GENOME STATE IN SOMATIC CELLS OF ATOMIC ENTERPRISE WORKERS AND THEIR CHILDREN, AND GRANDCHILDREN

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The clinical and experimental investigation evidence that instability of somatic cell genome plays the great role in forming the late consequences of exposure. There are comprehensive data about positive correlation and succession of damages induced in genome of somatic cells, and the consequent tumour development. It is emphasized the possibility to evaluate the genetic danger of exposure by level and character of chromosome changes into somatic cells (1). The purpose of this investigation was to evaluate the genome state in somatic cells of persons exposed to chronic radiation, and their offspring (generations I and II).

MATERIALS AND METHODS

The genome state of lymphocytes in peripheral blood was evaluated in workers of MAYAK PA, first atomic enterprise in Russia, who were exposed to chronic external γ-radiation or joint radiation (external and internal from plutonium-239 incorporated) at first years of building the MAYAK. Total doses of exposure varied from 0.5 to 4.0 Gy, and in some cases they went up to 6.0 Gy for 5-6 years of work. The amount of incorporated plutonium-239 ranged from 0 to 7.4 kBk. Period of 30 years went after end of contacting with exposure. Group of MAYAK workers contains 433 individuals, and control group consists of 150 persons. It was examined 179 children of exposed parents (the gonad dose of father - 1.78±0.11 Gy, of mother - 2.07±0.16 Gy). The age of children during period of chromosome investigation was in range of 30-40 years. It was examined 150 grandchildren (at age 2-6 years) of exposed professionals.

The standard methods of two-day culture of lymphocytes of peripheral blood and the obtaining of chromosome preparations were used. Preparations were stained by Romanovsky-Giesma method. The number of chromosomes in metaphase plate, and the aberrations of the chromatid and chromosome types were analyzed in 100 metaphases for each case.

RESULTS AND DISCUSSION

The frequency of aberrations of the chromosome type varies from 0 to 9 per 100 studied cells at late periods of chronic exposure. The mean values in different dose groups exceed the spontaneous level of aberrations at 4-8 times. The portion of aberration of stable type was 45.0-55.0% of total number of chromosome aberrations. The aberrations of instable type were mainly twin fragments and dicentrics with the accompanying fragments. The frequency of aberrations is higher when there is joint radiation influence, and is determined by correlation with the marrow dose of exposure to radionuclides (Figure). The higher frequency of chromatid aberration did not find out in comparison with control and pathological cell clones.

The frequencies of chromatid and chromosome aberrations in 179 children of exposed parents did not statistically differ from corresponding characters in control (children of town residents who had not occupational contacting with radiation) (Table 1). The portion of stable aberrations was higher in offspring exposed *in utero* (mean

dose of 0.17 Gy) and equal to almost up to 50% of total number of aberrations, than those in offspring not having antenatal exposure.

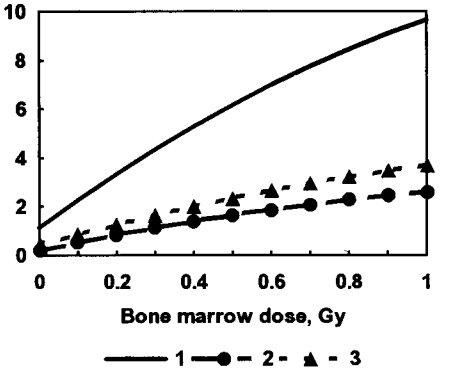

Figure 1. Chromosome aberration frequency (per 100 cells) by external γ-radiation and ^{239}Pu body burden (1 - Cromosome aberrations, 2 - Dicentrics, 3 - Stable aberrations)

Table

Chromosome aberrations (per 100 cells) in children of atomic workers

Groups	Number of patient	Cells scored	Chromatid aberrations	Chromosome aberrations		
				total	dicentrics	stable
Control	92	9200	0.4±0.08	0.37±0.07	0.11±0.04	0.16±0.04
Children of atomic workers	179	17900	0.53±0.06	0.37±0.06	0.11±0.03	0.13±0.08
Father	50	5000	0.52±0.12	0.30±0.08	0.08±0.04	0.10±0.04
Mother and father	37	3700	0.43±0.18	0.38±0.12	0.11±0.05	0.03±0.02
In utero irradiation	92	9200	0.57±0.08	0.40±0.10	0.13±0.04	0.19±0.06

The frequency of chromosome type aberration of examined 158 grandchild (generation II), which grandparents exposed to chronic radiation, corresponded to control (68 children) value (0.47±0.10 and 0.51±0.08 aberrations per 100 cell, respectively).

Thus, the instability of genome is keeping in professionals more than 30 years after chronical external and joint exposures in doses exceeded the maximum permissible dose. This cohort of workers is characterized the higher risk of malignant tumours, especially in those having plutonium-239 incorporation (2). Mutogenic effect of radionuclide was shown earlier (3, 4). In comparison with control, the heightened

instability of genome did not find out in first two generation (F1 and F2) of exposed parents by test of chromosome aberrations.

The cytogenetic effect of antenatal exposure is noteworthy. It is known that exposure *in utero* is the factor of higher risk of leukemia (4). It is necessary the future clinic-cytogenetic observation for seeking the possible prognosticating of exposure consequences by test of chromosome aberrations.

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