OF THE ORGANISM, ORGANS AND TISSUE. TEACHING THE TOPIC OF RECOVERY AFTER RADIATION EXPOSURE USING THE "EVERYONE TEACHES EVERYONE" METHOD

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Based on the review of AJ Ergashev , Candidate of Pedagogical Sciences (PhD)

Abstract: *This article is a 2nd year course of general and medical radiobiology at the Faculty of Medical Biology of Samarkand State Medical University, where the subject of radiosensitivity of the organism, organs and tissues is taught. The topic of recovery after radiation exposure is taught using the pedagogical technology "Everyone teaches everyone" method. 2 hours of practical and 2 hours of independent work are allocated, which allows students to devote more time to independent work, collect information and independently master the topic.*

Keywords: *Radiobiology , "Everyone teaches everyone" , didactic materials, radiation exposure .*

RADIOCHUVSTVITELNOST ORGANISMA, ORGANOV I TKANEY. TEMA VOSSTANOVLENIYA POSLE RADIATSIONNOGO VOZDEYSTVIYA "VSE UCHAT VSEX" OBUCHENIE PO METHOD

Annotation: *This article is taught in 2 courses of general and medical radiobiology at the faculty of medical biology at the Samarkand state medical university, radiochuvstvitelnost organism, organs and tissues Pedagogical technologies on the subject of rehabilitation after radiation exposure. Na obuchenie po metodo "kajdyy uchit kajdogo" otvoditsya 2 chasa prakticheskoi and 2 chasa self-standing work, chto pozvolyaet uchashchimsya work self-sufficient, sobriat danye i*

znakomitsya s tomoy, chto privodit k voelicheniyu vremeni na samostoyatelnoe obuchenie.

Klyuchevye slova: *Radiobiologiya, «Vse uchat vsex» didakticheskie materialy, radiatsionnoe vozdeystvie.*

RADIOSENSITIVITY OF THE BODY, ORGANS AND TISSUES. THE TOPIC OF RECOVERY AFTER RADIATION EXPOSURE "EVERYONE TEACHES EVERYONE" TEACHING USING THE METHOD.

Annotation: *This article was taught in the 2nd year of general and medical radiobiology at the Faculty of Medical Biology of Samarkand State Medical University, radiosensitivity of the organism, organs and tissues. Pedagogical technologies on the topic of recovery after radiation exposure 2 hours of hands-on and 2 hours of independent work are allocated for teaching using the "everyone teaches everyone" method, which allows students to work independently, collect data and learn about the topic. leads to more time for independent learning.*

Keywords: *Radiobiology, "Everyone teaches everyone" didactic materials, radiation exposure.*

on the topic in the Samarkand State Medical University platform system and the ability of students to log in to the system with their logins and passwords to study and gain knowledge and skills play an important role . The “Everyone teaches everyone” method is very useful for Samarkand State Medical University , since the lecture course is held after the practical lessons, because the formation of knowledge and skills in this method is a teaching method that allows students to become both teachers and learners, master certain knowledge, share knowledge and skills with their classmates. Especially after the lecture, if the students are given didactic materials, the effectiveness of mastering the subject will increase even more. The purpose of this method is to provide students with the maximum amount of information necessary in the teaching process, and at the same time arouse interest in receiving and giving information in students. Also, the student who receives information on the

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subject thinks for a certain time, conveys it to as many students as possible, and more students receive information for themselves.

The purpose of using the method:

- to force students to quickly find sources of information and quickly master the topic;
- to arouse students' interest in receiving and giving information;
- students' attentive listening and memorization of information;
- Listen to your partner's information and be able to convey it to the other partner more quickly.

ways to create .

Advantages of the method:

- learn to try to express their thoughts clearly and concisely ;
- to develop students' ability to listen attentively and remember;
- further increase students' interest in the subject or subject;
- awakening students' desire to distinguish the most correct from different opinions;
- students' ability to self-assess;
- students to engage in debates and discussions on the topic;
- rapid acquisition of knowledge and skills by students;
- Creating opportunities for students to use radionuclides in future diagnosis and treatment.

The main processes that students need to know are:

- sensitivity to radiation exposure;
- radiation syndromes;
- the general effect of radiation on the human body;
- somatic affect effect;
- genetic influence effect;
- radiation sickness;
- post-radiation complications;
- ways to treat light sickness;

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- critical organs;
- radiation doses .

Didactic materials for the topic.

Sensitivity to radiation (radiosensitivity) is the degree of manifestation of the response of cells, tissues, and biological organisms to the effects of ionizing radiation. The unit of measurement of radiosensitivity is the radiation dose (Gy).

Radiosensitivity varies among biological species and also among individual organisms. When comparing the radiosensitivity of different biological species, LD The value 50 is used. LD 50 - the dose at which 50% of the organisms exposed to radiation die.

To characterize the biological effects of radiation, the surgeon SB Goldberg attached 75 mg of radium bromide ($RaBr_2$) to his shoulder for ~3 hours and noted that after the radioactive substance was removed, a reddish spot formed on the skin, after 2 days necrosis began, and after 14 days - a purulent wound.

In 1902, it was discovered that skin tumors were caused by radiation exposure, and that radiation exposure could cause dramatic changes in tissues and organs in the human body, even leading to death.

The effects of radiation on the human body have been documented as acute and chronic radiation sickness, cataracts, leukemia, anemia, lymphoma, myeloma, thyroid cancer, respiratory system tumors, gastrointestinal cancer, bladder cancer, breast cancer, ovarian and testicular cancer, skin cancer, bone cancer, brain tumors, and other oncological diseases . Pathological conditions that develop after a certain period of time due to radiation exposure have also been documented, including reproductive system dysfunction, cataracts, and genetic changes.

Table 1

The effect of radiation on the human body:

Absorbed radiation dose (*Rad)*	**Impact level**

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Lethal dose:	Death occurs due to central nervous system dysfunction
1000-5000 Rad (10- 50 Gr)	Internal in organs (stomach - intestines) blood in the
300-500 *Rad* (3-5 Gr)	Bone marrow function violation as a result of radiation
150-200 Rad (1.5-2 Gr)	Symptoms of primary radiation sickness occur
100 Rad (1 Gr)	Causes infertility
25 Rad (0.25 Gr)	Emergency level dangerous dose
10 Rad (0.1 Gr)	Mutations at the gene level
2 Rad (0.02 Gr) per year	Category " *A* " input , that is directly radiation radiation in the facilities worker employee - employees for
0.2 *Rad* (0.002 Gr) per year (200 ***milliRad)***	Category " *B* " input , that is working release in the facilities radiation radiation effect probability there is
0.1 Rad (0.001 Gr) per year	Category " ***B*** " input , that is all population for borderline permission done dose
Per year (0.1-0.2 ***rad)***	Natural (cosmic and natural) background radiation
3 ***Rejections per year***	Dental radiography
30 ***Rad per year***	Gastrointestinal X-ray
1 ***microRad***	While watching a single hockey game on a CRT TV
84 ***microRad/hour***	8 ***km by plane*** during flight at altitude

The following effects occur in the human body when exposed to radiation: occurs:

I. Somatic effect effect:

a) Radiation sickness;

b) Leukemia;

c) Tumor diseases.

II. Genetic influence effect:

a) Gene mutations;

b) Chromosomal aberration.

It is noted that for the human body, exposure to ~400–500 Ber of radiation for a short period of time can lead to death. The probability of developing malignant tumors due to radiation exposure is high (Table 1.2).

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After radiation exposure, all forms of tumor diseases are fully manifested for ~50–60 years. The effects of radiation exposure after a certain period of time are expressed in the development of malignant tumors in almost all organs of the human body, such as bone, blood, ovaries, gastrointestinal tract, thyroid gland, genetic mutations, increased susceptibility to various diseases (i.e., a sharp decrease in the stability of the immune system), infertility, premature aging, mental and nervous system, mental development lag.

Table 2

The period of development of malignant tumors after the atomic bombing of Hiroshima and Nagasaki in 1945 [2,7,8]

Types of malignant tumors	The duration of the development period after receiving radiation exposure
Leukemia (blood cancer)	After 5 years
Thyroid tumor	After 10 years
Breast and lung cancer	After 20 years
Stomach, skin, bowel cancer	After 30 years

Also, exposure to radiation can cause serious disruptions in the functioning of the gastrointestinal system, central nervous system, and blood system in the human body.

Radiation sickness is a pathological condition with specific symptoms that occurs as a result of exposure to radiation in excess of the established, permissible normal dose. In general, radiation sickness is characterized by disruption of the functions of the blood-forming organs, nervous system, and gastrointestinal system in the body.

Depending on the dose of radiation, acute radiation sickness and chronic radiation sickness are distinguished. Acute radiation sickness is a pathological condition that occurs as a result of exposure to radiation exceeding 1 Gy (100 Rad) for a short period of time and is characterized by radiation toxemia, cytostatic effect, radiation capillaritis, functional disorders, sclerosis, and the development of the oncocomutagenic effect of radiation.

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Acute radiation sickness is classified into the following types depending on the radiation dose: bone marrow dysfunction (1–6 Gr), transitional form (6–10 Gr), intestinal dysfunction (10–20 Gr), toxemic form (20–80 Gr), cerebral form (80–120 Gr). Also, acute radiation sickness caused by radiation exposure above 120 Gr leads to immediate death in the human body. The form of acute radiation sickness associated with bone marrow dysfunction is divided into the initial period (primary response), latent period, exacerbation period and recovery or convalescence period.

Chronic radiation sickness is caused by prolonged exposure to radiation levels of around 1 Gy.

In experiments on mice, it was observed that 3 areas can be clearly observed in the curve of the average survival time value depending on the radiation dose, and on this basis, the following radiation syndromes are distinguished:

1. Radiation syndrome of the blood formation system;
2. Radiation syndrome of the gastrointestinal system;
3. Cerebral or brain radiation syndrome.

In this view, the phenomenon of spontaneous death from radiation exposure is directly explained by the presence of "critical organs" and systems in the mammalian body that are functionally impaired by radiation exposure. That is, there are organs with a high degree of sensitivity in certain areas of the radiation dose range.

In experimental animals exposed to radiation, a sharp increase in the probability of mutations at the chromosomal level as a result of damage to DNA macromolecules has been noted. In particular, it has been found that the activity of the repair mechanism, which is aimed at restoring structural damage to DNA macromolecules under the influence of various factors, is reduced.

Human radiation damage can be the result of external radiation, skin contact with radioactive substances, absorption of radionuclides into the body (incorporation), the combined effects of different types of radiation, and the combined effects of radiation and other factors (injuries, burns, trauma).

According to the rays that affect damage from external radiation, the following

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are divided into types:

* γ- or damage from X-rays;

* damage from neutron radiation;

* damage from proton radiation;

* damage from radiation.

X-rays and γ-radiation, as well as high-energy neutrons, have high penetrating power and damage all tissues in their path. When humans and animals are collectively irradiated with these rays in appropriate doses, acute radiation sickness occurs. Protons and α -radiation have much lower penetrating power. Therefore, they can only damage the skin layers.

Depending on the distribution of the absorbed dose, there are general and local effects in the body.

damage occurs. Depending on the duration of radiation exposure, there are acute and chronic forms of radiation damage. For acute radiation sickness, the damaging dose is received within a week. If the radiation time is several months or years, If the radiation dose is too high, a chronic form of damage develops. The severity of radiation damage depends mainly on the radiation dose. Acute radiation sickness γbegins to develop when more than 1 Gy of external radiation (X-rays, - and neutrons) is received in a short period of time. Depending on the radiation dose, there are the following forms of acute radiation sickness:

a) Clinical signs observed at radiation doses of less than 1 Gy are called acute radiation reactions. They include weakness, fatigue, and a decrease in the number of neutrophils and platelets.

b) When exposed to a dose of 1-10 Gy, the bone marrow form of acute radiation sickness develops. In this case, blood-forming tissues are damaged. This can lead to infectious complications, bleeding, and anemia.

c) Radiation at a dose of 10-20 Gy causes damage to the small intestinal epithelium.

d) Radiation in a dose of 20-50 Gy causes damage to almost all parenchymal organs and, as a result, the development of toxemia.

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e) Radiation greater than 50 Gy damages the central nervous system.

The concept of critical organs, which lead to the death of an organism depending on the radiation dose range, is introduced. Damage to a critical organ occurs at a time when damage to other organs has not yet developed to a level that is dangerous for the organism. Therefore, the relationship between average life expectancy and radiation dose has a staircase shape. The gradual nature of death associated with the failure of critical systems is a universal biological law, proven in many experiments on animals.

In general acute radiation, the hematopoietic organs are critical at doses of 1.5-6 Gy, the small intestinal epithelium is critical at doses of 10-100 Gy, and the central nervous system is critical at doses above 100 Gy.

The primary reaction of the human body to doses greater than 2 Gy is nausea, loss of appetite, headache, general weakness, and drowsiness. This lasts for 1-3 days.

Signs indicating a severe course of the disease (when the total dose exceeds 10 Gr) include a drop in blood pressure, brief loss of consciousness, subfebrile temperature, and diarrhea.

Neutrophilic leukocytosis in the peripheral blood in the first days after irradiation,

lymphopenia is observed.

A decrease in the number of myelokaryocytes and the loss of young cells occurs in the human bone marrow. An increase in sugar and bilirubin above 3-4 Gr and a decrease in the amount of chlorides are detected in the blood and urine.

After 2-4 days, the symptoms of the primary reaction disappear and the patient's condition improves. The latent or hidden stage of the disease begins. This stage depends on the severity of the lesion and lasts 14-32 days in humans. At doses greater than 10 Gr, this stage does not begin at all. In the latent stage, hair loss and neurological symptoms are observed. A blood test reveals pronounced lymphopenia, a decrease in the number of neutrophils and platelets. Aplasia is observed in the bone marrow from the first days, and signs of regeneration are observed within 2-3 weeks. During this period, ovarian atrophy and spermatogenesis are impaired. At the end of

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the latent stage, the patient's condition deteriorates sharply, weakness increases, the temperature rises, and the erythrocyte sedimentation rate increases. The severe stage of the disease begins. Hemorrhagic syndrome occurs: hemorrhages occur in the skin, mucous membranes, digestive tract, brain, heart, and lungs. During this period, these processes are most dangerous for the lives of patients.

The composition of the blood during this period mainly consists of lymphocytes. At this stage, anemia begins to increase. Regeneration begins in the bone marrow and lymph nodes. Hypoproteinemia and hypoalbuminemia are observed in the hematopoietic system, the content of basic nitrogen increases, the content of chlorides decreases. Due to metabolic disorders, the person's weight decreases. As a result of treatment, the fourth stage of the disease - recovery - may begin. Damage as a result of ionizing radiation hitting the internal organs.

The concentration of nuclides reaching a critical organ depends on the nature of the nuclides and

The International Committee on Radiological Protection estimates that when aerosols are 1 μm in size, 35% of the inhaled nuclides are exhaled, 30% settle in the upper respiratory tract, 25% settle in the alveoli of the lungs, and 8% settle in the trachea.

The biological half-life of nuclides from critical organs ranges from tens of days (^{3}H, $^{14}_{24}C$, Na) to infinity (complete absorption of strontium-90, plutonium-239). Depending on the distribution of nuclides in the body, they are divided into three groups: those that accumulate in the bones (yttrium-90, strontium-90, plutonium-239, etc.), in the liver (polonium-210, cerium-144, etc.), and those that accumulate throughout the body (tritium, carbon-14, cesium-137, etc.). When radionuclides enter the body, it is necessary to use methods for their rapid removal. For this, it is necessary to give recording drugs, nuclide adsorbents, and drink plenty of water.

digestive system is the route of entry and excretion of radionuclides into the body. The absorption of radionuclides in the digestive tract depends on their compound. For example, the absorption of plutonium-238 in the digestive system is 25 times greater than the absorption of plutonium nitrate.

Chronic radiation sickness caused by prolonged exposure to radionuclides resulted in ulcers and colds in the cecum, sigmoid colon, and rectum. In the chronic stage of the disease, some animals died from nephrosclerosis, dystrophic and sclerotic changes in the liver. Nearby arteries were also affected by the pathological process.

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