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MORPHOLOGICAL ASPECTS OF FEATURES OF CHRONIC LUNG IRRADIATION IN EXPERIMENTAL,

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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.

Relevance: Any external physical, chemical, biological effect on the body leads to a change in the structure and function of the organs of a given organism, including the respiratory system. In this case, 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 is acute and chronic sources of radiation, which, in certain doses, negatively affect the organs and systems of the body.

Radiation sickness, which occurs during chronic exposure, 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 protein is due to its denaturation. This is accompanied by a disruption of physicochemical

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processes in damaged cells, accompanied by depolymerization of nucleic acids. At the same time, the permeability of the cell membrane increases; radiation-sensitive components of the cell include the nuclear chromosome and cytoplasm [1,5].

A single, rapid exposure of the entire body to radiation can be fatal, but the accumulation of the same dose over several weeks or months causes significantly less harm. The effects of radiation also depend on the area affected. For example, a dose of more than 6 Gy from whole-body irradiation 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 tolerate a dose that will be 10 times higher without any special consequences [3,8,11].

The respiratory organs are one of the main targets of radiation exposure. In this regard, the first clinical and morphological works on little-studied lung pathology arising under the influence of radionuclides appeared in the literature [4,7].

At the same time, environmental risk assessment criteria are being developed using various methods. The impact of radioactive aerosol particles on lung tissue can lead to either degeneration or death of individual cells, and the appearance of calcified tissue in a given place.

The small number of scientific research works on the study of pathomorphological changes in various internal organs, including the respiratory organs under the influence of chronic irradiation in an experiment, determined the relevance and necessity of this study.

Purpose of the study. Determination and comparative assessment of the morphological picture of the respiratory organ - the lungs of experimental animals under the influence of chronic irradiation.

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

The preparation of a standard vivarium diet for laboratory animals was carried out according to the recommendations compiled by Nuraliev N.A. et al. [2016]. When keeping, killing and anatomical dissection of laboratory animals, all rules of biological safety and ethical principles of working with laboratory animals were strictly observed [Nuraliev N.A. et al., 2017]. Permission was received from the Ethics Committee of the Ministry of Health of the Republic of Uzbekistan

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(official letter No. 4 of November 16, 2022, protocol No. 8 of December 20, 2022) to conduct experiments with laboratory animals (white outbred rats).

All laboratory animals were divided into 2 groups:

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

Control group - laboratory animals kept in a standard vivarium diet and drinking water, which did not receive chronic irradiation (n=30).

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

In the experiment, laboratory animals were irradiated using a γ-therapeutic device AGAT-R1 (Estonia), the radiation source was Co-60. Research related to animal irradiation was carried out at the Bukhara branch of the Republican Specialized Scientific and Practical Center for 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 that are widely used in experimental studies (anatomical dissection).All biological microobjects 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 outbred rats. The preparation of histological preparations consists of 4 stages, which were carried out using traditional methods. To prepare the preparations, a YD-315 mechanical rotary microtome (China) was used; prepared sections were stained with hematoxylin and eosin.

In laboratory conditions, lungs isolated from albino rats exposed to chronic irradiation of 0.2 Gray daily for 20 days were fixed in a 10% formaldehyde solution and stained with hematoxylin and eosin. Photographing of micropreparations was carried out under a microscope with dimensions of 4x10.

Statistical processing of the obtained material was carried out using traditional variational statistical methods using the Excel program. Statistical processing was carried out on a personal computer based on Pentium IV processors using a software package for medical and biological research. The principles of evidence-based medicine were used in organizing and conducting research.

Results obtained and discussion. The histological preparations we prepared from the lungs of all laboratory animals (n=60) were microscoped and described in

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accordance with the rules. All changes were analyzed from a comparative perspective.

The essence of the macroscopic research method 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 position of organs, the presence of exudate in the pleural and abdominal cavities, and the condition of large and small blood vessels. The results of macroscopic studies were assessed in a comparative manner with the selected control group, as well as normative data published in the works of other researchers.

During our study, we described only the condition of the lungs of the animals studied. The macroscopic picture of the lungs of intact animals was practically without certain changes. When examining the lungs, no visible pathological changes were found, both lungs were pink, the parenchyma was unchanged, the general structure of the lungs was not disturbed, and no tubercles, spots, or compactions were found during a visual examination. This normal state of the lungs was visually observed in all animals of the control group.

When studying the microscopic picture of the lungs in white outbred rats that received chronic irradiation (the main group), pathological morphological changes were discovered. Next, we considered it necessary to present and describe some histological preparations prepared from the lungs of animals of the main group and to give the occurrence of a certain pathomorphological sign as a whole for the main group.

During the description, it was established that most of the alveoli have the same shape and structure (Fig. 1).

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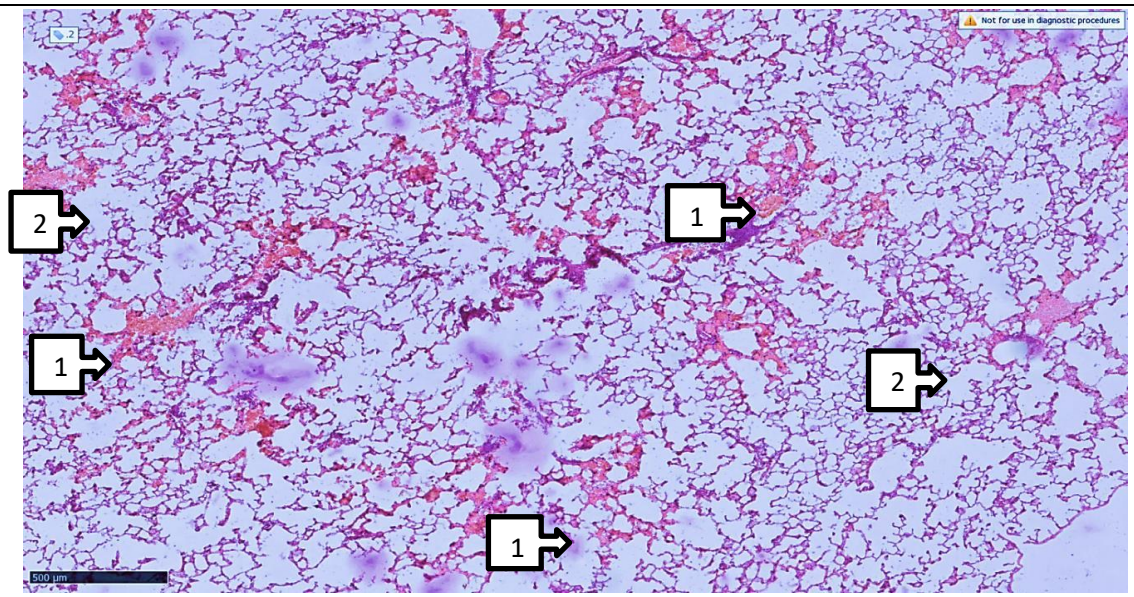

Rice. 1. Microscopic picture of the lung tissue of a white outbred rat that received chronic irradiation (pleasure is determined in the vessels of the segmental vein (1), in places degenerative changes in the interstitial tissue (2). Staining with hematoxylin-eosin, 4x10).

As is known, the alveoli are hemispherical protrusions and consist of connective tissue and elastic fibers, lined with the finest alveolar epithelium and intertwined with a dense network of blood capillaries. In the alveoli, gas exchange occurs between the 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 surfactant (surfactant) that lines the inside of the alveoli and prevents their collapse. Collectively, alveolocytes of all types form the alveolar epithelium and lie on the basement membrane [3,5].

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

When studying another histological specimen of a white outbred rat of the main group, it was revealed (Fig. 2) that here too pathomorphological changes are determined, characterized by the fact that the wall of the alveoli is thinned in 21 animals (70.0%), in addition, there are various signs of congestion in the vessels of the lungs (80.0%, n=24), signs of venous congestion are also revealed in the peribronchial vessels (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 in gas exchange. In this regard, microscopy of another histological specimen (Fig. 3), prepared from the

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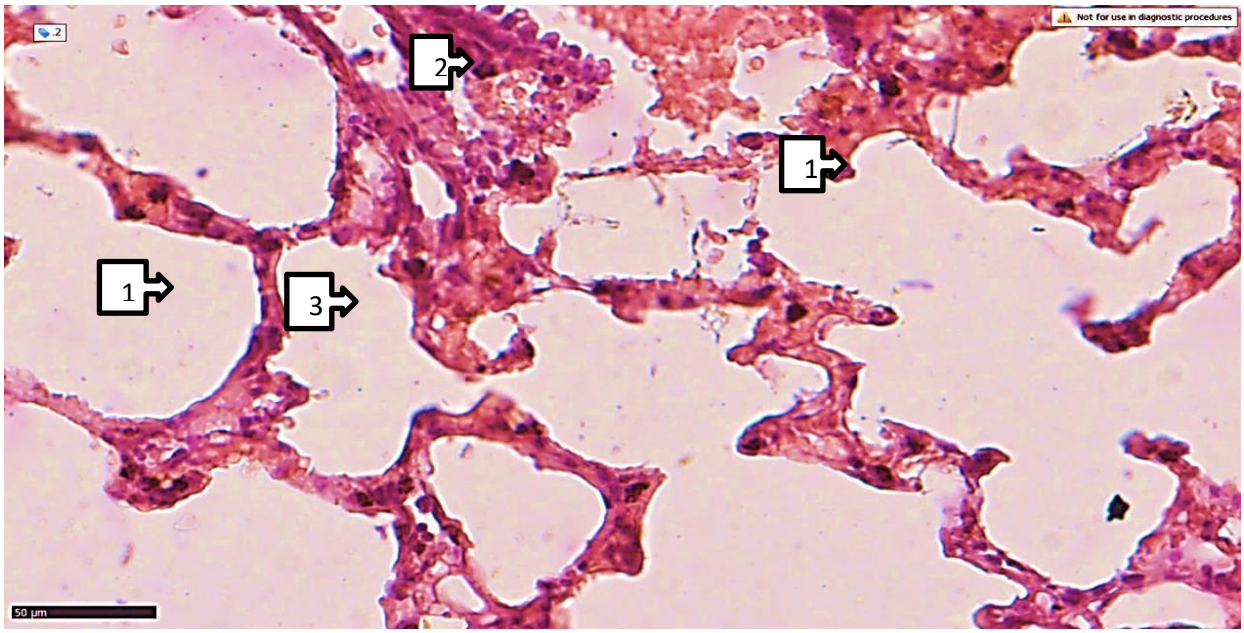
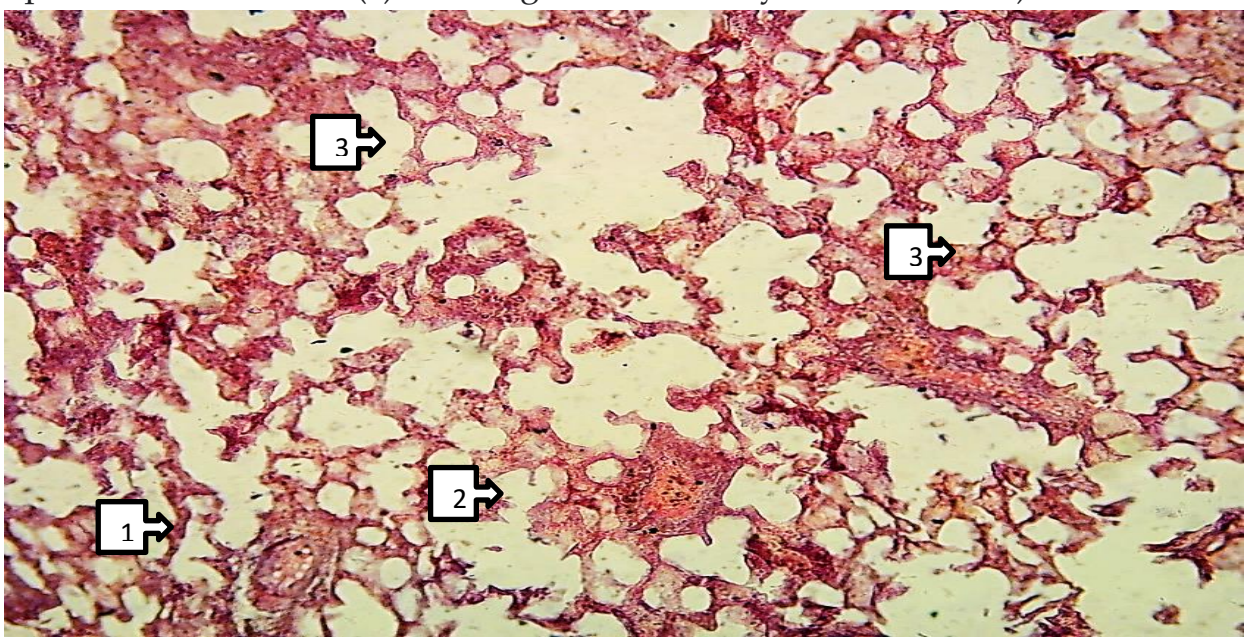
lungs of a laboratory animal that received chronic irradiation, revealed proliferation of the wall of small bronchi due to fibrosis (73.33%, n=22), congestion of blood vessels (80.0 %, n=24), thinning of the alveolar wall (66.67%, n=20).



Rice. 2. Microscopic picture of the lung tissue of a white outbred rat that received chronic irradiation (the wall of the alveoli is thinned (1), there are various signs of congestion in the vessels (2), signs of venous congestion are also revealed in the peribronchial vessels (3). Staining with hematoxylin-eosin, 40x10).



Rice. 3. Microscopic picture of the lung tissue of a white outbred rat that received chronic irradiation (proliferation of the wall of small bronchi due to

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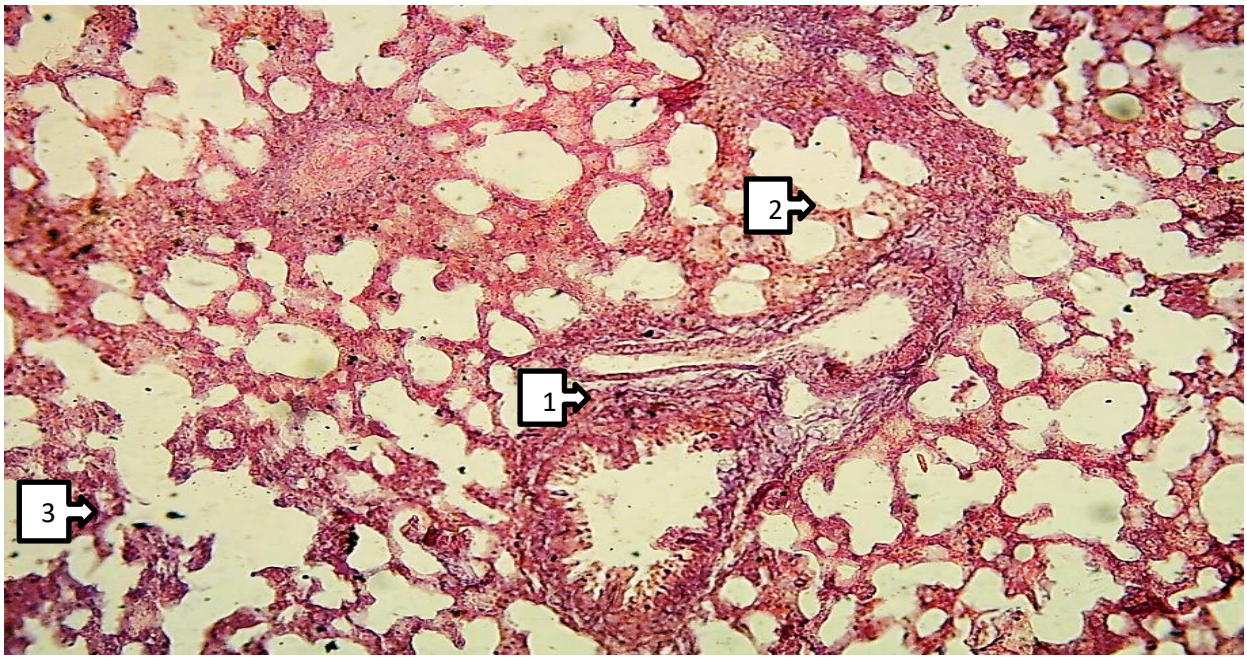
fibrosis (1), congestion of blood vessels (2), thinning of the alveolar wall (3) is noted. Staining with hematoxylin-eosin, 4x10).

In addition, changes 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).



Rice. 4. Microscopic picture of the lung tissue of a white outbred rat that received chronic irradiation (changes in the bronchial wall and the formation of connective tissue (1), light lymphocytic infiltration between the bronchi and interstitial tissue (2), focal emphysema (3). Hematoxylin-eosin staining, 4x10).

Lymphocytic infiltration is a key histological finding that indicates a process of acute cellular rejection, histologically this is seen as an increase in cellular 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 alveoli.

We have proven that the causes of the pathomorphological changes in the lungs found in the animals of the main group were chronic irradiation.

Conclusions.

1. It was established that the macroscopic picture of the lungs of intact white outbred rats was practically without certain changes. When examining the lungs,

no visible pathological changes were found, both lungs were pink, the parenchyma was unchanged, the general structure of the lungs was not disturbed, and no tubercles, spots, or compactions were found during a visual examination. This normal state of the lungs was visually observed in all animals of the main and control groups.

2. When studying the microscopic picture of lung tissue, no pathological morphological changes were revealed in the control group. In laboratory animals that received chronic irradiation, pathomorphological signs were found in the form of congestion of the segmental vein (63.33%), venous congestion in the peribronchial vessels (76.67%), as well as dystrophic changes in the interstitial tissue of the lungs (56.67%).

3. It was revealed that in animals of the main group the wall of the alveoli was thinned (70.0%), growth of the wall of small bronchi due to fibrosis (73.33%), thinning of the wall of the alveoli (66.67%), changes in the wall of the bronchi and formation 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 irradiation on the lungs of white outbred rats.

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