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SPECIFIC FEATURES OF THE INCIDENCE IN ACUTE LEUKEMIA IN CHILDREN OF BELARUS

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There is a significant difference in patterns of the incidence in leukemia in children and adults. In case of children a significant increase in crude incidence occurs already in the period 0–1 year after the birth. In the period of 2-3 years after the birth the crude incidence remains practically constant. Beginning from the fourth year after the birth a constant decrease in the childhood leukemia occurs. This temporal pattern of the incidence in childhood leukemia is to see from Fig. 1 that shows age-specific incidences in leukemia in infants and children of the United Kingdom [1].

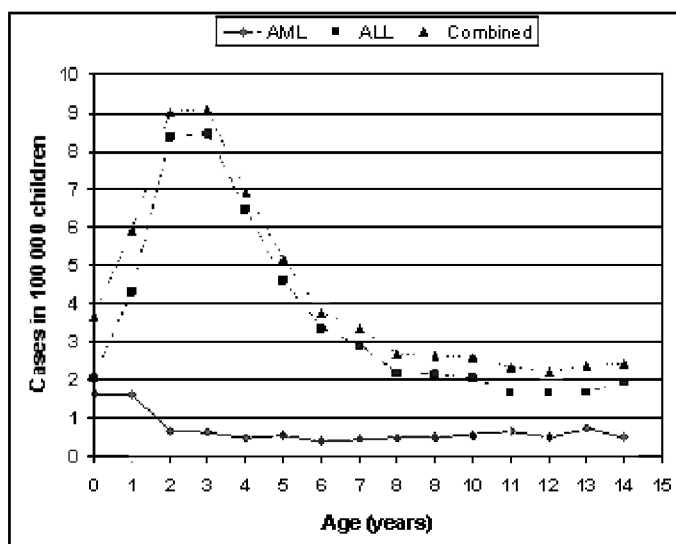


Figure 1— Incidence in childhood leukemia in children of the United Kingdom in 1996-2005 (AML- acute myeloid leukemia, ALL – acute lymphoid leukemia, combined – all types of acute leukemias)

Data shown in Fig.1 allows to assume that the reason for the leukemia incidence in infants and children lies in realization of genetic and other effects accumulated in the period of antenatal development of organism. It is evident that the impact of external factors after the birth plays lower role than at the stage of antenatal development of organism. Such conclusion follows from the fact of the existence of a constant decrease of the incidence in leukemia after reaching of maximal values at the age of 2-3 years despite the action of harmful external factors after the birth. Probably the most sever genetic changes and other harmful effects develop in the antenatal period and then manifest in the early period of life.

The other outstanding feature of the incidence in the childhood leukemia is the absence of a latency period. Such conclusion follows from the fact that first cases of acute leukemia appear very soon after the birth.

The analysis of existing data demonstrated that similar features shows the crude incidence in leukemia in the Belarusian children.

The absence of the latency is a reason for a practically immediate change of the incidence in the infant's leukemia if the intensity of harmful external factors is changed. This makes the incidence in the infant's leukemia a qualitative indicator of the environment quality.

Last specific helps to explain the temporary pattern of the incidence in infant's leukemia in Belarus observed in 1979-2010. Fig. 2 shows incidence rates of acute leukemia observed in Belarus in this period. It presents also data on the Great National Product of Belarus in 1979-2010 [2-4].

According to data of Fig.2 there was a slight increase of the incidence rate in acute leukemia in infants of Belarus in 1979-1985. Practical immediately after the Chernobyl accident the incidence in infant's leukemia in Belarus showed a significant increase. This was only a short-time increase and beginning from 1992 a significant drop occurred in the incidence in infant's leukemia in Belarus. As a result of this decrease the incidence rate of the infant's leukemia in Belarus in 1993 reached its minimal value that was practically one order in magnitude less than in 1987. Beginning from 2005 the new increase of the infant's leukemia was registered in Belarus.

One can see from Fig. 2 that the temporal pattern of the GNP is similar to the temporal pattern of the incidence in the infant's leukemia. There was a constant increase in the GNP of Belarus in the period 1979-1990. However after the crush of the former USSR a significant drop of the GNP of Belarus occurred. As a consequence of this drop the GNP of Belarus decreased by one order in magnitude in comparison with its value before the crush of the USSR. After 1995 the GNP of Belarus began to increase and in 2010 it was comparable with the value of the GNP in 1979.

It is clear that the value of the GNP reflects the amount of harmful substances that are released into the environment influencing the incidence in different diseases including the incidence in leukemia and other malignant neoplasms. The significant drop of the GNP occurred after the crush of the former USSR caused immediately the significant increase in the infant's leukemia in Belarus. This specific of the GNP allows to consider it as the some integral indicator of the anthropogenic impact on the organism.

Quite different situation arise in case of the age group 1-4 years and other children's age groups. The reason of this is a permanent transition between different age groups of children. All infants that reach the age 1 year leave the age group 0-1 going to the age group 1-4. All children in the age group 1-4 that reach the age 5 years leave this group and go to the age group 5-9 years and etc.

This transition helps to keep the incidence in leukemia in the age groups 1-4 and 5-9 years up to 1996 at practically the same level as at the end of eighties. This can be seen from data presented in Fig.3 that shows the temporal pattern of the incidence in acute leukemia in the combined age group 0-14 years.

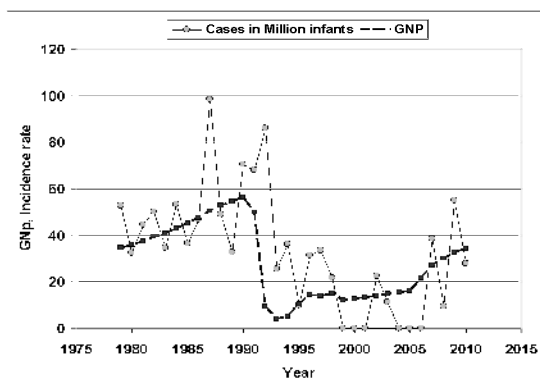


Figure 2 – Temporary patterns of the incidence in infant's leukemia and of the Great National Product of Belarus in 1979-2010

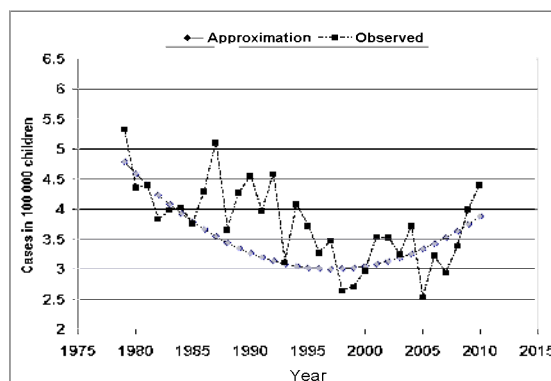


Figure 3 – Incidence rates of the acute leukemia in children of Belarus (0-14 years) in 1979-2010

Fig. 3 gives observed values of the incidence rates as well as expected values assessed by using the approximation polynomial equation:

$$Y = -1,0544 \cdot 10^{-5} x^3 + 6,8490 \cdot 10^{-2} x^2 - 1,4740 \cdot 10^4 x + 1,0519 \cdot 10, R^2 = 0,68,$$

established on the basis of a «window» method [5].

The values Y in the last equation is the incidence rate of the childhood leukemia in the year x .

In accordance with the «window» method the approximation of observed values has to be performed by excluding all «suspicious» data. By establishing of the equation shown here data observed in 1986-1995 were excluded because of probable manifestation of radiation-induced leukemia in this period in children of Belarus.

It is to notice here that correct evaluation of the incidence rate by using the given equation requires much more figures for each coefficient. The shown coefficients of the equation have only to demonstrate their order but they do not allow to estimate correct values of incidence rates of leukemia in children of Belarus (0-14 years).

The established approximation was used for an assessment of expected leukemias in children of Belarus in the period 1979-2010. It gave 759 expected cases of leukemia for the period 1986-1995 for the combined group 0-14 years. The total number of leukemias registered in this group in 1986-1995 was equal to 956 cases. Using these numbers gives the value of relative risk, RR , equal to 1,26 (95% CI from 1.15 to 1,39) as well as the following values of radiation coefficients: $ERR = 15,4\%/1 \text{ mSv}$ (95% CI from 0.86 to 22,8%/mSv), $EAR = 50,3/10^4 \text{ PYSv}$ (95% CI from 28,1 to 74,7/10⁴ PYSv), $AR = 20,6\%$ (95% CI from 11.5 to 30.6%). All these

values agree qualitatively with similar values assessed for children of Belarus in the report [5] and demonstrate that the accident at the Chernobyl NPP did not cause some catastrophic health consequences for Belarus.

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ОСОБЕННОСТИ ЗАБОЛЕАЕМОСТИ ОСТРЫМИ ЛЕЙКОЗАМИ ДЕТЕЙ БЕЛАРУСИ

Малько М.В., Иванов Е.П.

В докладе обсуждаются особенности заболеваемости лейкозами детей Беларуси. Показано, что конкуренция радиационного и антропогенных факторов определила заболеваемость лейкозами у детей Беларуси после аварии на ЧАЭС.

Оценено количество радиационно-индуцированных лейкозов у детей Беларуси в 1986-1995 годах вследствие аварии на ЧАЭС, составившее примерно 200 случаев. Это количество соответствует значению относительного риска равного 1,26 (95% CI от 1,15 до 1,39).