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Morphometric Parameters of Testicles of White Rats Under the Influence Of Radiation

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Annotation: Any external physical, chemical, biological impact on the organism leads to changes in the structure and function of the organs of this organism. In this case, the body responds by changing the clinical and laboratory parameters, including the morphology of organs, within the framework of compensatory-adaptive mechanisms [1, 14]. In this article, the morphometric parameters of the testicles of rats of different ages that received radiation were examined. It has been proven in the experiment that the radiation, which has a negative effect on the morphological structures of the testicle, has a significant effect on all the morphometric indicators of this organ. Chronic radiation sickness affects the vasculature of the testes and convoluted tubules, where the diameter of arterioles and venules, as well as the diameter of the convoluted tubules, is further reduced by radiation.

Key words: epididymis, radiation, rat, morphology, morphometry.

Relevance of the study. Radiation sources are actively used in medicine and pharmacy, research and industrial production, scientific fields. The use of ionizing radiation sources in various areas of human life has become an integral part of the existence of modern society and a necessary condition for further scientific and technical development. More than 40 countries have their own nuclear industry, nuclear power plants, mobile, ship, research and other power plants [1,4,8,9,10,11,21,22]. However, in addition to the obvious positive aspects, as a result of this, the radiation burden on the population increases, the risk of various levels of radiation, accidents increases, which in turn causes not only the negative impact of direct radiation and socio-psychological factors on human health, but also destabilizes the fragile ecological balance. leads to the formation of regions. Any external physical, chemical, biological impact on the organism leads to changes in the structure and function of the organs of this organism. In this, the body responds by changing the clinical and laboratory parameters, including the morphology of the organs, within the framework of compensatory-adaptive mechanisms [1,8,9,11,13,14]. One of such external influencing factors are acute and chronic sources of radiation, which have been proven to have a negative effect on organs and systems of the body in certain doses. Radiation sickness caused by acute and chronic radiation (irradiation) is a pathological condition of the organism, caused by exposure to doses of ionizing radiation higher than the maximum allowed standards [2,4,6]. Changes in the body under the influence of radiation, including the morphological characteristics of organs, and the development of treatment-prophylactic measures to reduce the effects of radiation have not lost their relevance [3,6,8,15].

Male infertility has many causes, ranging from unhealthy lifestyle choices to exposure to various chemical and physical factors. Among them, ionizing radiation has a special place,

because it is classified as a group 1 carcinogen by the International Agency for Research on Cancer and is included in the list of occupational carcinogens by the International Labor Organization. Nevertheless, "the number of radiation facilities and the number of their employees are increasing by approximately 15 and 6% per year, respectively." This emphasizes once again that reproductive health and related aspects are not only a medical but also a social problem. All over the world, special attention is being paid to research aimed at improving the early detection, treatment and prevention of diseases of the male reproductive system, including the epididymis, caused by various physical factors. In this regard, determining the amount of ionizing radiation that causes pathological changes in the male body; development of a health monitoring system for workers working with radiation sources; determine the level of risk of infertility and the occurrence and development of tumors in these individuals; The study of the mechanisms of action of drugs that reduce radiation exposure remains a priority area of scientific research. Assessment of the morphofunctional state of the testicles after long-term exposure to ionizing radiation in chronic radiation sickness, comparison of the morphometric and morphological characteristics of these organs, and at the same time, development of an optimal algorithm for prevention, diagnosis and treatment are among the priority tasks for scientists. . Targeted measures are being implemented in our country to fundamentally improve the healthcare system and improve the quality of medical services to the population. For this purpose, a number of tasks were defined, including "increasing the efficiency, quality and accessibility of medical care, implementing comprehensive measures aimed at supporting a healthy lifestyle and preventing diseases, including a healthy lifestyle the formation of a system of medical standardization, the introduction of high-tech diagnostic methods and treatment by creating effective models of patronage and clinical examination. Despite the positive results achieved in improving the quality of treatment of radiation-induced diseases of the reproductive system, in particular, oncological diseases, there is a need to develop new evidence-based treatment methods for specialists in this field. Solving the set tasks allows to reduce morbidity and mortality due to complications of oncological diseases that develop as a result of radiation, raise the quality of modern medical services in the diagnosis and treatment of diseases to a new level, and improve the use of modern technologies in the provision of quality medical services.

The purpose of the study is to determine the morphometric parameters of the testicles of rats of different ages that received radiation.

Material and methods. An experimental study was conducted on the material obtained from the testicles of 100 purebred rats aged between 180 and 360 days, which were housed in a vivarium with a 12-hour light regime, access to standard food and water. 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=100): Group I - rats that received radiation at a dose of 0.2 Gy (total dose 4.0 Gy) for 20 days from the age of 180 days (n=50); II - group - rats receiving radiation at a dose of 0.2 Gy (total dose 4.0 Gy) for 20 days from the age of 360 days (n=50).

The animals were slaughtered in the morning, on an empty stomach, under ether anesthesia by decapitation. After the abdominal cavity was opened, the extra testicles were removed and their mass, length, width, volume and tissue density were studied. The mass of each testicle was measured on an electric scale, and the length and width were measured with a millimeter tape. The obtained testicles were fixed in Bouin's solution. After passing through alcohol solutions of increasing concentration, they were embedded in hot paraffin, and then sections of testicular tissues with a standard thickness of 6-7 μm were prepared, which were oriented sagittally or

frontally. Sections were stained with hematoxylin and eosin according to Van Gieson. Prepared histological preparations were examined under a NLCD-307B binocular microscope (Novel, China).

Research results. In the 180-day-old male rats of the experimental group, the testicles were oval in shape and covered with a membrane whose thickness varied from 16.4 to 29.42 μm, with an average of 23.2 ± 1.324 μm. Its wall is represented by bundles of collagen and elastic fibers. Bundles of elastic fibers are thin and mainly oriented longitudinally. In places, thin reticular fibers form a fine ring network. The outer surface of the shell is covered with 2-3 layers of longitudinally oriented flat mesothelial cells. In the 180-day-old male rats of the experimental group, the testicles were oval in shape and covered with a membrane whose thickness varied from 16.4 to 29.42 μm, with an average of 23.2 ± 1.324 μm. Its wall is represented by bundles of collagen and elastic fibers. Bundles of elastic fibers are thin and mainly oriented longitudinally. In places, thin reticular fibers form a fine ring network. The outer surface of the shell is covered with 2-3 layers of longitudinally oriented flat mesothelial cells. Under the testicular membrane there are intrathecal vessels: arterioles with sizes from 127.94x127.94 to 132.43x132.43 μm, the average is 130.6 ± 0.433 μm. Their wall thickness varies from 18.03 to 32.04 μm, with an average of 25.1±1.459 μm. These arterioles pass in a transverse direction from the front, free edge of the testis to the surface where the epididymis is located. The distance between arterioles is from 360 to 775 μm, and their number is 9-12. The diameter of the venules is from 23.64x33.85 to 36.41x53.71 μm, the average is 50.3±0.865 μm, the wall thickness is 5.4±0.259 μm.

Convoluted seminiferous tubules form the base of the testis. Diameter - 144.52 - 192.22 μm (average - 172.5 ± 4.014 μm). The cross-sectional area of the tubes is 20198.4 - 27443.6 μm2 (average - 23358.6 ± 782.48 μm2). (see Fig. 1).

The basis of the tubular wall is the fibrous structure of connective tissue, which consists of reticular fibers and bundles of collagen and elastic fibers. Reticular fibers around the seminiferous tubules form a "honeycomb"-like network in transverse histological sections. The thickness of the spermatogenic epithelium ranges from 43.45 to 68.99 μm, the average is 53.1 ± 2.283 μm.

The first, more strongly stained layer of cells is the Spermatagonium. Their average size is 8.5±0.327 μm. The second layer consists of larger cells - spermatocytes (size 12.5 ± 0.148 μm).

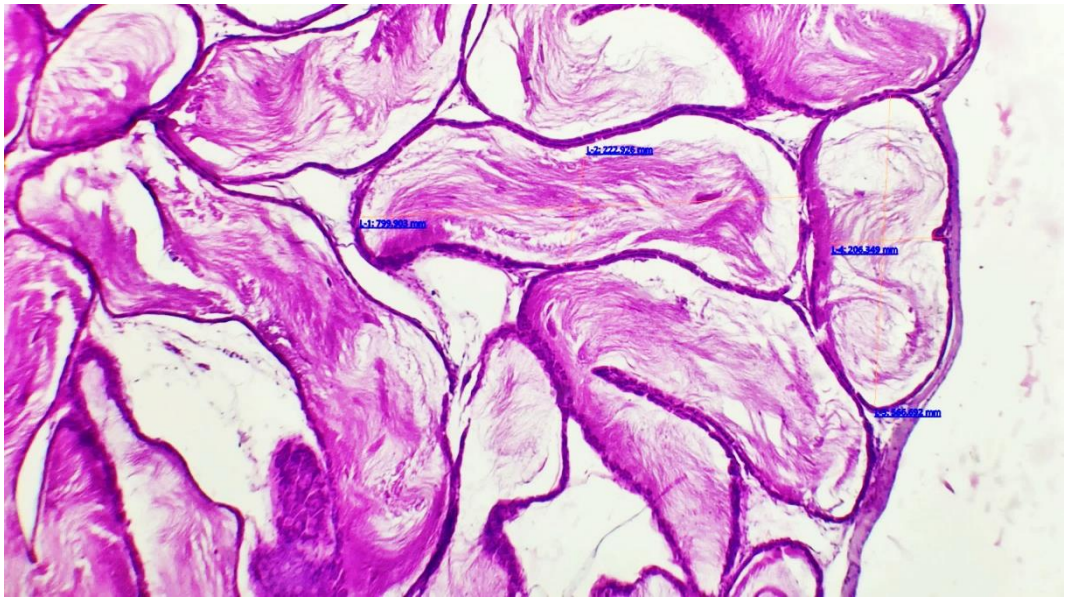

Fig. 1. Testicles of a 180-day-old rat suffering from chronic radiation sickness. 1-convoluted seed tubules; 2-channel space. Stained with hematoxylin-eosin. Ob. 10 x Ok. 10

The third layer of spermatids, their average size is 8.3±0.120 μm. The diameter of the free space (light zone) of the seminiferous tubule is 42.6-61.5 μm, on average - 55.6 ± 2.13 μm. Accompanying arterioles, venules, and capillaries are located in the intercanal spaces. The dimensions of intertubular arterioles range from 29.71x29.71 to 33.47x33.47 μm, the average is 31.5±0.322 μm, the average wall thickness is 9.9±0.193 μm. The inner membrane of arterioles is formed from endothelial cells with elongated nuclei located in the basement membrane. Outside the inner shell, there is an internal elastic membrane, which has a well-defined fold. The middle shell consists of a series of spirally arranged smooth muscle cells, the nuclei of which are spindle-shaped. The outer shell is made of loose connective tissue. The wall of intertubular venules is formed from one layer of endothelocytes. The average wall thickness of venules is 5.3±0.220 μm, and the cavity diameter is 27.3±0.721 μm. The capillary cavity diameter is on average 5.8±0.378 μm. Their wall thickness is 3.9±0.225 μm. Leydig cells - testicular endocrinocytes - are located in the interductal spaces in a triangular shape. The size of Leydig cells is from 7.43 to 10.61 μm, the average is 9.2 ± 0.290 μm, and their number in the field of vision is from 25 to 39, the average is 31.8 ± 1.269. Reticular and collagen fibers in the intertubular spaces form a network, in the rings of which Leydig cells are located.

In the 360-day-old male rats in the experimental group, the testicles have an oval shape, are covered with a protein film on the outside, and its frame is made of bundles of reticular fibers and collagen fibers. In some places bundles of elastic fibers are identified. Outside, it is covered with 2-4 rows of flat mesothelial cells. The shell wall thickness ranges from 20.2 to 38.05 μm, with an average of 29.4±1.301 μm. Under the testicular capsule there are subcapsular arterioles with diameters ranging from 148.66x148.66 to 155.54x155.54 μm, with an average of 152.3±0.577 μm. The average wall thickness of arterioles is 33.7±0.822 μm. Arterioles are located at a distance of 374 μm to 796 μm. In addition to them, venules are identified under the capsule, their sizes range from 29.85x42.61 to 55.14x72.40 μm, the average is 69.1 ± 0.525 μm. Their wall thickness is 6.0±0.351 μm. The diameter of the testis is from 205.96 to 227.57 μm, on average - 216.2 ± 1.976 μm, based on curved seminiferous tubules. The field of vision of seminiferous tubules ranges from 34321.7 to 40054.6 μm2, the average is 36692.8±573.29 μm2. Spermatogenic epithelium is located inside the wall of seminiferous tubules. Its height ranges from 57.51 to 73.46 μm, with an average of 67.4 ± 1.225 μm. The layered arrangement of the spermatogenic epithelium does not differ much from previous ages. In the cavity of the seminiferous tubules, there is an intercellular trophic substance that forms the light zone. The diameter of the free space is from 60.2 to 78.7 μm, the average is 69.8±1.85 μm.

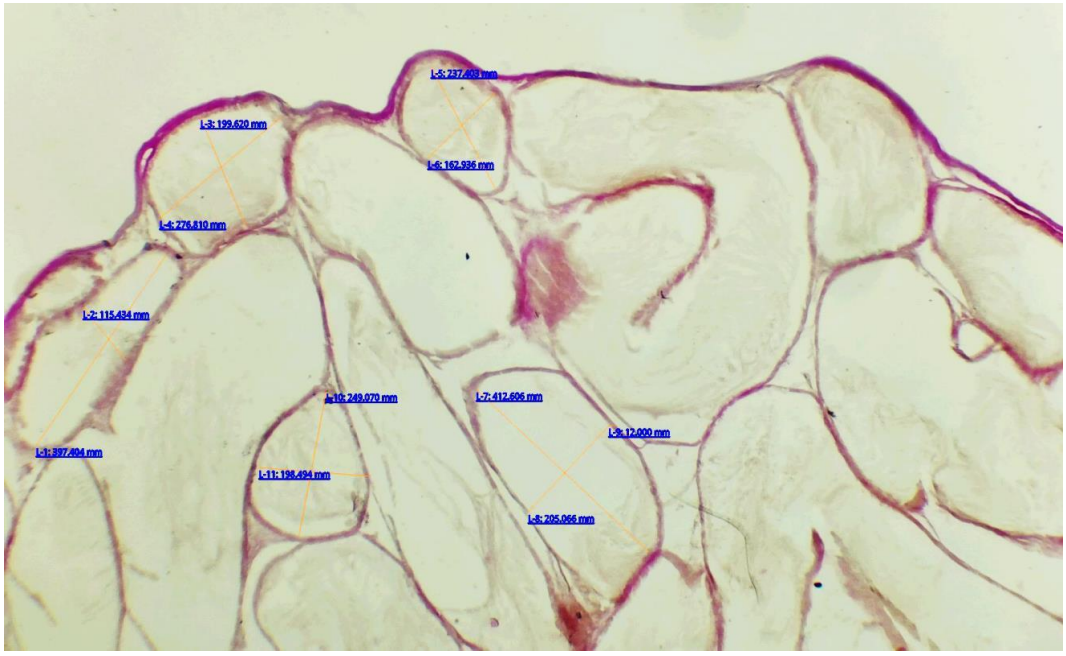

Fig. 2. *Testicles of a 360-day-old rat suffering from chronic radiation sickness. 1-convoluted seed tubules; 2-channel space. Stained with hematoxylin-eosin. Ob. 10 x Ok. 20*

In the intertubular spaces there are Leydig cells, the size of which is 8.54-12.17 μm. Average - 11.0±0.310 μm. The number of Leydig cells ranges from 30 to 47, on average - 41.3±1,230 μm. In addition, accompanying arterioles and venules are located in the intertubular spaces. The diameter of arterioles ranges from 34.19x34.19 to 37.24x37.24 μm, with an average of 35.8±0.265 μm. The average wall thickness of intertubular arterioles is 12.2±0.302 μm. It consists of 3 shells. Internal - forms endothelial cells with elongated nuclei located in the basement membrane. Outside of it there is an internal elastic membrane, which has a well-defined tooth. The middle shell is represented by a single layer of spirally arranged smooth muscle cells with elongated nuclei. The outer shell is made of loose connective tissue. In the wall of intertubular venules there are single-layered endothelial cells with large nuclei. The average wall thickness of venules is 6.5±0.382 μm. The average diameter of the capillary cavity is 6.9 ± 0.410 μm. The capillary wall is formed by a single layer of endothelocytes with an elongated nucleus located at a close distance from each other. The wall thickness of the capillaries is 4.7±0.094 μm. Reticular fibers in the intertubular spaces form a fine ring network, surrounding the intertubular vessels and Leydig cells. Bundles of collagen fibers are multidirectional.

Summary. Irradiation, which has a negative effect on the morphological structures of the epididymis, leads to a delay in the development of spermatogenic epithelium in all morphometric parameters, including the thickness of the albuginea. Latency is more pronounced in purebred rats at 180 days and less at 360 days. This is related to the activation of the body's protective and compensatory mechanisms. Chronic radiation sickness affects the vasculature of the testes and convoluted tubules, where the diameter of arterioles and venules, as well as the diameter of the convoluted tubules, is further reduced by radiation.

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