Medical and Genetic Radiation Effects in Children Exposed as a Result of the Chernobyl Accident Residing in the Contaminated Area of the Kaluga Region, Russia

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The Chernobyl accident revealed a large-scaled environmental contamination that resulted in the forming of a significant subpopulation of children in early age with a high risk of radiation-induced diseases in particular of blood, thyroid, hereditary pathology, etc.

The aim of this work is a medical and genetic study of individual radiosensitivity in children of the early age residing at the areas of the Kaluga region affected by radionuclides as a result of the Chernobyl accident.

Actuality of the research performed is subjected to the new clinical and genetic approaches to the individual, complex and differentiated estimate of health state of the exposed children taking into account their age peculiarities, and individual radiosensitivity.

We examined the children of three age groups residing in the territories with a soil contamination by radioactive cesium-137 of 7 Ci/sq.km to 15 Ci/sq.km. Group I included 9 children who were at the age of 1.5 - 3 years at the time of the Chernobyl accident. Dosimetric data for the thyroid received over the first days and months after the accident showed individual doses by radioactive iodine-131 of 33 rad to 320 rad. Group II included 7 children born in 1986, whose age at the time of the accident was a few months. The thyroid doses of iodine-131 ranged individually from 1 rad to 274 rad. The children of group III (7 persons) were born after the Chernobyl accident (1987, 1988, 1989) and were exposed only to low levels of radiation for several years of their lives.

The examined children of group I (1982, 1983, 1984) are considered to be often-ailing ones by their somatic status (their anamnesis detected ARD 2-5 times a year, stomatologic pathology, thyroid changes, etc.).

Cytogenetic analysis showed that individual variations of aberrant cells of the peripheral blood in the examined children ranged from 1.5 % to 3.5 % per 100 analyzed cells. Radioindication markers involved dicentric chromosomes, abnormal monocentrics, and rings. The marker frequency of radioindication-exchange chromosome aberrations per 1 analyzed cell (lymphocyte) ranged individually from 0.001 to 0.01. The ratio of chromosome aberrations to structural chromatid disorders is 2.14:1. This ratio probably indicates a contribution of a radiation mutagenous factor to the disorders in the genetic structure of lymphocytes of the peripheral blood in the examined children compared to the other mutagenous factors of non-radiation nature.

In Group II, including the children of 1986, the medical and genetic anamnesis in 50 % of the examined children is very dramatic. For instance, the boy F.D.V. was born as the first of hetero-ovular twins and his sister was stillborn, etc. The analysis of somatic status showed that the majority of the children related to the category of often-ailing ones (ARD, stomatologic pathology, etc.)

Cytogenetic analysis of aberrant cells showed that individual radiosensitivity in the examined children of this age group was within 1.5 % and 4.0 %. Radioindication markers per 1 lymphocyte ranged from 0.005 to 0.025. The ratio of chromosome and chromatid aberrations is 1.3:1.0. It indicates the insignificant role of the radiation component in the mutagenous effect onon-radiation factors on the genetic structure of lymphocytes in children´s blood.

Group III (7 persons) includes the children born after the accident but having been living on the affected territories since their birth. The hereditary and somatic status of most children is dramatic. For instance, the boy of 1988 was born as a result of a fifth pregnancy with a minor weight. During only one year he suffered from pneumonia twice, ARD - four times, stomatitis, ect.

Cytogenetic analysis showed that individual variations of aberrant cells ranged from 1.5 to 3.0 % per 100 analyzed lymphocytes while the frequency of chromosome exchanges-markers of radioindication was within 0.001 and 0.015 per 1 analyzed cell. The ratio of chromosome and chromatid aberrations is 2.14:1.0 that indicates the prevalence of radiation mutagenous component in the disorders of the genetic structure of lymphocytes in the examined children over mutagenous factors of non-radiation nature.

Thus, the children of the three age groups form the group of risk, require dynamic monitoring and clinical correction in order to mitigate the aftermath of the Chernobyl accident taking into account the duration of their lives and their individual radiosensitivity.