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MEDICAL CONSEQUENCES OF THE CHERNOBYL ACCIDENT: AFTERMATH AND UNSOLVED PROBLEMS*

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Data on the health consequences of the 1986 Chernobyl accident are generalized. The volume and quality of the information available at different times after the accident which is required for diagnostics of the prognosis and for picking methods for minimizing the consequences of the accident are evaluated. The decisions made during the early period using the limited information available at the time but requiring that immediate measures be taken, whose accuracy can be evaluated in the future, are compared. Three basic groups of individuals drawn into the accident situation with a different combination of health risk factors are singled out: emergency shift workers, participants in post-accident cleanup, and the population in the accidental emission zone. The health consequences for these groups and the principles of their observation in the future are evaluated.

Twenty five years have passed since the large-scale accident at the Chernobyl NPP. During these years, the main indicators characterizing the type of accident and what caused it and the irradiation, physical and mental health of different groups of people were studied throughout the world and especially in our country. The extensive information which has been accumulated makes it possible to return to the initial ideas which arose immediately after the accident and critically evaluate the reliability of the predictive criteria adopted at that time and the adequacy of the measures taken to overcome and minimize the damage done to people's health.

Certain problems, which still exist, must be singled out and the initial predictions and solutions re-examined:

1) determine the main population groups with different degrees of involvement with the accident, analyze their irradiation (absorbed dose), health dynamics and indications for future general or specialized observation;

2) evaluate not only the direct but also the main future (oncological and neuro-psychological) consequences as well as the degree of social adaption of different contingents participating in the accident; and

3) examine the adequacy of the initial evaluations and measures used to minimize the health consequences of the accident and determine the criteria for determining the time required and the consequences and character of the treatment-prophylactic measures taken.

An explosion in the RBMK-1000 reactor in the No. 4 unit of the Chernobyl NPP occurred at 1 h 23 min 49 sec on April 26, 1986. As a specialist in acute radiation sickness [1, 2] and the chief of the clinic at the Institute of Biophysics, located in hospital No. 6, I was notified of the accident between 2 and 3 h on April 26 by a telephone call from the Medical-Sanitary Department (MSD) at the Chernobyl NPP (MSD No. 126); subsequently, this information was confirmed by an orderly at the No. 3 Directorate of the Ministry of Health. The clinical manifestations in the people drawn into the accident gave doctors at this MSD a basis for supposing the development of acute radiation sickness. It soon became apparent that

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already more than 100 people exhibited such symptoms; they were taken by ambulance to MSD No. 126 for first aid. Then I made the decision to hospitalize all victims in the Moscow clinic.

During conversations in the evening of April 26 at MSD No. 126, we learned of two fatalities (one person was buried in debris, another died at the MSD from serious thermal burns) and the first results of diagnostics work performed by the emergency team at the Institute of Biophysics (IBP) on April 26 in Chernobyl. Already during the first day, when urgent countermeasures were taken, a group of individuals requiring examination and treatment was selected and the sequence of evacuation to specialized institutions was determined. The clinic at the IBP and the medical facilities in Kiev were selected to provide treatment. Three-hundred fifty people thought to have acute radiation sickness were sent to medical hospitals. The first patients entered the IBP clinic at night from April 27 to 28. Two-hundred seven people, including 115 patients with an initial diagnosis of acute radiation sickness, subsequently confirmed in 108 people, were taken in two jet airplanes to Moscow. About 100 people arrived in Kiev; the diagnosis was verified in 26 people. Later, the IBP clinic accepted another 148 people from the initial participants called to examine the reasons for and to minimize the consequences of the accident [3, 4].

The present article analyzes the basic scientific-medical and practical consequences of the acute and future period over the 25 years after the accident. Here, it should be kept in mind that clinical-laboratory criteria for the dose level and seriousness of the injuries and not the dosimetric data were used as the basis for assessments of the levels of irradiation and possible health consequences. Only later were they compared with data on the possible dose levels according to certain dosimetric criteria: determination of the nuclide content in hospitalized living patients and at post-mortem autopsy [5, 6].

It is also necessary to take account of the fact that previously scientists had never encountered accidents involving enormous territories and contingents. The accidents in Great Britain, Southern Urals, Brazil, and USA did not involve as many people and zones exposed to emissions due to the accident [7].

Three groups of participants in the Chernobyl accident and post-accident cleanup clearly stand out in the totality of information obtained:

1) individuals who witnessed the accident and suffered acute radiation sickness;

2) individuals who worked on post-accident cleanup and who did not manifest acute radiation sickness; and

3) individuals living in Pripyat and the adjoining zone of populated points which were quickly resettled; a large number of individuals lived on extensive territories with different degrees of contamination and were not all subjected to short-notice or continual resettlement and change of life-style.

Unquestionably, the group of individuals suffering from acute radiation sickness must be analyzed first.

Acute Radiation Sickness. The initial dose assessment of the victims was based on biological dosimetry (bio-indication) and included the following:

1) evaluation of the patient's average body irradiation dose according to the number of chromosomal aberrations in the lymphocytes and bone-marrow cells (subsequently according to the number dynamics of peripheral-blood cells);

2) elimination of the neutron component in the dose structure according to the absence of activation of bio-elements in human body; and

3) determination of the nuclide content in precipitates, on skin and in the body and iodine isotopes in the thyroid gland [4].

Another urgent problem was evaluation of the health of people who were present during the first few days on the plant site and in whom acute radiation sickness could develop. This diagnosis was subsequently confirmed in 108 of the 129 people directed to the IBP and in 26 people of the total number sent to Kiev facilities; no acute radiation sickness was confirmed in children. Subsequently, attempts were made to compare the dose evaluated by bio-indication with information on irradiation conditions.

As already mentioned, the radionuclide content in patients (on skin, in the thyroid gland (iodine isotopes) and in the entire body (radioactive cesium and other isotopes) were determined using a human-body radiation spectrometer [4].

A radiological safety regime (radiometric control posts, changes of clothes, linens and objects used in patient care, washing contaminated surfaces and others), was instituted in the clinic; this regime was subsequently recommended in guidelines for organizing medical assistance during radiation accidents [8].