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Retrospective Analysis of Population Oncological Morbidity at the Certain Territories, Suffered from the Chernobyl Accident (1981-2005).

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ABSTRACT

The authors represented the data analysis of oncological morbidity during the 25-year period of observation (1981-2005) among the population of two regions of Russia, with different level of radioactive contamination after the Chernobyl accident. The particularities of oncopathological development in the territories, polluted by radio nuclides, are shown. The most distinct differences were observed after 5-11 years of the Chernobyl accident. During the final years of observation (2001-2005) there is the second less-noticeable wave of oncological morbidity. The dynamics of oncological morbidity growth rate among the population of the suffered territories has one direction and the development of malignant new growths contemporizes both in Belgorod and Bryansk region.

Keywords: ionizing radiation, small doses of radiation, malignant new growths.

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INTRODUCTION

Ionizing radiation is one of the most studied factors of environment causing the malignant new growths (MNG) growth at the population level [1, 2]. However the problem of cancerogenic risk estimation of small and midget doses of radiation is very important. It became socially significant, as it concerns not only professionals. It is caused by the rapid development of atomic engineering, using of ionizing radiation in war industry, in medical and other fields of study, so it leads to the increase of the radiation burden for each inhabitant of the Earth as an anthropogenous component of the radioactive background [3]. Moreover, in the large highly-inhabit territories, the external irradiation of people is aggravated with incorporated radio nuclides after the nuclear weapon tests, industrial disasters, acts of radiation terrorism [4, 5]. Thus, as a rule, the quantitative estimation of small doses, and also the nature of possible consequences of an irradiation remain the problems facing serious scientific and methodical difficulties [2, 6].

However being a tragedy the Chernobyl accident (CHAC) has created unique possibility for studying oncopathology at the population level: time of the action beginning for biothat radiating factor is known (26.04.1986), the spectrum is deciphered and the quantity of the radio nuclides emissions from the destroyed reactor to the atmosphere is established; the levels of pollution of surface contamination ^{137}Cs are defined and the number of the people living in these territories is calculated; many researches of individual and collective doses of an irradiation of the population are conducted [7-9]. The limited number of individual doses of the irradiation received by direct measurements is the vulnerability of this situation [10, 11]. Even if we taking into account all uncertainty and will use the mo dern mathematical technologies, available data have the big variability and, correspondingly, they are considered to be rough [6,12]. Thereupon for the role defining of the radiating factor, the long-term MNG monitoring received on the basis of population cancer-registers is used; it allowed to receive analytical data by development of oncopathology at population level in dynamics of the whole postdamage period among the population of the Belgorod and Bryansk regions [8,12].

METHODOLOGY

Population data of cancer-registers of Belgorod and Bryansk regions in Russia are used. Belgorod region is one of 15 administrative territories in Russia which has undergone to influence of small doses of radiation as a result of the CHAC. According to Federal Hydrometereology and Environmental Monitoring Service the pollution area in 1986 involved 1620 km^2, 2 or 6 % of territory, at levels of surface contamination ^{137}Cs from 1 to 5 Ci/km^2. The contamination data by ^{131}I are absent. The retrospective analysis, held in 2004 by IRSN, Russian Academy of Sciences, showed that surface contamination ^{137}Cs is distributed in regular intervals on the territory of this region and makes 23 kBq/м^2, and the collective dose ^{131}I on thyroid gland can make about 76 Gy on the person [9, 10].

104978 first time revealed cases with the diagnosis of a MNG across the Belgorod region were included in the analysis, also there were 113686 cases in Bryansk region, and more than 10 million cases in Russia.

Dynamics of absolute and relative indicators ("rough" indicators on 100 000 of population) of oncological morbidity is studied taking into account following parameters:

- Population morbidity of men and women, i.e. totally all annual cases of MNG during one generation is fixed.
- Population morbidity of men and women after the five year periods of observation is studied (1981-1985 - the period before disaster; 1986-1990, 1991-1995, 1996-2000, 2001-2005).
- The rate of oncological morbidity growth (%) after the five year periods of observation is examined (the data from 1986 to 1990 in relation to that in 1981-1985 the data from 2001 to 2005 in relation to 1996-2000).

MAIN PART

Annual dynamics of oncological morbidity for the 25-year period of observation (1981-2005) at the population of the Bryansk and Belgorod regions suffered after the CHAC, and the similar data across Russian Federation (Fig. 1) were examined.

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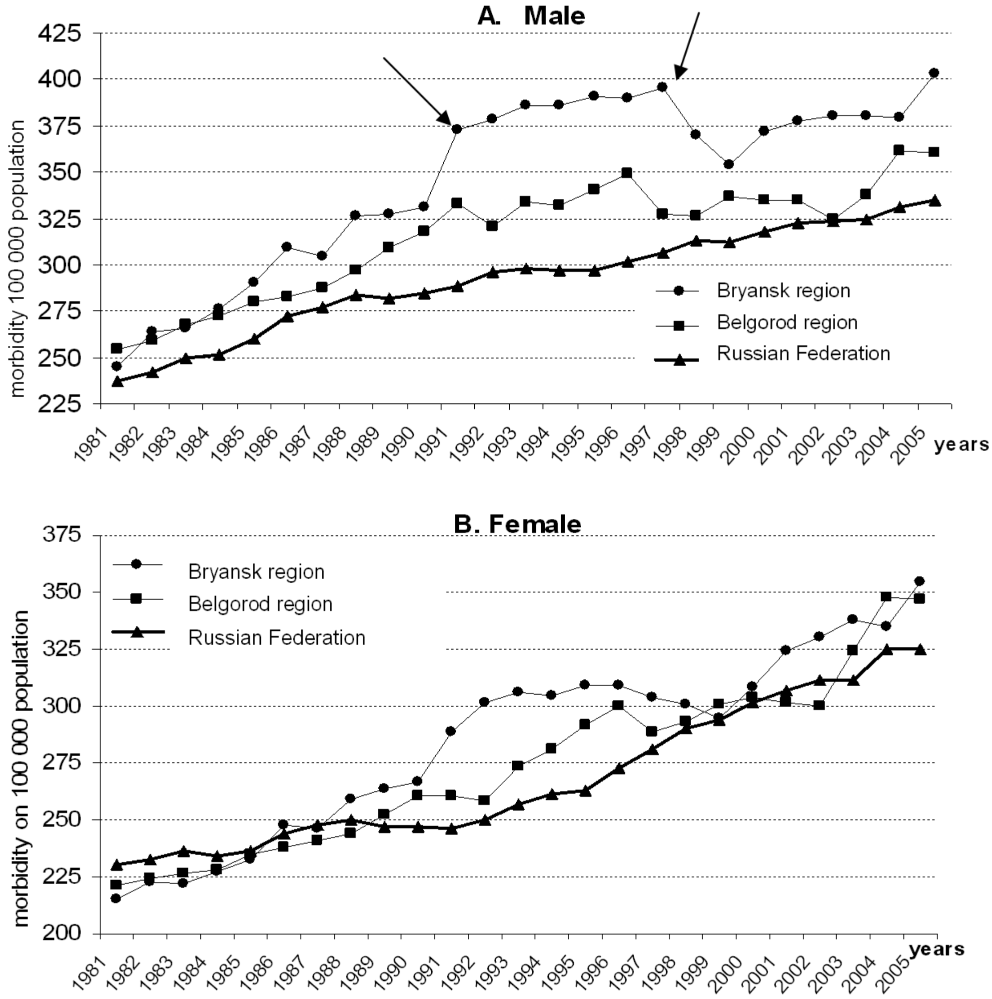

Figure 1: Annual dynamics of oncological morbidity among men (A) and women (B) for the 25-year period of observation (1981-2005). "Rough" indicators on 100 000 male and female population.

The presented makes it clear that oncopathology of men and women in Russian Federation has smooth growth throughout all years of observation whereas for the population of the territories polluted by radio nuclides, especially the Bryansk region, most suffered in Russia after the CHAC has the presence of original "hump" of oncological morbidity the top, both for men, and women, is revealed in 1991-1997, i.e. after 5-11 years after this accident (see arrows on Fig.1).

The data presented on fig. 1, can be essentially added during the analysis of oncological morbidity according to the five year periods of observation (Tab. 1).

Table 1: Oncological morbidity of Belgorod, Bryansk regions and the Russian Federation the population according to the five year periods of observation. "Rough" indicators on 100 000 population

The observation periods, years	Male			Female		
	Russian Federation	Bryansk region	Belgorod region	Russian Federation	Bryansk region	Belgorod region
1981-1985	248,3±0,5	268,1±5,6 *	266,6±5,8 *	234,0±0,5	224,0±4,6 *	227,0±4,9 *
1986-1990	279,9±0,6	319,7±6,0 *	299,0±6,1 *	247,1±0,5	256,6±5,0 *	247,2±5,0
1991-1995	295,6 ±0,6	383,1±6,6 *	331,9±6,2 *	255,5±0,5	302,1±5,4 *	272,8±5,2 *
1996-2000	310,3±0,6	376,1±6,5 *	334,8±6,1 *	287,7±0,5	303,5±5,4 *	297, 3±5,3 *
2001-2005	327,2±0,6	384,2±6,8 *	344,1±6,2 *	316,0±0,6	336,3±5,9 *	324,1±5,5 *

* - differences are statistically significant in comparison with the data across Russian Federation (p <0,05)

Table 1 shows that male oncological morbidity on the suffered territories statistically significantly higher in the period before CHAC, and for females, is contrary lower, than in the Russian population at all. The indicators of oncological morbidity among the male and female population living in polluted territories are higher throughout of all postdamage period, while statistically significant differences are recorded in 1991-1997.

One of the criteria of an estimation the additional cancerogenic factor action among the population, i.e. "the unaccounted" small doses of radiation, is the rate of oncological morbidity growth according the observation periods (Fig. 2).

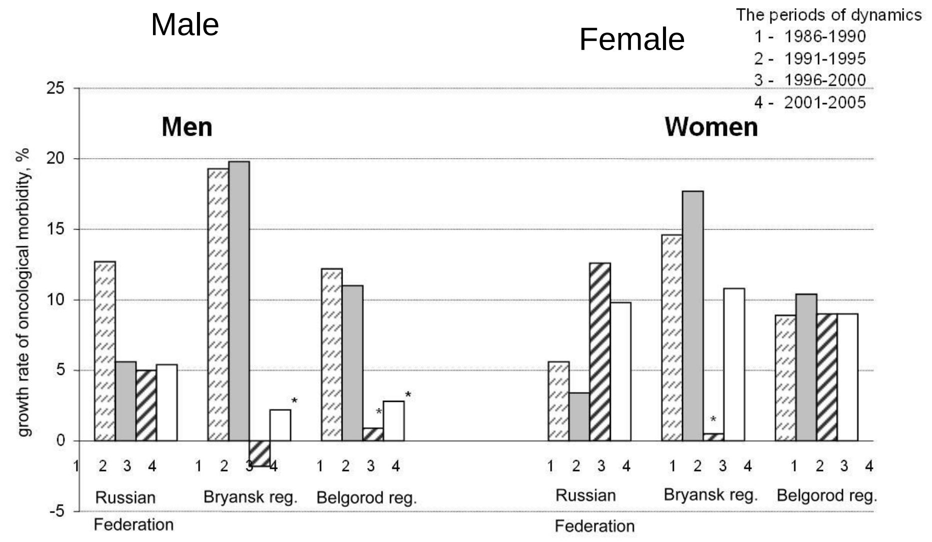

Figure 2: Dynamics of growth rate (%) * of oncological morbidity by MNG according to the five years' periods of observation.

* – differences statistically insignificant concerning the previous period of observation.

It is clear that in the first and the second five year periods (1986-1990, 1991-1995) the Bryansk region rate of oncological morbidity growth among male population appeared to be the highest (19,2 % and 19,8 %) in comparison with the rate in the Belgorod region (12,1 % and 10,7 %) and across Russian Federation (12,7 % and 5,6 %).

The rate indicators of oncological morbidity growth during the third postdamage period of observation (1996-2000) deserve special attention. The results of oncological morbidity growth rate among the male population in Bryansk and Belgorod regions had a sharp recession after the high rates of growth in the first and second five year periods (–1,8 % and 0,9 %, respectively). In the Russian Federation the growth rate remains practically at the level of the second (1991-1995) postdamage five year period (5,0 % and 5,6 %).

During the fourth postdamage period (2001-2005) the positive growth rate of male oncological morbidity in Bryansk and Belgorod regions is mentioned, though it remained below the all-Russian indicators (2,1 %, 2,8 % and 5,4 %, respectively). Both female and male indicators of oncological morbidity growth rate throughout 25-year observation period showed considerable variations, especially in the more suffered Bryansk region (Fig. 2).

CONCLUSION

The described wavy character of oncological morbidity in female and male populations is unlikely to be an accident, but an original reflection of certain staging development of oncopathology in the contaminated territories. Such a picture of oncological morbidity in the suffered territories can testify both the presence and negative influence of the additional cancerogenic factor. Taking into account the CHAC, radio nuclides could be such an additional factor due to its possibility of MNG development: presence of the latent period, progressing growth rate of oncological morbidity, deceleration of growth and occurrence of the second less noticeable morbidity wave [1, 4, 11].

FINDINGS

The higher indicators of oncological morbidity are observed among the male and female population, living in polluted territories (Bryansk and Belgorod regions of Russia) throughout of the postdamage period. Statistically significant differences fall on the period 1991-1997 in comparison with the Russian Federation, i.e. in 5-11 years after the accident. Dynamics of oncological morbidity growth rate has one direction with the MNG and its time of development both in «less polluted» Belgorod region and in «more polluted» Bryansk region. More accelerated growth rate of oncological morbidity was recorded within first ten years after the disaster (1986-1995), especially among the inhabitants of Bryansk region in comparison with the all-Russian indicators. In the third postdamage period (1996-2000) the further growth of oncological morbidity is either absent, or has negative values. By the end of the observation (2001-2005) the second, less noticeable, growth wave of oncological morbidity is recorded.

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