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INFANT'S LEUKEMIA IN BELARUS BEFORE AND AFTER CHERNOBYL

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Introduction. It is well known that hematopoietic tissues and organs are very sensitive to carcinogenic impact of the ionizing radiation. It has been established that the infants and children have the highest radiation risks of leukemia [1-3]. A number of the epidemiological studies have been performed soon after the accident at the Chernobyl NPP to explore the possible increase in the leukemia incidence in infants in countries that were affected as a result of this accident [4,5,7]. Conclusions of thesestudies are quite controversial. One of possible reason for the controversy lies in the limited scope of data analyzed by the authors [4,5,7].

Materials and Methods The data of the Belarusian Republican Registry of Hemoblastoses and the data of population census of the Republic of Belarus have been used in this presentation without separate consideration of boys and girls.

Results and discussion. The mean collective doses, mean individual doses of the whole body irradiation of the infants, numbers of registered cases of leukemia, the mean incidence rates as well as the mean standard errors estimated for different periods of time are shown in Table 1.

It should be noted here that the mean individual doses given in the Table 1 (h(indiv.)) have been estimated by division of collective doses evaluated for different periods of time for all Belarusian infants by total numbers of the infants in Belarus. Real doses of irradiation in some contaminated areas could be up to two orders in magnitude higher than mean doses. The mean doses given in Table 1 were used in the present report simply because performing of the analysis of the infant's leukemia on the population level.

According to the data shown in Table 1 the whole body irradiation of the Belarusian infants has been occurring practically only within the period 1986-1992. In this period occurred also some marked increase in the incidence of leukemia in infants of Belarus. This is to see from Fig.1, that presents temporary trend of the crude incidence rate of the incidence in leukemia in the infants of Belarus.

Table 1 – Registered cases and incidence rates of leukemia in infants of Belarus

Period	1979-1985	1986-1992	1993-1999	2000-2006	2007-2010
H(Coll). PYSv	0	59	4.58	2.78	2.76
h(indiv.). mSv/a	0	0.39	0.04	0.03	0.02
Cases	49	67	16	3	14
$IR*10^5$	4.33	6.36	2.28	0.47	3.26
$SE*10^5$	0.62	0.78	0.57	0.27	0.87

As a result of this increase approximately 21 additional leukemia cases have manifested in the infants of Belarus within this period (95% CI from 0 to 56). This number of additional leukemias has been estimated by the use of the mean incidence rate registered in 1979-1985 ($IR=4{,}33 10^{-5}/a$) considered as the mean value of the expected incidence rate of leukemia in 1986-1992.

The established data give relative risk equal to 1.468 (95% CI from 1.008 to 2.138) indicating that the registered increase in leukemia incidence in the infants of Belarus in 1986-1992 is statistically significant.

In reality the lower limit of 95% confidential interval is higher than the value 1,008 because as can be seen from Fig.1 the expected incidence rate in the period of 1986-1992 had to be lower than the mean incidence rate registered in 1979-1985.

It is well known that leukemia in newborns is linked to harmful effects appearing during the stage of embryonic development of the organism. Occurring of an evident jump in the infant's leukemia at the time when maximal doses of the whole body irradiation caused by the Chernobyl accident were delivered to the Belarusian population allows assuming that the most probable reason of this jump is the *in utero* irradiation.

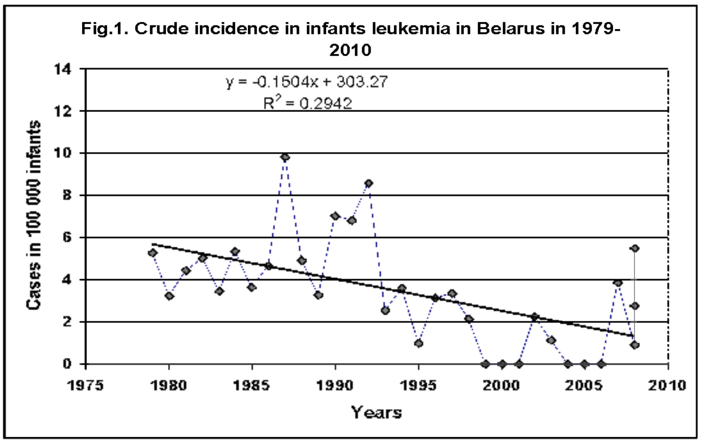

Figure 1 – Crude incidence in infants leukemia n Belarus in 1979-2010

This assumption allows to assess the radiation risk of the incidence in the infant's leukemia. The following data have been estimated upon this assumption: excessive relative risk, ERR =1208/Sv (95% CI from 19,4 to 2940/Sv); excessive absolute risk, EAR =524/10^4 PYSv (95% CI from 8,4 to 1274/10^4 PYSv, attributive risk, AR =31,9% (95% CI from 0,5 to 77,5%). These values have been estimated by using the method described by the authors [5].

References:

1. Petridou E., Trichopoulos D., Dessypris N., Flytzani V., Haidas S., Kalmanti M., Koliouskas D., Kosmidis H., Piperopolou F., Tzortzatou D. Infant leukemia after in utero exposure to radiation from Chernobyl. Nature, 382, 352-353 (1996).
2. Michaelis J., Kaletch U, Burkart W., Grosche B. Infant leukemia after the Chernobyl accident. Nature, 387, 246 (1997).
3. Steiner M., Burkart W., Grosche B. Kaletch U, Michaelis J. Trend in infant leukemia in West Germany in relation to in utero exposure due to the Chernobyl accident. Radiat. Environ. Biophys., 37, 87-93 (1998).
4. Ivanov E.P., Tolochko G.V., Shuvaeva L.P., Ivanov E.V., Iaroshevich R.F, Becker S., Nekolla E., Kellerer A.M. Infant leukemia in Belarus after the Chernobyl accident. Radiat. Environ. Biophys., 37, 53-55 (1998).
5. Ivanov, E.P., Ivanov V.E., Malko, M.V. Assessment of leukemia radiation risk in children of Belarus. Kongressband zum Internationalen Kongress «20 Jahre Leben mit Tschernobyl – Erfahrungen und Lehren für die Zukunft»- 14. bis 17. September 2006 in Feldkirch. Voralberg, Osterreich. 2007. Otto Hug Strahleninstitut – MHM e.v., München, S. 139-148.

ЛЕЙКОЗЫ У НОВОРОЖДЕННЫХ БЕЛАРУСИ ДО И ПОСЛЕ АВАРИИ НА ЧАЭС

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В докладе обсуждается заболеваемость лейкозами новорожденных Беларуси в 1979-2010 г. После аварии на ЧАЭС(в 1986-1992 гг.) установлено кратковременное повышение заболеваемости острой лейкемией детей в возрасте 0-1 лет. Наиболее вероятной причиной его явилось внутриутробное обучение новорожденных. В соответствии с результатами

анализа значение избыточного радиационного риска (ERR) заболеваемости лейкозами у новорожденных Беларуси составило 1208/Sv (95% CI от 19,4 до 2940/Sv).