



Effect of Radiation on the Thymus Gland

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Abstract: This article is devoted to morphological indicators in the study of the state of pathologies of the thymus gland, thymus tissue under irradiation, which are urgent problems of modern radiology and immunology, as well as the prediction of the occurrence of the disease, which presents an analysis of the morphometric parameters of the rat thymus after irradiation. The study was conducted on 64 white-beardless 6-month-old rats. The results of the study of the morphometry of the thymus showed that in postnatal ontogenesis, their average mass, size, thickness of layers varied in different ways. The volume of the thymus, length, perimeter and thickness of thymocytes varies unevenly depending on age. In rats with chronic radiation exposure, the growth rate of these parameters is slowed down in comparison with the control group.

Chronic radiation sickness negatively affected the number and size of the Gassal body and led to a decrease in the number of T – lymphocytes and a delay in their maturation rate.

Key words: thymus, Gassal's corpuscles, T-lymphocytes.

Introduction. One of the most reactive, fast-reacting systems of the body to the effects of damaging factors at the earliest stages is the human immune system. It is formed by a complex of organs and tissues that create protection from foreign endogenous and exogenous influences [1]. The thymus as the primary organ of the immune system largely determines not only the state of peripheral organs of immunogenesis, but also the severity of protective reactions of the whole organism [4]. The regulatory and censor role of the thymus in immunogenesis is associated with the state of its reticuloepithelium and lymphocytes. The cells of thymic bodies (Gassal) produce a humoral factor of the thymus, which determines the immune competence of lymphoid tissue [3]. It is known that the development of oncological diseases depends on genetic causes, as well as on hormonal regulation, immune reactions of the body and other factors. However, recently, scientists have been paying the most attention to studying the state of immunity. It was revealed that the central organ of the immune system, the thymus, not only with age, but also with a number of diseases, including various infections, severe injuries, malignant neoplasms, undergoes atrophic changes [2]. It has been established that the tumor process in the body leads to the development of acquired immunodeficiency [5].

An analysis of the literature shows that in many works the morphological status of the thymus has been superficially studied. There is no clear idea of studying the cellular composition of parts of the thymus when exposed to physical or chemical environmental factors in the age aspect.

All this requires a deeper study of the morphological changes occurring in this organ under the influence of various factors.

The purpose of the study: to study the morphofunctional features of the rat thymus in normal and on the background of radiation sickness.

Research material and methods: The study used 180 white randomized male rats in a newborn and at the age of 3, 6, 9 months, who are in normal vivarium conditions. At the beginning of the experiment,



all sexually mature rats were quarantined for a week, and after the exclusion of somatic or infectious diseases, they were transferred to the usual vivarium regime. The animals were divided into 2 groups (n=54): group I – (intact) control (n=28); group II – rats exposed to radiation for 20 days from 2 months of age at a dose of 0.2 Gy (the total dose was 4.0 Gy) (n=26);

The results of the study: The wall thickness of the trabecular artery of 3-month-old rats in the distal part averaged 16.4 ± 0.19 , and the veins averaged 16.6 ± 0.25 microns, the inner diameter of the artery averaged 21.6 ± 0.31 , and the veins averaged 18.7 ± 0.22 microns.

The thickness of the wall of the arteriole of the cortical layer was on average – 15.7 ± 0.14 , and the venules on average – 14.1 ± 0.13 ; the inner diameter of the arteriole of the cortical layer was on average – 17.4 ± 0.43 , and the venule is on average – 23.4 ± 0.19 microns.

The thickness of the wall of the arteriole of the medulla was on average – 14.2 ± 0.16 , and the venules on average – 14.3 ± 0.21 ; the inner diameter of the arteriole of the medulla was on average – 16.7 ± 0.27 , and the venule is on average – 17.9 ± 0.13 microns.

In 6-month-old rats, the diameter of the right internal thoracic artery ranged from 217.4 to 260.1 microns, on average 234.3 ± 0.22 , the left internal thoracic artery was 213.5 to 257.9 microns, on average 233.8 ± 0.68 . The width of the right internal thoracic vein varied from 198.6 to 322.8, on average 302.5 ± 0.24 microns, and the left is equal to 269.2 to 304.6, on average 281.2 ± 0.13 .

The thickness of the thymus capsule of 6-month-old baby rats at the gate was on average 4.7 ± 0.21 , at the anterior end on average 7.6 ± 0.34 , and at the posterior end on average 6.1 ± 0.14 microns. The diameter of the trabecula in the proximal part averaged 12.1 ± 0.19 , in the distal part it is on average 8.7 ± 0.24 microns. The depth of the trabecula averaged 12.7 ± 0.31 . The area of the thymus lobule of 6-month-old baby rats is on average 65.3%.

The wall thickness of the trabecular artery of 6-month-old rats in the proximal part averaged 19.7 ± 0.32 , and the veins averaged 17.1 ± 0.24 microns, the inner diameter of the artery averaged 25.1 ± 0.15 , and the veins averaged 24.4 ± 0.33 microns.

The wall thickness of the trabecular artery of 6-month-old rats in the distal part averaged 16.9 ± 0.27 , and the veins averaged 17.8 ± 0.16 microns, the inner diameter of the artery averaged 22.4 ± 0.21 , and the veins averaged 19.2 ± 0.3 microns.

The thickness of the wall of the arteriole of the cortical layer was on average – 16.4 ± 0.17 , and the venules on average – 14.9 ± 0.23 ; the inner diameter of the arteriole of the cortical layer was on average – 18.2 ± 0.33 , and the venule is on average – 24.1 ± 0.25 microns.

The thickness of the wall of the arteriole of the medulla was on average – 15.6 ± 0.36 , and the venules on average – 15.1 ± 0.11 ; the inner diameter of the arteriole of the medulla was on average – 17.8 ± 0.17 , and the venule is on average – 18.1 ± 0.21 microns.

In 9-month-old rats, the diameter of the right internal thoracic artery varied from 221.5 to 252.8 microns, on average 242.3 ± 0.34 , the left internal thoracic artery was 218.2 to 259.4 microns, on average 230.8 ± 0.25 . The width of the right internal thoracic vein ranged from 206.7 to 323.2, on average 302.9 ± 0.84 microns, and the left is equal to 272.5 to 311.3, on average 294.2 ± 0.42 .

The thickness of the thymus capsule of 9-month-old rats at the gate was on average 3.9 ± 0.41 , at the anterior end on average 7.3 ± 0.29 , and at the posterior end on average 5.6 ± 0.11 microns. The diameter of the trabecula in the proximal part averaged 11.8 ± 0.17 , in the distal part it is equal to an average of 8.1 ± 0.14 microns. The depth of the trabecula averaged 12.2 ± 0.71 . The area of the thymus lobule of 9-month-old baby rats is on average 53.7%.

The wall thickness of the trabecular artery of 9-month-old rats in the proximal part averaged – 20.3 ± 0.18 , and the veins averaged 18.8 ± 0.34 microns, the inner diameter of the artery averaged 26.3 ± 0.25 , and the veins averaged 25.6 ± 0.13 microns.



The wall thickness of the trabecular artery of 9-month-old rats in the distal part averaged 17.7 ± 0.17 , and the veins averaged 18.3 ± 0.21 microns, the inner diameter of the artery averaged 23.7 ± 0.31 , and the veins averaged 19.8 ± 0.4 microns.

The thickness of the wall of the arteriole of the cortical layer was on average – 17.3 ± 0.21 , and the venules on average – 15.2 ± 0.13 ; the inner diameter of the arteriole of the cortical layer was on average – 19.1 ± 0.23 , and the venules were on average – 25.2 ± 0.35 microns.

The thickness of the wall of the arteriole of the medulla was on average – 16.1 ± 0.19 , and the venules on average – 16.6 ± 0.23 ; the inner diameter of the arteriole of the medulla was on average – 18.3 ± 0.33 , and the venule is on average – 19.3 ± 0.15 microns.

Conclusions: Morphometry of the thymus showed that the length, perimeter and thickness change unevenly and unequally with age. In rats with chronic radiation exposure, the growth rate of these parameters is slowed down.

1. Chronic radiation sickness negatively affected the number and size of thymocytes.
2. Chronic radiation sickness has led to an increase in irregularly shaped lymphoid corpuscles.

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