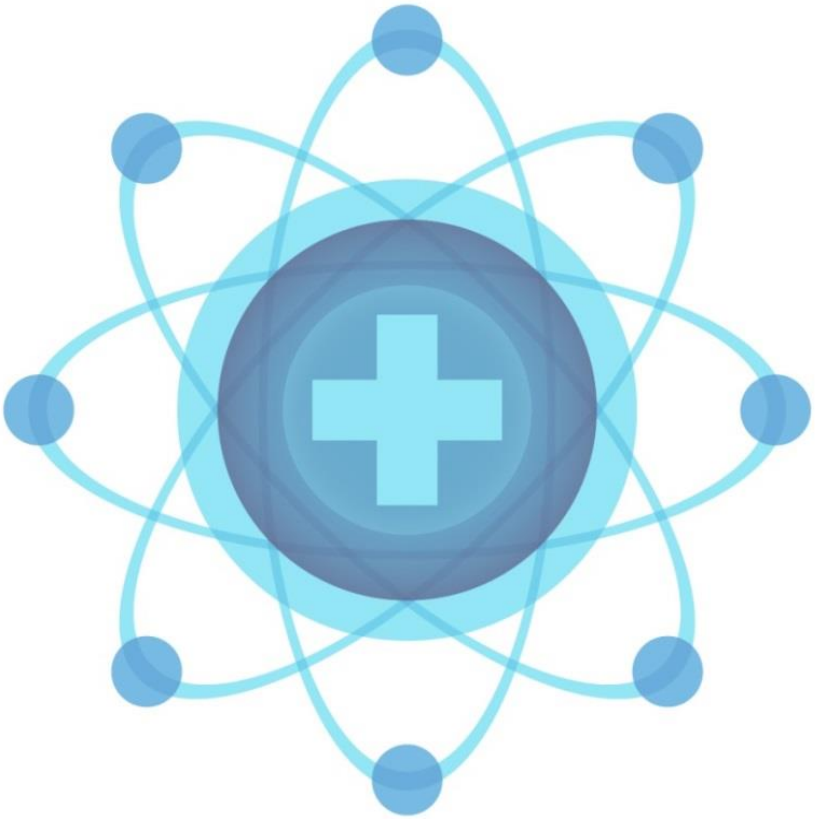

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CONSEQUENCES OF CHRONIC EXPOSURE TO THE KIDNEYS OF WHITE LABORATORY RATS

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Abstract. Chronic exposure - as a result of prolonged low-frequency exposure to ionizing radiation, radiation sensitivity of organs develops to varying degrees. It has been established that atrophic and sclerotic changes in the organs of the immune system (spleen, lymph nodes, malt and salt structures, bone marrow and thymus) develop under chronic irradiation. Organs with low sensitivity to radiation - kidneys, liver, lungs, tissues. In chronic irradiation, organs are damaged in the same way as when exposed to a thermal factor. It has been established that an increase in vascular permeability, cellular hypoxia and metabolic disorders lead to stimulation of the synthesis of fibroblast tropocollagen, sclerotic changes in organs and atrophy of parenchymal elements.

Keywords:irradiation, kidney, labile cells, dystrophy, destruction.

Relevance. The impact of small doses on the organism of animals and humans seems to be the most possible in the current conditions of development and application of radiation technologies. The importance of conducting research in this direction is noted in the decision of the V Congress on Radiation Research (2006), at international conferences (Aleksakhin PM, 2008), in the works of foreign scientists (Cuttler JM, et al., 2009). Radiation manifestations of chronic low-intensity radiation exposure are complex, since long-term damage to cells is combined simultaneously with repair processes in them. The rate of these reactions is determined by many factors - the duration of irradiation, its nature, dose rate, sensitivity of cellular and tissue systems, the type and age of animals, etc. etc. (Akleev A.V., Aleshchenko A.V., Gotlib V.Ya. et al., 2004; Yarmonenko S.P., 2006). There are conflicting data on the mechanism of the biological action of prolonged exposure to low-power radiation (Zherbin E.A., Chukhlovin A.B., 1989; Burlakova E.B. et al., 1996; E.A. Nasonova et al., 2006; Burlakova E. B. et al., 2006; Akleev A. V. et al., 2006; Moskalev A. A., 2008). In this regard, this issue is relevant both because of its importance, and because of the lack of knowledge.

The types of ionizing radiation include: short-wave electromagnetic oscillations, x-rays, ɣ-radiation,χ- and β-particles (electrons), protons, positrons, neutrons and other irradiated particles (Zolotareva S.N. et al., 2015; Mikheev AN, 2016; Shimizu Y. et al., 2010; Darby SC et al. , 2013). It is shown that X-rays and α-radiation have the greatest and deepest penetration into the body, and β-radiation has the smallest.

Among the isotopes, the most dangerous are those that have a long decay period; when they enter the body, they remain a source of internal radiation throughout a person's life. Radioactive elements are excreted through the gastrointestinal tract, respiratory tract and kidneys. The primary stage of radiation exposure is the ionization of molecules and atoms of the cellular composition (Samilovskaya M.Yu., Pozharishchenskaya D.A., 2018; Wang W. et al., 2020).

The indirect effect of radiation is explained by the formation of radiolysis of water, which makes up 70-80% of the body; when water is ionized, radicals with oxidizing and alkaline properties are formed. In addition, the formation of atomic hydrogen, hydroperoxyl radicals, and hydrogen peroxide is of great importance. Free oxidizing radicals enter into an enzymatic reaction, as a result of which active sulfhydryl groups are converted into inactive disulfide compounds. These biochemical processes lead to a decrease in the catalytic activity of enzyme systems, which, in turn, leads to a decrease in DNA and RNA in cell nuclei, which disrupts their renewal processes (Akleev A.A., Dolgushin I.I., 2018; Murzina E. V. et al., 2020).It is known that the kidneys are a radiosensitive organ, in which radiation nephropathy develops in partial or complete body irradiation with a dose of 5–10 Gy. According to T. Mercantepe et al. degenerative changes in the epithelium of the nephron tubules, as well as the presence of atypical glomeruli and plethora of blood vessels in the interstitial tissue, were observed when studying the effect of X-ray radiation on the kidneys of rats with a dose of 6 Gy [Mercantepe, T., et al., 2019]. At the same time, when using a pulsed electron accelerator, first of all, the development of an acute vascular reaction in response to exposure to low doses of radiation (2 Gy) without signs of fibrosis was found. It should be noted that the number of full-blooded blood vessels increased depending on the dose increase, therefore, these changes are dose-dependent, which was partly observed by other authors when studying the use of gamma radiation [Abozaid, OAR, et al., 2017]. However, the absence of such destructive changes as necrosis of the epithelium of the nephron tubules and vascular glomerulus can be explained by a more sparing effect of electron irradiation on the kidney tissues and pulsed exposure, unlike other types of irradiation. Thus, it can be assumed that the degree and depth of kidney damage that develops against the background of irradiation directly depend on the dose. Other equally important factors that affect the nature of pathological changes are the type of radiation (x-rays, gamma rays, etc.), its direction (general, targeted), activity and strength of the installation. how the necrosis of the epithelium of the tubules of the nephron and the vascular glomerulus can be explained by a more sparing effect of electron irradiation on the tissues of the kidneys and impulse exposure, unlike other types of irradiation. Thus, it can be assumed that the degree and depth of kidney damage that develops against the background of irradiation directly depend on the dose. Other equally important factors that affect the nature of pathological changes are the type of radiation (x-rays, gamma rays, etc.), its direction (general, targeted), activity and strength of the installation. how the necrosis of the epithelium of the tubules of the nephron and the vascular glomerulus can be explained by a more sparing effect of electron irradiation on the tissues of the kidneys and impulse exposure, unlike other types of irradiation. Thus, it can be assumed that the degree and depth of kidney damage that develops against the background of irradiation directly depend on the dose. Other equally important factors that affect the nature of pathological changes are the type of radiation (x-rays, gamma rays, etc.), its direction (general, targeted), activity and strength of the installation. directly dependent on the dose. Other equally important factors that affect the nature of pathological changes

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However, despite the successful use of electron irradiation in the treatment of tumors of various localizations, there are no data on the use of this method in the treatment of kidney cancer. In this regard, one of the most important tasks of radiobiology is the selection of optimal doses for leveling side effects in the course of treatment. For a more detailed study of this problem, it is necessary to create experimental models with subsequent morphological evaluation.

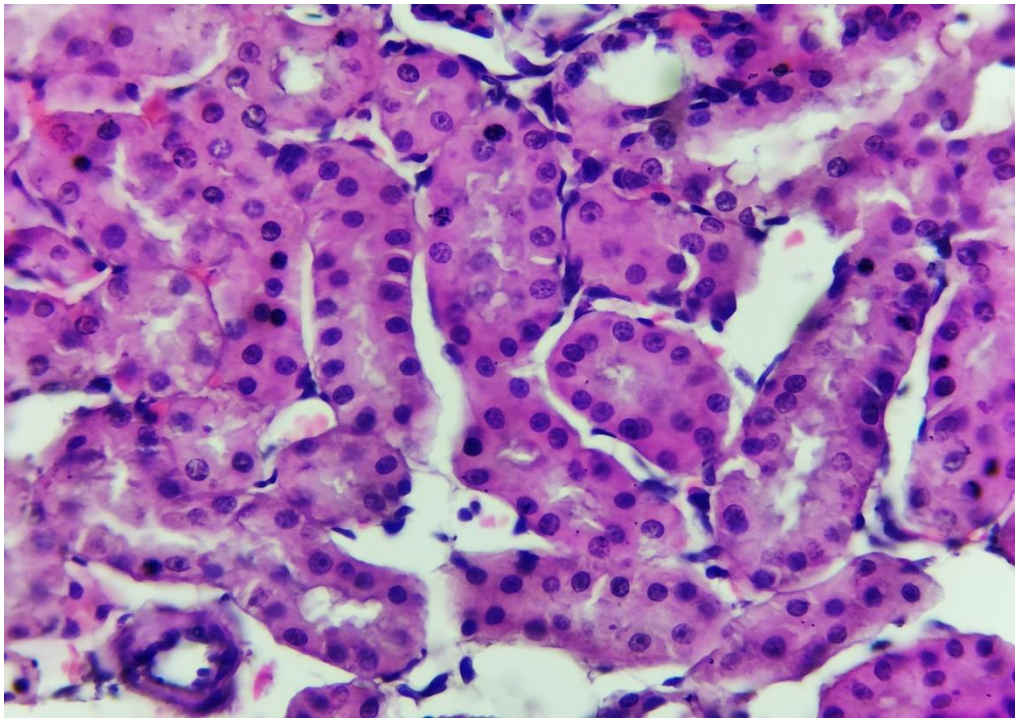
Pathological changes in the kidneys under the influence of acute and chronic irradiation, the lack of scientific studies of the effect of biocorrection on the experimentally irradiated organism determined the relevance and necessity of this study.

Purpose of the study. Determination and comparative evaluation of the morphological state of the kidneys of experimental animals under the influence of chronic irradiation.

Materials and research methods. For experimental studies, 30 white male rats weighing 160-180 g were selected. All laboratory animals were obtained from the same vivarium and were of the same age. All were kept under standard vivarium conditions.The studies were carried out in compliance with the rules of humane treatment of animals, which are regulated by the "Rules for carrying out work using experimental animals", approved by the ethical committee of the Bukhara State Medical Institute named after A.I. Abu Ali ibn Sino (No. 18 of 01/16/2018).

Under laboratory conditions, kidneys isolated from white outbred rats exposed to chronic irradiation with 0.2 Gray daily for 20 days were fixed in 10% formalin solution and stained with hematoxylin and eosin. Micropreparations were photographed under a microscope with dimensions 4x10, 10x10, 20x10, 40x40, 60x10, 80x10.

Research results. In chronic irradiation, organs are damaged in the same way as when exposed to a thermal factor. It has been established that an increase in vascular permeability, cellular hypoxia and metabolic disorders lead to stimulation of the synthesis of fibroblast tropocollagen, sclerotic changes in organs and atrophy of parenchymal elements. The following microscopic changes are determined: dystrophic changes in the general background of the renal tissue and plethora of venous vessels in the pericortical region, deformation of the shape of the glomeruli, foci of hydropic dystrophy are determined in the proximal tubules, plethora in the peritubular vessels that has developed in the epithelium of the proximal tubules, deformation and compression atrophy in the glomeruli, plethora vessels of the cerebral part of the paratubular veins, narrowing of the intercanal spaces,



Picture 1. Hydropic dystrophy of the tubules, homogeneous protein structures and changes in the general background of the renal tubules are determined.

Hematoxylin-eosin staining. 4x10.

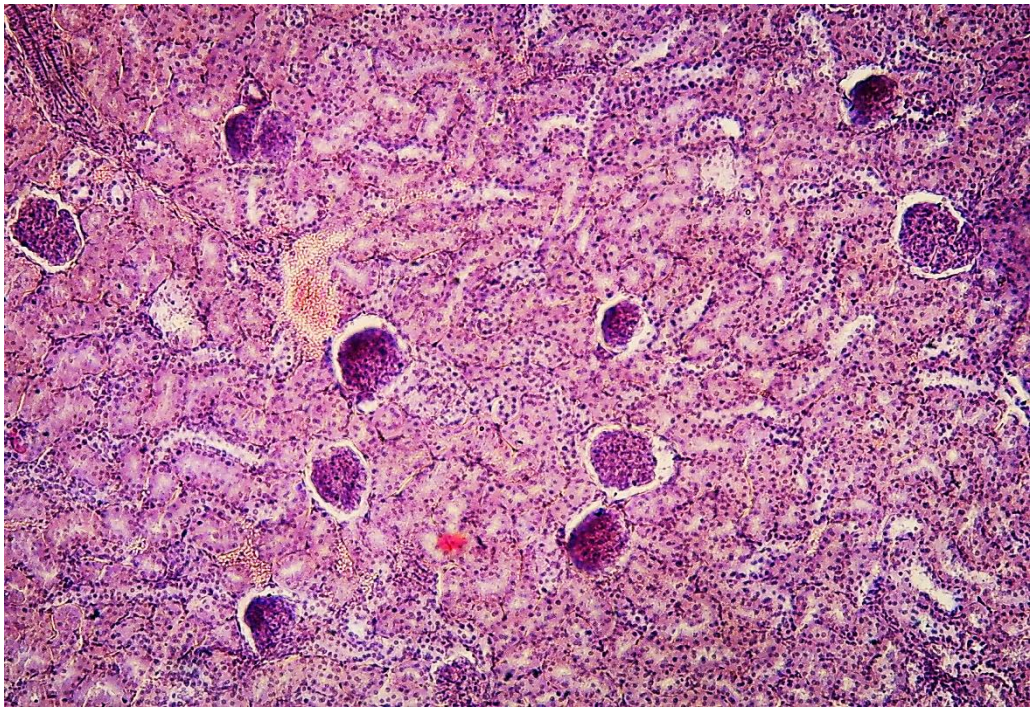


Figure 2. The shape of the glomeruli is deformed (1), foci of hydropic dystrophy are determined in the proximal tubules (2), plethora in the peritubular vessels (3) G-E dye. 10x10.

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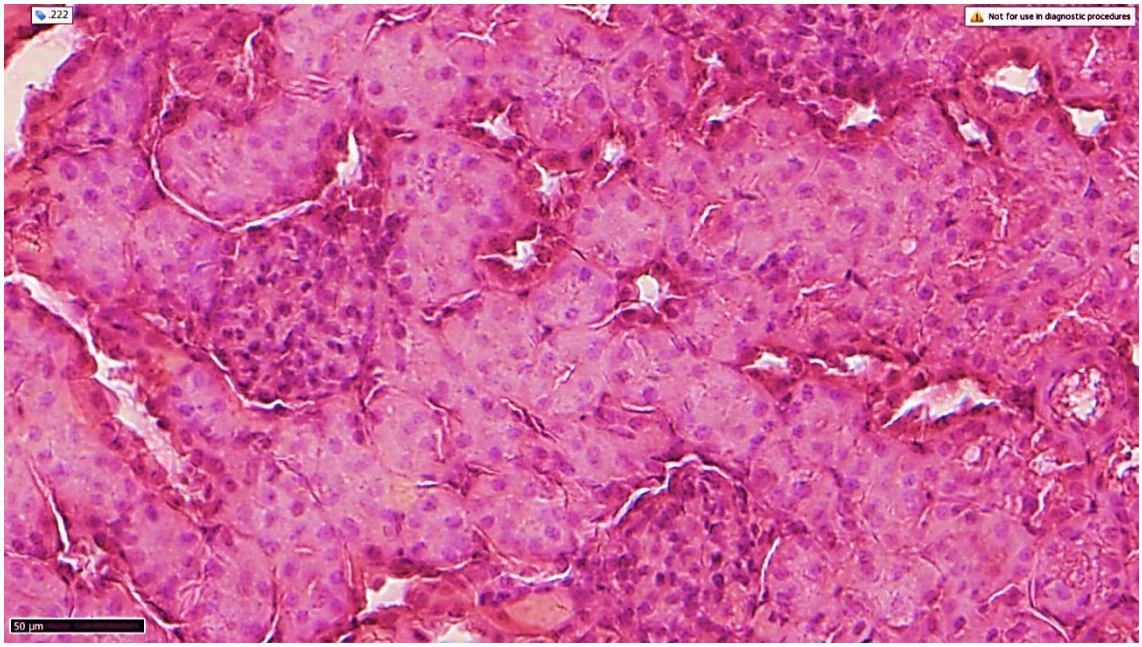

Figure 3 Due to hydropic dystrophy (1), which developed in the epithelium of the proximal tubules, deformity and compression atrophy developed in the glomeruli (2). Paint G-E. 4x10.

Conclusion.

In chronic irradiation, organs are damaged in the same way as when exposed to a thermal factor. It has been established that an increase in vascular permeability, cellular hypoxia and metabolic disorders lead to stimulation of the synthesis of fibroblast tropocollagen, sclerotic changes in organs and atrophy of parenchymal elements.

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