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IMPACT OF RADIOACTIVE EXPOSURE ON HUMAN HEALTH AND STRATEGIES FOR RADIATION PROTECTION

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Abstract
Nowadays, the problems of ensuring the safety of human life have become even more acute. The frequency and destructive power of accidents, fires, incidents and disasters in countries and regions of the world are increasing year by year. Thousands of people die as a result of these emergencies, and unprecedented economic and other types of damage are being caused. Therefore, the issues of protection from various dangers, including radiation safety, are of great importance.

Keywords: Radiation, radiation, radioactivity, chronic radiation, acute radiation, somatic effects, toxemic state, asthenia.

Introduction

Radiation (lat. radiation-radiation) is electromagnetic and corpuscular radiation, solar radiation, and cosmic rays that occur as a result of nuclear changes [1,2]. Radioactivity can be natural and artificial. Natural radioactivity is the free, random decay of unstable nuclei found in nature. These include chemical elements with a mass number of more than 83 (uranium, radium, radon, plutonium, etc.). There are more than 40 naturally radioactive elements and more than 270 radioactive compounds. Artificial radioactivity occurs when the nucleus of a chemical element is affected by protons, alpha particles, and neutrons. As a result of the impact, the transition from an excited state to a stable state is accompanied by the release of high energy in the form of alpha, beta particles,

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and γ radiation. There is no fundamental difference between natural and artificial radioactivity; they follow common laws [3].

While radiation has many beneficial applications, it also poses potential health risks due to its ionizing nature. Prolonged or high-level exposure can damage living tissue, increase the risk of cancer, and cause genetic mutations. Therefore, radiation protection standards, including time, distance, and shielding principles, It includes issues aimed at ensuring radiation safety in areas of human activity, creating favorable working conditions, educating citizens on radiation safety measures, helping them to act and protect themselves correctly in radiation emergencies, and preventing the impact of ionizing radiation on the environment. More than 100 years have passed since the discovery of the phenomenon of radiation, and man has always felt the effects of a certain amount of radiation emanating from space and the environment - from soil, groundwater, food. The use of artificial sources created by man, X-rays and atomic energy in medicine and industry has led to additional exposure to radiation on the human body. The use of ionizing radiation sources in medicine, industry and life brings undoubted benefits to our society. However, we know that excessive amounts of radiation can have tragic consequences for human life, health and well-being. Radiation can both cure and cause diseases [4].

Radioactive substances have certain special properties, and as a result of their impact on the human body, a dangerous situation can arise. The most dangerous aspect of radioactive substances is that their effects are not felt by the sensory organs of the human body. That is, despite the fact that a person works under the influence of radioactive rays for a long time, they may not feel their harmful effects at all. The result of this is tragic. Therefore, when working with radioactive substances, one should be especially careful. Radioactive radiation of the human body can be internal and external. Since radiation from the outside occurs under the influence of a certain external radiation source, the penetrating power of the emitted rays is of great importance. Rays with a high penetrating power are also more harmful to the body. Internal radiation occurs when radiation-emitting substances enter the internal systems of the human body, for example, through

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damaged skin layers into the blood, respiratory organs, lungs and mucous membranes, and digestive organs. In this case, the radiation lasts as long as the emitting substance is irradiated or as long as it is stored in the body. Therefore, radioactive substances are especially dangerous when they have a long decay period and strong radiation. The biological effect of radioactive radiation is characterized as the ionization of atoms and molecules in the body, which in turn leads to a change in the composition of various chemical compounds and disruptions in normal molecular connections. This, in turn, leads to a disruption of the metabolism in living cells and the failure of biochemical processes in the body. If the effect of high-intensity radiation continues for a long time, the death of some cells is observed, and this ends with the death of some organs, and even the death of the entire organism. Under the influence of radioactive radiation, a disruption of the general circulatory system of the body is observed. In this case, the blood circulation rhythm slows down, the blood's ability to clot is lost, blood vessels, especially capillary blood vessels, become fragile, the digestive system is disrupted, a person loses weight, and the body's ability to fight external infectious diseases decreases. The effect of radioactive substances on the hands is not noticeable at first. Over time, the hands become dry, cracks appear on them, and nails fall off. When alpha and beta rays of radioactive rays act from the outside, the skin layer of the body can provide sufficient resistance. However, when these radioactive rays fall on the digestive system, their harmful effects intensify. Most radioactive substances have the property of accumulating in certain parts of the body. For example, their accumulation in the liver, kidneys, and bones quickly disables the entire body.

Some radioactive substances are toxic, their toxicity level is higher than that of the most dangerous harmful substances. The amount of radioactive substance in the human body can be estimated by considering the radiation dose to the body [5].

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Chronic radiation sickness occurs as a result of repeated low-dose radiation exposure over years and has a wave-like course.

Table 1 Changes in the human body exposed to radioactive substances

Radiation level	Clinical signs of the disease	Recovery period
First level (mild)	increased fatigue, general weakness and pain around the heart, hypotension, functional disorders of the gastrointestinal tract, susceptibility to colds and other infectious diseases	After cessation of exposure to ionizing radiation and appropriate treatment, recovery usually occurs within a short period of time.
Second level (average)	chronic radiation sickness, along with asthenoneurotic symptoms, pronounced changes in the myocardium, moderate disorders of the gastrointestinal tract	The disease is usually characterized by a long course of treatment and the inability to fully recover.
Third degree (severe	Bleeding, organic changes in internal organs, and acute manifestations of hematoma diseases.	With long-term treatment, the symptoms of the disease can be temporarily slowed down.

- chronic radiation sickness and is characterized by infectious complications with a progressive course with a continuous course.

Unlike acute radiation sickness, chronic radiation sickness is caused by prolonged exposure to radiation on the human body. Chronic radiation sickness can occur both in military situations and when radiation workers do not take precautions.

Symptoms of chronic radiation sickness depend on the amount of radiation, how it is distributed in the body, and how sensitive the human body is to the effects of radiation. In this regard, chronic radiation is currently divided into three periods according to the effect of radiation on the body. The first period is characterized by the same effect of radiation on the body over a long period of time. The second period includes cases of exposure to radiation both from the outside and from inside the person, in which the radiation can have a local effect on a particular organ. The third period includes types of general and local radiation. The relationship between the amount of radiation passing through the body and the severity of the disease in chronic radiation sickness has not been established. There are opinions that if a person who has received about 1-1.5 grays of radiation does not clearly show symptoms of the disease, then patients who have received

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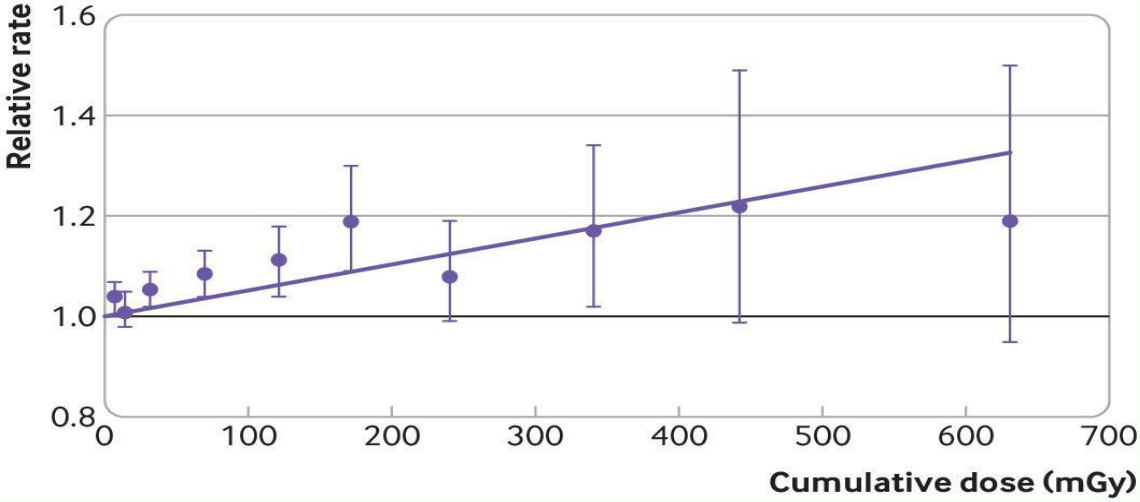
4-5 grays of radiation have a severe course of radiation sickness. Chronic radiation sickness begins with a deterioration in the patient's general condition. This includes: 1) changes in the autonomic and central nervous system (neurosis with sleep disorders and memory loss, excessive sweating, etc.). 2) ECG shows a decrease in tooth voltage, a drop in blood pressure, and heart and vascular insufficiency with bradycardia; 3) enlargement of the liver, yellowing of the skin and whites of the eyes; 4) hair loss, thinning of nails, dryness and peeling of the skin; 5) changes in blood composition; 6) hemorrhages into the subcutaneous and mucous membranes.



2- image. cumulative dose (mGy)

In the mild form of the disease (chronic radiation sickness of the I degree), we see the changes discussed above. The number of leukocytes in the blood changes. In this case, it is possible to observe a decrease in the number of leukocytes (up to 3109/l), a decrease in neutrophils, and an increase in the number of lymphocytes. This form of the disease is mild, and patients recover by the end of the second month. In the moderately severe form of the disease, the symptoms of the disease are also diverse. In addition to the symptom's characteristic of asthenia and vascular dystonia, subcutaneous hemorrhages, dysfunction of internal organs, and metabolic disorders can be observed. The number of erythrocytes and hemoglobin in the blood decreases. The number of leukocytes and platelets also decreases sharply. In this regard, patients complain of subcutaneous hemorrhages, bleeding from the gums, nose, and in women from

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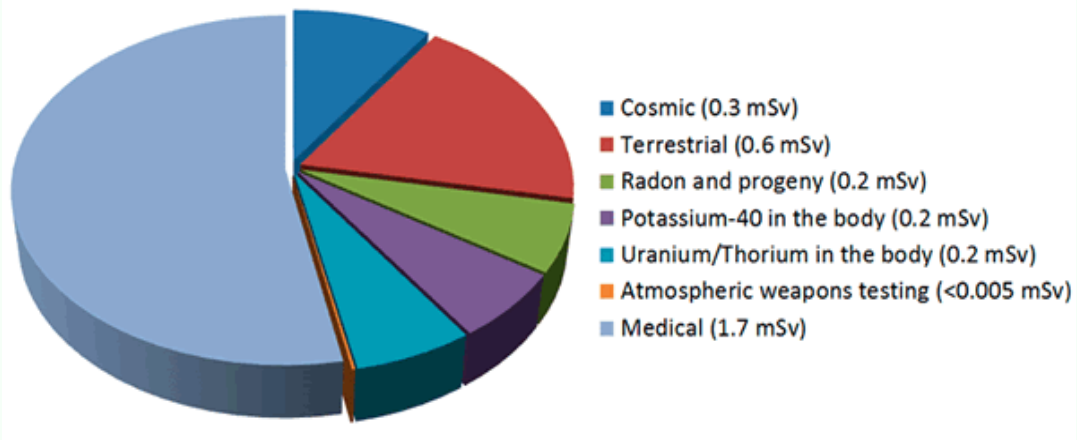
the uterus. Various trophic changes occur, bones become brittle. Pain appears in the heart area, and the heart begins to beat slowly (bradycardia). The disease lasts for years and is aggravated by severe fatigue and infections. Such patients need to be treated many times. Often, even after this, the patient does not fully recover from the disease. In severe forms of chronic radiation sickness, there is a bleeding disorder, a sharp deterioration in the functioning of blood-forming organs, irreversible processes in the central nervous system and internal organs, and the development of infectious complications. Severe anemia, a sharp decrease in the number of leukocytes, granulocytes in the blood, and thrombocytopenia occur. The disease is severe and often ends in the death of the patient due to bleeding or infectious complications. In some cases, incomplete remission is observed, characterized by a slight improvement in the blood composition and the general condition of the patient [6]. Treatment and prevention of the disease. To prevent the disease, it is necessary to follow safety rules in places where radiation is used. In such places, the amount of radiation that can affect the human body should be controlled.



1-imaje. Sources of Radiation

The disease must be treated completely. In mild cases of chronic light sickness, drugs that invigorate and improve nervous activity (ginseng, lemongrass, eleutherococcus, etc.), vitamins, and minor tranquilizers are prescribed. In moderate cases of the disease, in addition to the above drugs, drugs that improve the functioning of the central nervous system, stimulate the production of blood and leukocytes, and stop blood clotting, antibiotics, blood and its components are used. Severe cases of chronic light sickness require long-term and persistent

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treatment. The main attention is paid to improving the blood condition (transfusion of erythrocytes, leukocytes, and platelets into the blood), combating infectious complications (drugs that kill bacteria, gamma globulin, etc.). Acute radiation sickness is a general disease of the body and occurs as a result of exposure to a radiation dose of 1 Gy (100 rad) or more. The degree of exposure to ionizing radiation depends on its amount, that is, how much radiation has passed through the body. The unit of radiation exposure to living tissue is the gray (Gr), 1 gr is equal to 100 rad.

Currently, it is accepted to divide the clinical manifestations and course of acute radiation sickness into four stages: mild, moderate, severe and very severe. Mild type of the disease; 1-2 Gr; moderate type; 2-4 Gr; severe type; 4-6 Gr; very severe type; radiation above 6 Gr occurs [7]. At a dose of radiation of 1-10 Gr, the body is mainly damaged by carbon, therefore this type of acute radiation sickness is called the carbon type. When a person receives radiation at a dose of 20 Gr and above, in addition to the blood-forming organs, the intestinal epithelium is also damaged. When the intestine is damaged, serious changes in the blood-forming organs may not occur, but those who are damaged quickly die. When a person receives very large doses of radiation, a toxemic and cerebral type of acute radiation sickness develops, in which the irradiated person dies after a few hours, sometimes a day. One of the unique aspects of acute light sickness is its cyclical nature. Four periods are distinguished [8, 9]:

- the initial period or the period of the body's primary reaction to radiation,
- the latent period or the period of clinical calm,
- the period of exacerbation or the period when all the symptoms of the disease appear,
- the period of recovery.

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