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INFLUENCE OF HIGH-DOSE ACUTE RADIATION ON MICROBIAL GROWTH PATTERNS: EXPERIMENTAL FINDINGS

Jabborova Oysha Iskandarovna

Bukhara State Medical Institute, Bukhara

Annotation. The main objective of this research work was to determine the percentage of germination of microorganisms translocated from the large intestine to the internal organs. The percentage of microorganisms that passed through the large intestine from the peripheral blood of irradiated laboratory animals increased as the observation period increased. Analysis of the results showed that irradiation increases the permeability of the colon mucosa against the background of general immunodeficiency. In prophylactically biocorrected, irradiated animals, the percentage of germination of microorganisms decreased over time. In both groups, its values were significantly higher than in the control group. The aim of the study was to experimentally study the degree of occurrence of microorganisms that provide the phenomenon of bacterial translocation in the dynamics of observation under the influence of acute irradiation.

Keywords. Microorganism, immune system, translocation, bacteriological examination, biocorrection, parameter, microflora, laboratory animals, immunodeficiency.

Activity, used as an indicator of the amount of radionuclide present, is expressed in units called becquerels (Bq): one becquerel is one act of decay per second. The half-life is the time required for the activity of a radionuclide to decay to half its original value.[1] The half-life of a radioactive element is the time during which half of its atoms decay. It can range from fractions of a second to millions of years (e.g., the half-life of iodine-131 is 8 days and the half-life of carbon-14 is 5,730 years). Humans are exposed to natural and artificial radiation every day. Natural radiation has many sources, including more than 60 naturally occurring radioactive substances present in

soil, water, and air. The main source of natural radiation is radon, a natural gas released from rocks and soil. Radionuclides are inhaled daily by humans from the air and enter the digestive tract with food and water.[2] Humans are also exposed to natural cosmic ray radiation, especially at high altitudes. On average, 80% of the annual dose that humans receive from background radiation comes from natural terrestrial and cosmic ray sources. Levels of such radiation vary in different geographical areas and in some areas can be 200 times higher than the global average.The effects of visible light are responsible for less than 1% of fatal injuries (80% of fatal injuries are attributable to light of wavelengths less than 312 nm). Visible light of 450 nm wavelength induces base pair substitutions and frameshift mutations in E. coli. Light wavelengths of 550 nm and especially 410 nm induce photolysis of Myxococcus xanthus. The effect is determined by the absorption of light by iron porphyrins [3]. These effects are determined by the fact that in bacteria an unusual base 4-thiouridine is present in t-RNA in the 8th position (absent in eukaryotes). This base absorbs UV intensively, with the greatest effect being produced by light with a wavelength of 340 nm. Excited by light, 4-thiouridine binds to cytosine located at the 13th position in t-RNA, which prevents t-RNA from binding to amino acids and therefore leads to suspension of protein synthesis.[6]

At relatively high doses of near-UV, mutagenic and lethal effects. DNA damage is caused not so much by the UV rays themselves, but by other molecules excited by the light. The absorption of near-UV by 4-thiouridine also plays a role in these effects. The mutagenic and lethal effects depend on the presence of oxygen. Lethal effects are associated not only with DNA damage, but also with damage to membranes (their transport systems) [5].

The purpose of the study was to experimentally study the degree of encounter of microorganisms that provide the phenomenon of bacterial translocation in the observation dynamics under the influence of acute radiation. The main task of this research work was to determine the percentage of germination of microorganisms translocated from the large intestine to internal organs.

Research material and method. Since the main task in this research work is to determine the percentage of microorganisms translocated from the large intestine to internal organs, only the genera of microorganisms capable of translocation were identified - Escherichia spp, Proteus spp, Staphylococcus spp, Enterococcus spp, Bacteroides spp Acute irradiation of laboratory animals was carried out using the γ-therapeutic apparatus AGAT-R1 (Estonia, 1991), where the radiation source was So-60.

Research results. White mice that received acute radiation were kept on a common vivarium diet until the 5th day, group 2 laboratory animals were treated prophylactically with "Lactopropolis-AWL" produced in our country from the day of irradiation. Group 1 and 3 animals were kept only on vivarium diet. In the experiment, the percentage of microorganisms translocated from the large intestine to the mesenteric lymph nodes of laboratory animals was different from each other in all three groups (table 1).

Table 1

The percentage of microorganisms translocated from the large intestine to the mesenteric lymph nodes after acute radiation in the experiment

Groups	Period after acute radiation	Results	
		Absolutely	%
First group, n=54	Day 5, n=18	16	88.89±7.41
	Day 7, n=16	15	93.75±6.05
	Day 9, n=12	12	100.0
The second group, n=54	Day 5, n=18	15	83.33±8.78
	Day 7, n=17	13	76.47±10.29
	Day 9, n=16	9	56.25±12.40
The third group, n=54	Day 5, n=18	1	5.56±5.40
	Day 7, n=18	0	0
	Day 9, n=18	1	5.56±5.40

If in the first group, on the 5th day after irradiation, the percentage of microorganisms translocated from the large intestine was 88.89±7.41%, by the 7th day, this indicator increased to 93.75±6.05%. On the 9th day after irradiation, translocation reached a maximum level - 100.0%. It can be seen that the percentage of translocated microorganisms increased dynamically after irradiation.

In the second group of laboratory animals, we observed the opposite. Over time, the percentage of microorganisms from the mesenteric lymph nodes decreased - 83.33±8.78% on the 5th day, respectively; 76.47±10.29% on day 7 and 56.25±12.40% on day 9. However, no changes were observed in the third group during the observation period. Microorganisms with translocation did not exceed 5.56±5.40%, their increase or decrease trend was not observed.

The analysis of the results showed that the irradiation increased the permeability of the colonic mucosa together with the total immunodeficiency, because the percentage of microorganisms in the other groups was significantly increased compared to the control group ($R<0.001$). Over time, the percentage of encounters in the first group increased and reached the maximum level (100.0%) by the end of the observation period.

The normal microflora located in different biotopes of a person (gastrointestinal system, respiratory system, skin and mucous membranes, urogenital system) participates in the formation and maintenance of the body's immune system, provides constant antigen stimulus, and ensures an active immune response against antigens. In turn, the immune system plays an important role in the quantitative and qualitative regulation of representatives of the normal microflora in different biotopes. We studied the degree of meeting of microorganisms that ensured the phenomenon of bacterial translocation in the observation dynamics under the influence of acute radiation.

In this article, after studying and describing the dynamics of the percentage of microorganisms that passed through the large intestine in the internal organs, we considered that it is necessary to study the indicators of germination of these strains in the peripheral blood of experimental animals. A total of 162 male white mice were

included in the research. Their weight was not less than 25 g, and their age was 3 months.

All laboratory animals were divided into 3 groups:

The first (main) group (n=54) - white mice without acute radiation;

The second (comparison) group (n=54) - white mice without acute radiation and preventive biocorrection;

The third (control) group (n=54) is mice without acute radiation.

In the peripheral blood of irradiated laboratory animals, their germination tendencies remained unchanged (Fig. 1).

As with the previous results, after irradiation during the observation period in the first group, the percentage of germination of strains increased over time - 61.11±11.49% on the 5th day, respectively; 75.0±10.83% and 83.33±10.76% on day 7. In the second group, the opposite was observed. A different feature from the studied internal organs is that in the non-irradiated animals of the control group, strain germination was observed during the observation period - from 5.56±5.40% to 11.11±7.41% (in 1 or 2 of 18).

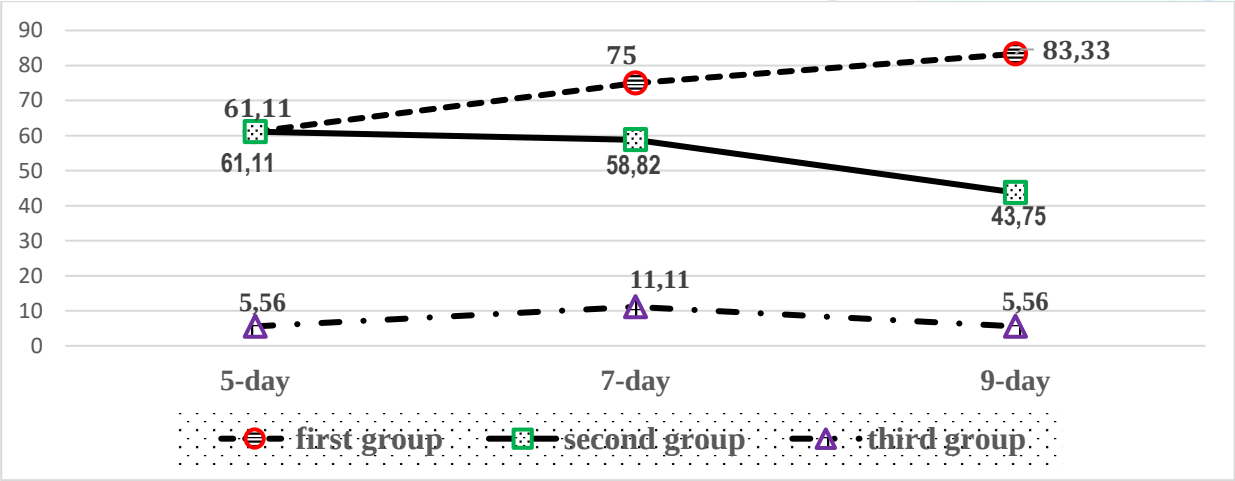

Figure 1. Indicators of the percentage of germination of microorganisms translocated from the colon to the peripheral blood, %

Conclusion. Thus, the percentage of microorganisms passing through the colon from the peripheral blood of irradiated laboratory animals increased as the observation period increased. In prophylactically biocorrected, irradiated animals, the percentage

of microorganism germination decreased over time. In both groups, its values were significantly higher than those in the control group.

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