Section: Research Paper

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MORPHOLOGICAL PICTURE OF THE LUNGS UNDER THE INFLUENCE OF CHRONIC EXPOSURE IN THE EXPERIMENT

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Annotation.The aim was to determine and evaluate the morphological picture of the lungs of experimental animals under the influence of chronic irradiation. It was found that the macroscopic picture of the lungs of white outbred rats of the main and control groups were unchanged. The study of the microscopic picture of the lungs revealed no pathomorphological changes in the control group. In laboratory animals that received chronic irradiation, pathomorphological signs were found, in the form of plethora of the segmental vein, venous plethora in the peribronchial vessels, dystrophic changes in the interstitial tissue of the lungs, and growth of the wall of small bronchi due to fibrosis, thinning of the alveolar wall, changes in the bronchial wall and formation of connective tissue were noted. tissue, lymphocytic infiltration between the bronchi and interstitial tissue, focal emphysema. It has been proven that these pathomorphological changes were the result of the negative effect of chronic irradiation on the lungs of white outbred rats.

***Key words*:** lungs, chronic exposure, macroscopic and microscopic picture, pathomorphological changes.

Any external physical, chemical, biological impact on the body leads to a change in the structure and function of the organs of this organism, including the respiratory organs. At the same time, the body reacts by changing clinical and laboratory parameters, as well as the morphology of organs, within the framework of compensatory and adaptive mechanisms. One of these influencing external factors are acute and chronic sources of radiation, which, in certain doses,

negatively affect the organs and systems of the body. Radiation sickness that occurs during chronic irradiation is a pathological condition of the body caused by exposure to radiation doses exceeding the maximum permissible norms [2,8,9].

The pathogenesis of radiation sickness is explained by the direct and indirect effects of ionizing radiation on the body. The direct effect of radiation on the protein is due to its denaturation. This is accompanied by a violation of physico-chemical processes in damaged cells, accompanied by depolymerization of nucleic acids. At the same time, the permeability of the cell membrane increases, the radiation-sensitive components of the cell include the nuclear chromosome and cytoplasm [1,5]. A single rapid exposure to radiation on the entire body can be fatal, but the accumulation of the same dose in a few weeks or months causes significantly less harm. The effects of radiation exposure also depend on the affected area. For example, a dose of more than 6 Gy when irradiated with the whole body can be fatal. However, with limited exposure to a small area for several weeks or months, for example, during antitumor radiation therapy, a person is able to transfer a dose that will be 10 times greater without any special consequences [3,8,11].Respiratory organs are one of the main targets of radiation exposure. In this regard, the first clinical and morphological works on poorly studied lung pathology arising under the influence of radionuclides appeared in the literature [4,7]. At the same time, criteria for assessing environmental risk are being developed using various methods. The impact of radioactive aerosol particles on the lung tissue can lead either to degeneration or to the death of individual cells, the appearance of calcified tissue in this place. The small number of research works on the study of pathomorphological changes in various internal organs, including respiratory organs under the influence of chronic radiation in the experiment determined the relevance and necessity of this study.

The purpose of the study. Determination and comparative evaluation of the morphological picture of the respiratory organ - the lungs of experimental animals under the influence of chronic radiation**.**

Materials and methods of research. For experimental studies, 60 white mongrel male rats weighing 160-180 g were selected. All laboratory animals were taken from the same vivarium and were of the same age. The selected sexually mature (3-month-old) mongrel white rats were kept in standard vivarium conditions with relative humidity (50-60%), temperature (19-22 °C) and lighting mode (12 hours of darkness and 12 hours of light mode).

The preparation of a standard vivarium diet of laboratory animals was carried out according to the recommendations compiled by Nuraliev N.A. et al. [2016]. When keeping, killing and anatomical autopsy of laboratory animals, all the rules of biological safety and ethical principles of working with laboratory animals were strictly observed [Nuraliev N.A. et al., 2017]. Permission was obtained from the Ethics Committee of the Ministry of Health of the Republic of Uzbekistan (official letter No. 4 dated 16.11.2022, Protocol No. 8 dated 20.12.2022) to conduct experiments with laboratory animals (white mongrel rats).

All laboratory animals were divided into 2 groups:

The main group - laboratory animals contained in a standard vivarium diet and drinking water, which were irradiated daily for 20 days at a dose of 0.2 Gray 1 time per day - chronic irradiation (n=30).

The control group consisted of laboratory animals contained in a standard vivarium diet and drinking water that did not receive chronic radiation (n=30).

All animals involved in the experiment (n=60) were representative by age, sex, weight, conditions of keeping and feeding. Both groups of white mongrel rats were formed at the same time.

In the experiment, irradiation of laboratory animals was carried out using the gamma-therapeutic apparatus AGAT-P1 (Estonia), the radiation source was Co-60. Studies related to the irradiation of animals were conducted in the Bukhara branch of the Republican Specialized Scientific and Practical Center of Oncology and Radiology of the Ministry of Health of the Republic of Uzbekistan.

To study the morphological parameters of the organs of laboratory animals, research methods were used, which are widely used in experimental studies (anatomical autopsy). All biological micro-objects were examined using a trinocular microscope (PRC) model HL-19 with software. The main objects of the study were histological preparations obtained from representatives of white mongrel rats. Preparation of histological preparations consists of 4 stages, which were carried out by traditional methods. A mechanical rotary microtome of the YD-315 brand (PRC) was used to prepare the preparations, the prepared incisions were stained with hematoxylin and eosin.

In laboratory conditions, lungs isolated from white mongrel rats exposed to 0.2 Gray chronic radiation daily for 20 days were fixed in a 10% formalin solution and stained with hematoxylin and eosin. Micro-preparations were photographed under a microscope at a size of 4x10.

Statistical processing of the obtained material was carried out using traditional variational methods of statistics using the Excel program. Statistical processing was carried out on a personal computer based on Pentium IV processors using a software kit for biomedical research. The principles of evidence-based medicine were used in the organization and conduct of research.

The results obtained and the discussion. Histological preparations prepared by us from the lungs of all laboratory animals (n=60) were microscopized and described in accordance with the rules. All changes were analyzed in a comparative aspect.

The essence of the macroscopic method of investigation was that after opening the animals, the organs of the thoracic and abdominal cavities, as well as the genitals and brain were visually examined. During the examination, attention was paid to the location, condition of the parenchyma, size, consistency and color of the organ. In addition, attention was paid to the relative location of organs, the presence of exudate in the pleural and abdominal cavities, the condition of large and small blood vessels. The evaluation of the obtained results of macroscopic

studies was carried out in a comparative aspect with the selected control group, as well as normative data published in the works of other researchers.

During the study, we described only the condition of the lungs of the studied animals. The macroscopic picture of the lungs of intact animals was practically unchanged. When examining the lungs, no visible pathological changes were found, both lungs are pink, the parenchyma is unchanged, the general structure of the lungs is not disturbed, no tubercles, spots, seals were found during visual examination. Such a normal lung condition was visually observed in all animals of the control group.

When studying the microscopic picture of the lungs in white mongrel rats receiving chronic radiation (the main group), pathological morphological changes were found. Further, we found it necessary to cite and describe some histological preparations prepared from the lungs of animals of the main group and to cite the occurrence of a certain pathomorphological trait as a whole for the main group.

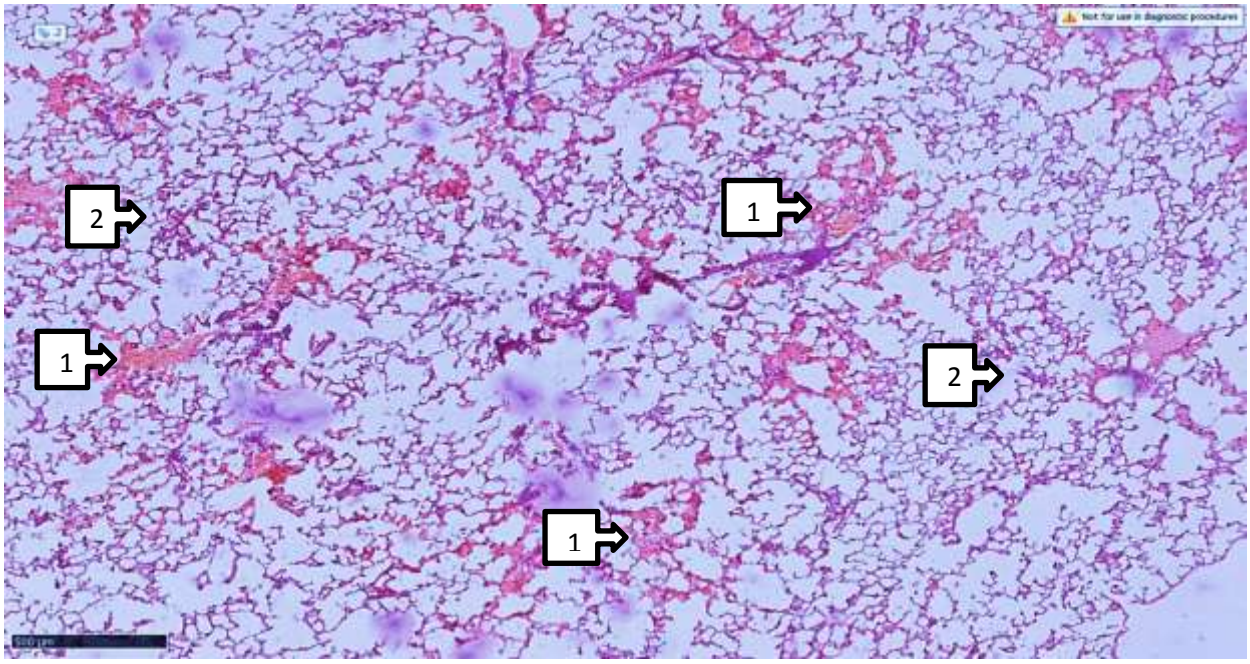

Fig. 1. Microscopic picture of the lung tissue of a white mongrel rat that received chronic radiation (fullness in the vessels of the segmental vein is determined (1), sometimes dystrophic changes in interstitial tissue (2). Staining with hematoxylin-eosin, 4x10).Как it is known that the alveoli are hemispherical protrusions and consist of connective tissue and elastic fibers, lined with the thinnest alveolar epithelium and braided

with a dense network of blood capillaries. In the alveoli, there is a gas exchange between blood and atmospheric air. The inner layer of the alveolar wall is formed by respiratory alveocytes (type 1 alveocytes) and secretory alveocytes (type 2 alveocytes), alveolar macrophages (type 3 alveocytes). Type 2 alveocytes are located on the basement membrane and produce a surfactant (surfactant) lining the inside of the alveoli and preventing their decay. Together, alveolocytes of all types form the alveolar epithelium and lie on the basement membrane [3,5].

Fullness is determined in the vessels of the segmental vein (63.33%, n= 19), dystrophic changes in the interstitial tissue of this organ are visible in places (56.67%, n=17).

When studying another histological preparation of a white mongrel rat of the main group, it was revealed (Fig. 2) that pathomorphological changes are also determined here, characterized by the fact that the wall of the alveoli is thinned in 21 animals (70.0%), in addition, there are various signs of fullness in the vessels of the lungs (80.0%, n=24), in the peribronchial vessels there are also signs of venous fullness (76.67%, n=23).

When describing lung tissue, the condition of the walls of the bronchioles and alveoli is considered very important, since they are important for gas exchange. In this regard, microscopy of another histological preparation (Fig. 3), prepared from the lungs of a laboratory animal that received chronic irradiation, revealed an overgrowth of the wall of small bronchi due to fibrosis (73.33%, n=22), vascular fullness (80.0%, n=24), thinning of the wall of the alveoli (66.67%, n=20).

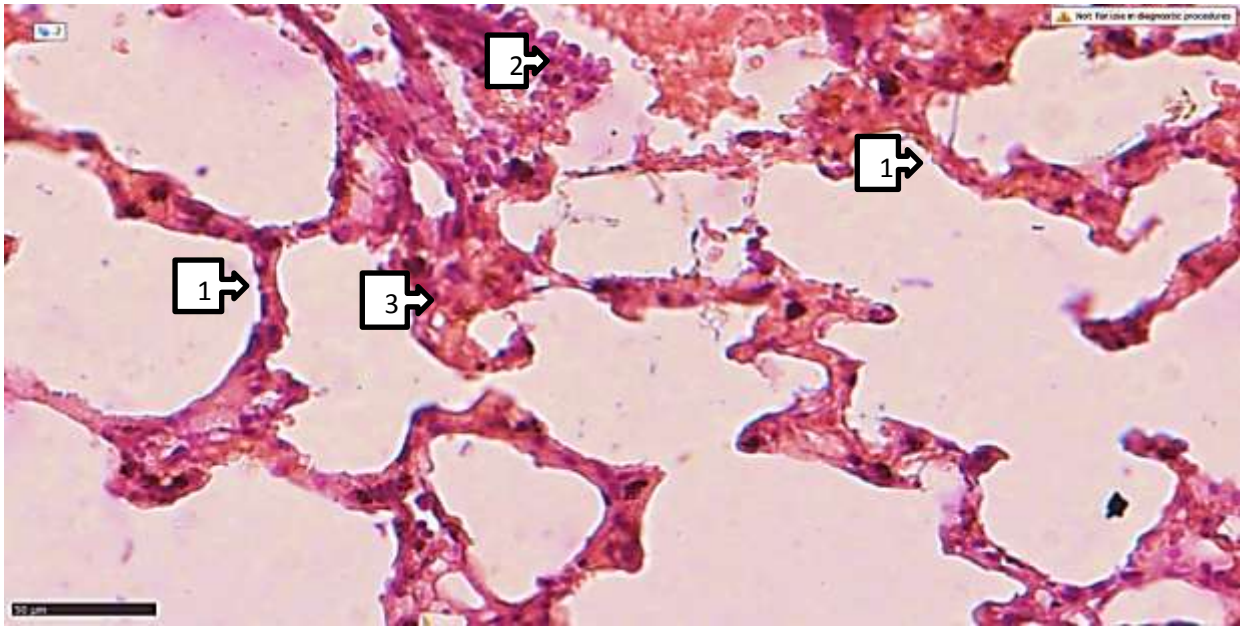

Fig. 2. Microscopic picture of the lung tissue of a white mongrel rat that received chronic radiation (the wall of the alveoli is thinned (1), there are various signs of fullness in the vessels (2), signs of venous fullness are also detected in the peribronchial vessels (3). Staining with hematoxylin-eosin, 40x10).

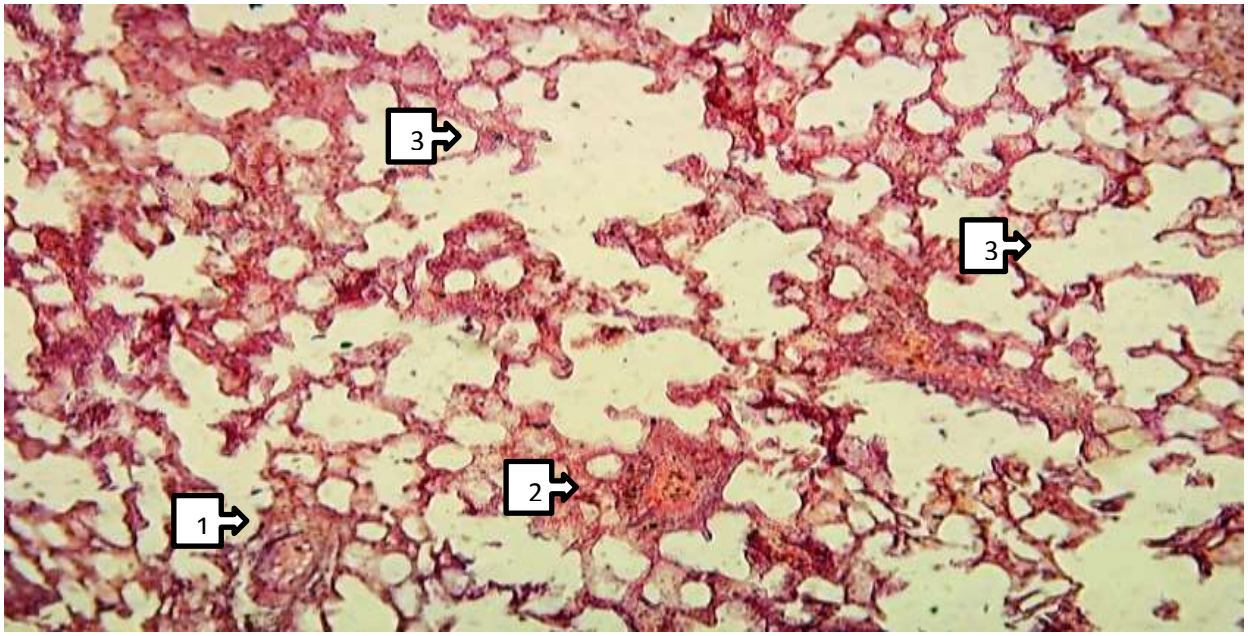

Fig. 3. Microscopic picture of the lung tissue of a white mongrel rat that received chronic irradiation (there is an overgrowth of the wall of small bronchi due to fibrosis (1), vascular fullness (2), thinning of the wall of the alveoli (3). Staining with hematoxylin-eosin, 4x10).

In addition, a change in the bronchial wall and the formation of connective tissue (66.67%, n=20), light lymphocytic infiltration between the bronchi and interstitial tissue (43.33%, n=13) were detected, which were recognized as

pathomorphological signs (Fig. 4).

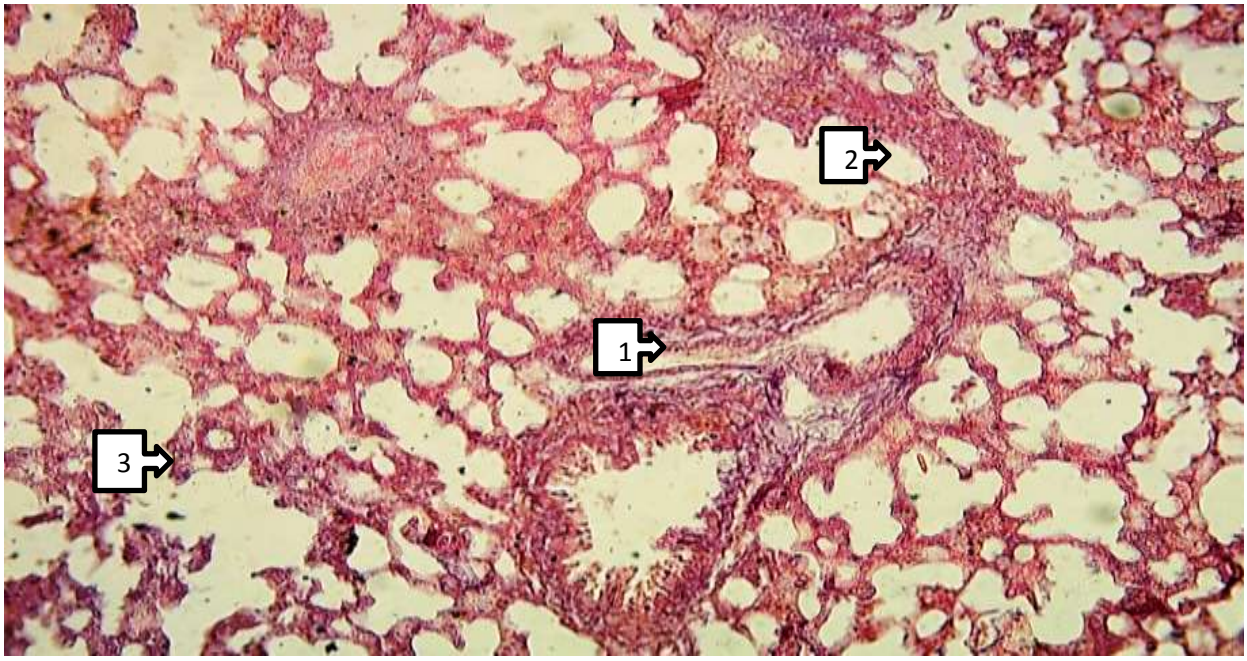

Fig. 4. Microscopic picture of lung tissue of a white mongrel rat that received chronic radiation (bronchial wall change and connective tissue formation (1), mild lymphocytic infiltration between bronchi and interstitial tissue (2), focal emphysema (3). Staining with hematoxylin-eosin, 4x10). Lymphocytic infiltration is a key histological finding that indicates the process of acute cellular rejection, histologically it is considered as an increase in cell area. Activated lymphocytes that are associated with cellular damage may have enlarged nuclei and cytoplasm compared to normal lymphocytes [6,12].

In addition, another pathomorphological sign was found in the lung tissue of experimental animals - focal emphysema (36.67%, n=11). As is known, focal emphysema is characterized by increased airiness due to excessive expansion of the alveoli and destruction of the walls between them, accompanied by destructive changes in the alveolar.

We have proved that the causes of pathomorphological lung changes found in animals of the main group were chronic radiation exposure.

Conclusions.

1. It was found that the macroscopic picture of the lungs of intact white mongrel rats were practically unchanged. When examining the lungs, no visible pathological changes were found, both lungs are pink, the parenchyma is

unchanged, the general structure of the lungs is not disturbed, no tubercles, spots, seals were found during visual examination. Such a normal lung condition was visually observed in all animals of the main and control groups.

2. When studying the microscopic picture of lung tissue, pathological morphological changes were not detected in the control group. Pathomorphological signs were found in laboratory animals that received chronic radiation, in the form of segmental vein fullness (63.33%), venous fullness in peribronchial vessels (76.67%), as well as dystrophic changes in interstitial lung tissue (56.67%).

3. It was revealed that in the animals of the main group, the wall of the alveoli was thinned (70.0%), there was an overgrowth of the wall of small bronchi due to fibrosis (73.33%), thinning of the wall of the alveoli (66.67%), a change in the wall of the bronchi and the formation of connective tissue (66.67%), lymphocytic infiltration between the bronchi and interstitial tissue (43.33%) and focal emphysema (36.67%). All these pathological morphological changes are a consequence of the negative effect of chronic radiation on the lungs of white mongrel rats.

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