

MECHANISM OF RADIATION EXPOSURE TO THE BODY

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Abstract

Currently, radiation therapy is a method of treatment using ionizing radiation in medical practice. Currently, radiotherapy is used in the treatment of tumor (cancer) diseases in 80% of cases.

Keywords: radiation exposure, biological organism, leukemia, blood, bone, anemia, cataract.

RADIATION NURLANISHNI ORGANIZMGA TA'SIR MEXANIZMI

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Annotatsiya

Hozirgi vaqtda radiatsion nurlanish yordamida davolash (radioterapiya) - tibbiyot amaliyotida ionlashtiruvchi nurlanish yordamida davolash uslubi hisoblanadi. Hozirgi vaqtda asosan, radioterapiya uslubi 80% holatlarda o'sma (saraton) kasalliklarini davolash amaliyotida qo'llaniladi.

Kalit so'zlar: radiatsion nurlanish, biologik organizm, leykoz, qon, suyak, anemiya, katarakta.

МЕХАНИЗМ ДЕЙСТВИЯ РАДИАЦИОННОГО ИЗЛУЧЕНИЯ НА ОРГАНИЗМ

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Аннотация

В настоящее время лечение с помощью радиационного излучения (радиотерапия) является методом лечения с помощью ионизирующего излучения в медицинской практике. В настоящее время в 80% случаев в практике лечения опухолевых (рак) заболеваний применяется в основном метод радиотерапии.

Ключевые слова: радиационное излучение, биологический организм, лейкоз, кровь, кость, анемия, катаракта.

As a primary source of information regarding the negative impact of radiation on the human body, it is possible to cite the date in the 16th century when T. Paracelsus and G. Agricola recorded the

occurrence of an abnormal disease in the lungs of mineral deposit workers. The mechanisms of primary radiation exposure to biological objects were studied in detail by B.N. Tarusov. In particular, it is noted that radiation forms chain-like response reactions in biological organisms, i.e., reactions that occur gradually and sequentially over time. In the 1950s, B.N. Tarusov established that LPO products enhance the effect of radiation radiation. Additionally, scientists such as N.N. Semyonov, N.M. Emmanuel, and E.B. Burlakova conducted scientific research on the experimental study of the mechanism of radiation exposure to biological objects. The degree of probability of tumor diseases occurring under the influence of radiation exposure depends on the radiation dose. As a result of the conducted research, it was established that in the course of generations (30 years) of the human body under the influence of 1 Zv (100 Ber) radiation in chronic characteristics, 2 out of every 1000 newborns are born with serious genetic defects. If exposure to radiation is observed continuously and chronically, the probability of genetic mutations also increases. Furthermore, biological organisms differ in their resistance to radiation exposure. For example, under the influence of radiation, 50% of animals exposed to it perish within 30 days; the radiation value for a guinea pig is 250 X-rays, for a dog 335 X-rays, for a monkey 600 X-rays, for mice 550–650 X-rays, and for a snake 8000–20000 X-rays. During the study of the radiosensitivity properties of organs and tissues, J. Bergone and L. Tribonodo established the following pattern in 1906 (Bergone-Tribonodo principle): the faster cells divide, the longer the duration of the mitotic cycle, and the less differentiated the cells are, the higher the sensitivity they exhibit to radiation exposure (the law of radiation sensitivity). It is noted that low-division and highly differentiated cells are relatively resistant to radiation exposure. According to the Bergone-Tribonodo principle, blood-forming bone marrow cells, ovarian cells, and cells of the intestinal and skin epithelial layers are considered highly sensitive to radiation exposure. Furthermore, brain cells, muscle, liver, kidney, bone, cartilage, and tendon cells are relatively resistant to radiation exposure. It should be noted that although lymphocytes do not possess the ability to divide and are sufficiently differentiated, they exhibit a high degree of sensitivity to radiation exposure. Furthermore, the body's sensitivity to radiation exposure is also characterized by the fact that its tissues differ in their ability to respond to various types of radionuclides. Specifically, it has been established that the radioactive isotopes $^{90}_{38}\text{Sr}$, $^{226}_{88}\text{Ra}$, $^{239}_{94}\text{Pu}$, $^{241}_{95}\text{Am}$, $^{238}_{92}\text{U}$ accumulate primarily in bone marrow cells. It has been noted that radiation exposure causes acute and chronic radiation sickness, cataracts, leukemia, anemia, lymphoma, myeloma, thyroid cancer, respiratory diseases, stomach and intestinal cancer, bladder cancer, breast cancer, ovarian and testicular cancer, skin cancer, bone cancer, brain tumor, and other oncological diseases in the human body. [5; 125-b.].

Studies have shown a sharp decrease in the level of locomotive activity in rats under the influence of experimental β - (0.15 Gr) and γ -radiation (2 Gr) [2; P. 26]. Studies show that gamma (γ) radiation causes oxidative stress in rat liver cells (hepatocytes), which in turn activates the generation of active forms of oxygen (free radicals). [8; 498–499-b.].

In some studies, the standard method for determining creatinine phosphokinase activity was used [3; [p. 177-184] and creatinine concentration using the method described in the works of the following authors [6; 585-587; 7; 33-35; 8; 495-496) showed an increase in the concentration of MDA and NO, which are LPO products in hepatocytes, as well as a decrease in the activity of antioxidant enzymes such as SOD, catalase, and glutathione-S-transferase, and an increase in the concentration of ALT, AST, and creatinine in the blood [8; 495–496]. Additionally, the study analyzed the morphological

structure of rat liver after gamma (γ) radiation using a microscopic method described by the following author [8; 499–500 p.]. Specifically, studies have shown that significant changes occur in the ultrastructure of rat liver cells under the influence of γ -radiation (Fig. 1).

Conclusion. Thus, it has been established that radiation γ -irradiation leads to the development of the pathogenesis of diseases associated with atherosclerosis, tumor diseases, asthma, arthritis, cardiovascular diseases, and disorders of the structure and function of hepatocytes by increasing the formation of active forms of oxygen (free radicals) in the tissue cells of the biological organism. [1; 48–50-p; 8; 499–501-p; 10; 313–315-p.].

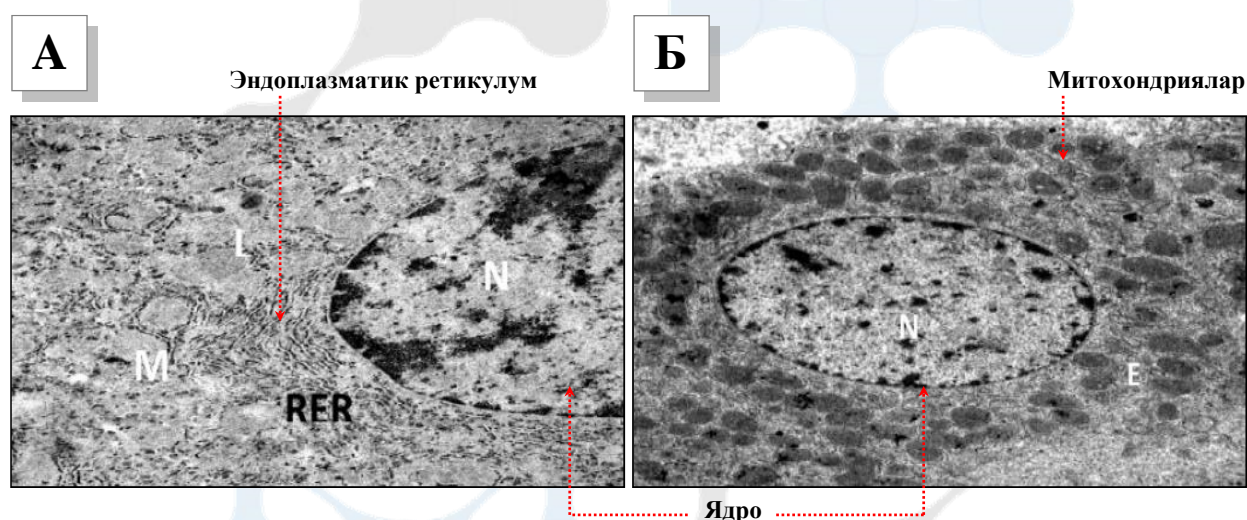


Figure 1. Ultrastructure of rat liver cells in the control group (A) after exposure to gamma (γ) radiation (6 Gr) [8; 503 p.]. Electron microscopic image magnified by 8000x. Here, in the control group, the hepatocyte nucleus with a 2-layer membrane, nuclear pores, mitochondria, and parallel endoplasmic reticulum networks with ribosomes on the membrane can be observed. It is also noted that under the influence of γ -irradiation, the boundaries of the hepatocyte nucleus change, the endoplasmic reticulum networks break down into fragments, and mitochondria swell, which is clearly visible..

In studies using the "Teragam" (Co60) gamma device (Czech Republic), it was established that under the influence of γ -radiation, the concentration of LPO products in the tissues of various rat organs increases, and the activity of certain enzymes changes sharply[4; 92–93-p.].

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