.

The width of the mantle area ranged from 26.4 µm to 38.3 µm, with an average of -36.28±1.07 µm. The boundary area is 56.3 - 69.7 µm wide with an average of 65.32±1.45 µm. The width of the Periarterial area ranged from 38.6 µm to 46.4 µm, with an average of -43.16±1.06 µm.

The white pulp of the spleen of newborn white rats is made up of lymphocytes of different stages of maturation.

The White bat spleen is fully formed during the three-month period. When the spleen of healthy rats in the 3-month period was studied, the following data were obtained:

Animal body weight in the 3-month period ranged from 90 g to 130 g, averaging - 104.16±3.68 g. The absolute weight of the spleen is 0.3 - 0.7 g, with an average of - 0.42±0.037 g. The weight index ranged from 0.333% to 0.551% with an average of 0.45±0.02%. When compared to newborn white bats, the animal weight increased by 22.04 times and the member's absolute weight increased by 14.25 times.

The length of the spleen was from 21.4 to 29.2 mm, and on average - 24.78±0.63 mm. The growth rate is about 262.0% compared to newborn white rats. The width of the spleen was 4.6-6.4 mm, and on average - 5.84±0.26 mm. The growth rate is -177.2% compared to newborn white bats. The thickness of the spleen was from 1.8 mm to 3.9 mm, and on average - 2.82±0.19 mm. The growth rate is about 133.3% compared to newborn white rats.

In the histological preparations of Healthy White Rats of 3 months of age, it was observed that the red and white pulp of the member parenchyma is clearly separated from each other.

The white pulp had a relative area of 18.8% to 26.2%, averaging - 22.2±0.59% (figure 3.1.3). When compared to newborn white bats, the relative area of the white pulp increased by 28.4%. The relative area of connective tissue elements was from 5.0% to 6.1%, and on average – 5.42±0.1% (compared to the total area of the spleen incision)

In the white pulp of the spleen, it is possible to clearly distinguish between periarterial lymphatic couplings and lymphatic nodules. The Palm was 112.6 µm to 139.6 µm in diameter, averaging - 132.14±1.56 µm. The growth rate is about 30.9% compared to newborn white rats. Lymphatic nodules

increased in diameter by 92% when compared to newborn rats, and ranged from 341.8 µm to 476.05 µm, averaging - 456.05±13.27 µm. The prosent ratio of primary and secondary LTS is 32% -68% respectively. Reproductive centers formed in secondary LTS have been identified. The Km lari ranged in diameter from 92.6 µm to 167.8 µm, averaging - 147.8±6.73 µm. Lt is large and some have merged with each other. Spleen lymphatic nodules are mostly circular, oval, and oblong in shape.

In most cases, functional areas are clearly differentiated in LTS. The width of the mantle sphere ranged from 37.7 µm to 49.45 µm, with an average of - 45.32±0.89 µm. The boundary area is 70.3 µm - 84.7 µm wide with an average of -75.14±1.32 µm. The width of the Periarterial area ranged from 81.9 µm to 89.4 µm, with an average of 85.04±0.69 µm. The width of the mantle, border and periarterial areas increased by 28.45%, 20% and 90.6% respectively when compared to newborn bats.

The study found that the total number of lymphocytes in LTS without a breeding Centre was 42-53 with an average of 45.3±1.01 cells.

The White bats of the 6-month period weighed between 188 g and 240 g, averaging - 221.2±5.4 g. The absolute weight of the spleen is 0.6 - 0.9 g, with an average of - 0.89±0.032 g. The weight index ranged from 0.315% to 0.405% with a mean of 0.348±0.01%. Compared to rats in the 3-month period, rats increased their body weight by 1.95 times and the member's absolute weight by 1.52 times.

The length of the spleen was from 24.4 mm to 35.7 mm, and on average - 31.76±1.0 mm. The growth rate is about 18.6% compared to three - month-old white rats. The width of the spleen was 4.9-7.8 mm, and on average - 6.34±0.03 mm. The growth rate is about 6.73% compared to three - month-old white rats. The thickness of the spleen was from 2.4 mm to 4.4 mm, and on average - 3.12±0.19 mm. The growth rate is about 6.86% compared to three - month-old white rats.

In white bats of the control group at 6 months of age, the relative area of the spleen white pulp ranged from 16.2 to 24.6% with an average of -20.54±0.69%. When compared to white bats of the 3-month period, the relative area of the white pulp decreased by 8.1%. Connective tissue elements had a relative area of 5.6% to 6.8%, and averaged - 6.21±0.12% (relative to the total area of the spleen incision).

The Palm was 118.2 µm to 141.6 µm in diameter, averaging - 126.22±1.55 µm. The growth rate is about 3.1% compared to three - month-old white rats. Lymphatic nodules ranged in diameter from 380.8 to 477.05 µm, averaging - 410.96±10.44 µm. The prosent ratio of primary and secondary LTS is 34% - 66% respectively. Breeding centres ranged in diameter from 132.4 µm to 147.7 µm, averaging - 135.08±2.53 µm. The diameter of the LTS and kmes decreased by 9.7% and 9.42% respectively when compared to the White bats of the 3-month period. LTS have a circular, oval and oblong shape.

The width of the spleen lt lari mantle domain ranged from 40.5 µm to 50.4 µm, averaging 44.56±1.06 µm. The boundary area is 75.5 - 86.2 µm wide with an average of 80.72±1.26 µm. The width of the Periarterial area ranged from 84.9 µm to 94.7 µm, with an average of 89.42±1.06 µm. The extent of the mantle, boundary, and periarterial areas increased by 2.74%, 4.64%, and 5.15% respectively when compared to the White bats of the 3-month period.

The study found that the total number of lymphocytes in LTS without a breeding centre was 53-61 with an average of 57.2±0.97 cells. The total number of lymphocytes in LTS that do not have a breeding center increased by 21.0% when compared to white bats in the 3-month period.

The total number of lymphocytes in Periarterial lymphatic Mufta was 56-61 with an average of 58.4 ±0.76 cells. The total number of lymphocytes in Periarterial lymphatic mufts increased by 22.7% when compared to white rats in the 3-month period.

The weight of laboratory animals in the 9 - month period was from 220 g to 280 g, and on average-246.33±5.52 g. The absolute weight of the spleen is 0.7 - 1.0 g, and the average is 0.78±0.028 g. The weight index ranged from 0.302% to 0.370% with an average of 0.317±0.01%. Compared to white bats in the 6-month period, the animal weight increased by 1.16 times and the member's absolute weight increased by 1.06 times.

The length of the spleen was from 30.3 mm to 37.4 mm, and on average - 34.21±0.74 mm. The growth rate is about 7.7% compared to six - month-old white rats. The width of the spleen was 5.1 - 7.8

mm, and on average - 6.52±0.26 mm. The growth rate is about 2.84% compared to six - month-old white rats. The spleen was 2.5 mm to 4.4 mm thick and averaged 3.21±0.17 mm. The growth rate is about 2.8% compared to six - month-old white rats.

In healthy white bats of 9 months, the relative area of white pulp ranged from 18.1% to 22.4% with an average of 20.14±0.42%. When compared to white bats of the 6-month period, the relative area of the white pulp decreased by 2.2%. The relative area of connective tissue elements is 5.7% - 6.6%, and the average is 6.23±0.1% (relative to the total area of the spleen incision).

The Palm was 133.2 µm to 142.3 µm in diameter, averaging - 136.72±0.93 µm. The growth rate is about 1.1% compared to six - month-old white rats. Lymphatic nodules ranged in diameter from 378.7 µm to 447.3 µm, averaging - 413.84±6.31 µm. The prosent ratio of primary and secondary LTS is 35% - 65% respectively. Breeding centres ranged in diameter from 114.4 µm to 142.8 µm, averaging - 117.62±2.52 µm. The diameter of the Lt and kmes, compared to the White bats of the 6-month period, decreased by 1.47% and 5.85% respectively. LTS have a circular, oval and oblong shape.

Spleen lt lari ranged in mantle area width from 38.4 µm to 49.9 µm, averaging - 44.77±1.06 µm. The boundary area is 70.1 -82.4 µm wide with an average of 77.34±1.13 µm. The width of the Periarterial area ranged from 78.7 µm to 92.8 µm, averaging - 84.97±1.29 µm (figure 3.1.7). The width of the mantle, border and periarterial areas decreased by 4.0%, 5.74% and 5.24% respectively when compared to white bats of the 6-month period.

The study found that the total number of lymphocytes in LTS without a breeding centre was 49-56 with an average of 52.2±0.74 cells. When compared to white rats in the 6-month period, the total number of lymphocytes in LTS decreased by 9.6%.

The total number of lymphocytes in Periarterial lymphatic Mufta was 56-65 with an average of 61.3±0.83 cells. When compared to white bats in the 6-month period, the total number of lymphocytes in Palm increased by 3.2%.

White bats from the 12-month period in the control group weighed between 260 and 320 g, with an average of 282.44±6.48 g. The member has an absolute weight of 0.8 - 1.1 g, with an average of 0.88±0.03 g. The weight index ranged from 0.288% to 0.354% with an average of 0.325±0.01%. Compared to the White bats of the 9-month period, animals increased their weight by 1.1 times, and the member's absolute weight by 1.1 times.

The length of the spleen was from 34.4 mm to 43.7 mm, and on average - 36.57±0.89 mm. The spleen is 5.3-8.2 mm wide with an average of 6.56±0.31 mm. The thickness of the spleen was from 2.7 mm to 4.5 mm, and on average - 3.23 ±0.20 mm. The linear dimensions of the spleen: length, width and thickness increased by 6.7%, 0.61% and 0.62%, respectively, when compared with white bats of the nine-month period.

In healthy white bats of the 12-month period, the relative area of white pulp ranged from 16.2% to 21.8% with an average of -18.44±0.49%. When compared to white bats of the 9-month period, the relative area of the white pulp decreased by 8.64%. Connective tissue elements have a relative area of 5.8% -6.8%, with an average of 6.38±0.11% (relative to the total area of the spleen incision).

The Palm was 131.4 to 141.8 µm in diameter, averaging - 136.56±1.23 µm. Lymphatic nodules ranged in diameter from 370.7 µm to 437.3 µm, averaging - 408.98±7.19 µm. The prosent ratio of primary and secondary LTS is 49% -50% respectively. It is difficult to distinguish between their Km. The diameter of the breeding centres ranged from 110.2 µm to 132.7 µm, averaging 120.12±2.43 µm. The diameters of Palm, lt, and kms decreased by 0.85%, 1.68%, and 6.23% in mos Hol when compared to nine-month-old white bats. White pulp LTS have an oval and oblong shape.

The width of the spleen lt lari mantle area ranged from 35.4 µm to 47.7 µm, with an average of - 41.32±1.12 µm. The width of the boundary sphere is 68.4 - 76.7 µm, with an average of -72.42±0.89 µm. The width of the Periarterial area ranged from 74.8 µm to 84.7 µm, with an average of - 79.98±1.06 µm (figure 3.1.8). The extent of the mantle, border and periarterial areas decreased by 8.32%, 5.27% to 6.24%, respectively, when compared to the White bats of the 9-month period.

The study found that the total number of lymphocytes in LTS without a breeding center was 47-53 with an average of 50.3±0.65 cells. When compared to white rats in the 9-month period, the total number of lymphocytes in LTS decreased by 3.6%.

The total number of lymphocytes in Periarterial lymphatic Mufta was 53-61, with an average of 55.8 ±0.86 cells. When compared to white bats in the 9-month period, the total number of lymphocytes in Palm decreased by 4.2%.

Analysis of the results of the study showed that the highest growth rate of body and limb absolute weight of newborn white bats occurred in the 3 - month period, occurring respectively - 22.14 and 16.24 times, while the minimum occurred in the 12-month period, increasing correspondingly-1.1 i 1.15 times.

The growth rate of spleen length, width and thickness was highest in the 3-month period, at 262.0%, 180.2% and 143.3% in mos Hol, and lowest in the 12-month period, at 6.79%, 0.61% and 0.62% respectively.

In newborn white bats, the relative area of spleen white pulp was 17.16±0.64%, increasing in later ages and decreasing after a peak period of 6 months of 22.2±0.49%, 6 months of age, and having a value of 18.54±0.98% over a 12-month period.

The relative area of connective tissue elements is 5.84±0.14% in neonatal White bats, with this indicator found to be relatively low (5.42±0.1%) in animals at 3 months, and high (6.48±0.1%) at 12 months.

Palm diameter was 101.2±2.05 μm in newborn white bats, with the highest value of this indicator observed in the 9-month period (138.72±0.93 μm). The 12-month period decreased to 136.56±1.23 μm.

The LTS increased in diameter by 1.92 times over a 3-month period and were 467.05±13.27 μm. Gradually decreasing after the 3-month period, it reached a value of 407.98±7.29 μm during the 12-month period. Breeding centers were not detected in newborn white bat spleen histological preparations, with the highest incidence of this indicator being in the 3-month period (147.8±6.83 μm), while the minimum was observed in the 12-month period (120.02±2.43 μm).

The highest value of mantle, boundary, periarterial area width was found to occur in the 6 - month period, corresponding to - 46.56±1.06 μm, 80.72±1.36 μm, 89.42±1.06 μm, decreasing after the 6-month period, and corresponding to the 12-month period-41.32±1.22 μm, 72.62±0.89 μm, 79.98±1.06 μm.

The total number of lymphocytes in LTS without a breeding Centre was higher at 6 months and in Palm at 9 months, respectively - 57.2±0.87 and 60.3±0.83 cells. In the 3-month period, the rate was the lowest (respectively - 47.3±1.01 and 46.2±1.1 cells).

CONCLUSION

The spleen of newborn rats is not functionally mature, lymphatic nodules are not fully formed, it is difficult to distinguish all areas in them, the Centers of roughness are not identified. Up to the six-month period, the spleen has the highest immune activity, manifested by an abundance of lymphatic nodules with a center of reproduction, a high number of lymphocytes in them and in periarterial lymphatic mufts. From the period of nine months, involutional changes are observed, which are classified by an increase in the amount of connective tissue elements in the spleen, a decrease in the total number of lymphocytes in lymphatic nodules that do not have reproductive centers, periarterial lymphatic couplings and reproductive centers.

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