RADIOBIOLOGICAL AND MEDICAL ASPECTS OF THE DIAGNOSIS AND TREATMENT OF ACUTE RADIATION SYNDROME IN VICTIMS OF THE CHERNOBYL DISASTER

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The Chernobyl disaster of 1986 became the largest man-made radiation accident in the history of nuclear energy and led to new approaches to the diagnosis, treatment, and medical-radiobiological care of individuals exposed to ionizing radiation. A distinctive feature of the accident was the massive release of radionuclides into the environment, which led to the irradiation of significant segments of the population and the development of acute radiation sickness among Chernobyl NPP personnel, firefighters, and accident cleanup workers.

In the first days following the accident, the key task was the early diagnosis of the severity of acute radiation sickness and the prediction of the course of bone marrow syndrome. It was established that hematological and cytogenetic studies became the most informative methods of early biological dosimetry. Determining the level of peripheral blood lymphocytes in combination with the analysis of chromosomal aberrations in lymphocyte cultures made it possible to assess absorbed radiation doses and refine the severity of radiation damage. Cytogenetic dosimetry based on the analysis of dicentric and ring chromosomes was performed on virtually all victims with suspected acute radiation sickness.

It was shown that the clinical course of acute radiation sickness in victims of the Chernobyl accident had a number of features caused by the combined effects of external gamma and beta radiation, the incorporation of radionuclides, and the toxic effects of combustion products. In many cases, a wave-like pattern of cytopenias and delayed development of bone marrow syndrome were observed. It was found that primary hematological changes did not always correspond to the subsequent severity of the clinical course of the disease, which underscores the importance of comprehensive laboratory monitoring.

Based on the results of cytogenetic studies, a mathematical model of multiple linear regression was proposed for the first time to retrospectively assess the severity of acute radiation sickness using a set of cytogenetic indicators. It was demonstrated that the use of a multifactorial approach provides a higher accuracy in assessing radiation damage compared to the analysis of individual cytogenetic parameters.

An important step in the treatment of severe forms of acute radiation sickness was the use of bone marrow transplantation in patients with life-threatening hematopoietic disorders. The implementation of comprehensive pathogenetic therapy, including detoxification measures, blood transfusions, and bone marrow transplantation, has made it possible to significantly reduce the severity of the clinical manifestations of acute radiation sickness and improve the survival of victims.

The experience gained as a result of the Chernobyl disaster is of exceptional importance for modern radiation medicine and biological dosimetry. The comprehensive use of hematological, cytogenetic, and clinical research methods is a prerequisite for the early diagnosis, prognosis, and treatment of acute radiation injuries in humans.