Acute myeloid leukemia: Incidence and observed survival in children of Belarus

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Summary
Increase of incidence of the different types of leukemia was supposed after contamination of a big area of Belarus with radioelements due to the Chernobyl accident. The goal of this study was the analysis of incidence of childhood (0-14) acute myeloid leukemia (AML) in Belarus for period 1989-2003 years and observed survival as well.

Analysis was performed on the data of Children cancer-subregistry of Belarus which has verified base of cases back to 1989 year. General number of childhood (0-14) de novo leukemia cases are 1156 for period 1989-2003 years, acute lymphoblastic leukemia (ALL) – 919 (80%), acute myeloid leukemia (AML) – 163 (16%). Age-standardized incidence rate of childhood (0-14) de novo AML – 0,499±0,040. Standardized incidence ratio (SIR) in 1989-1994/1998-2003 was 93,388±4,848 for all leukemia (incidence decreased; n.s.), 87,035±5,211 for ALL (incidence decreased; p<0,05), 136,59±16,564 for AML (incidence increased; p<0,05). Overall survival of children (0-14) with de novo AML has been improved last ten years from 0,22±0,06 (in 1989-1993) to 0,49±0,05 (in 1994-2003).

Incidence of de novo AML increased last years in children, mainly in boys. The age specific incidence is highest in 10-14 years. Exposure predisposing children to develop AML more often last years is unclear and may be connected with possible influence of continued low-dose rate exposure. Additional epidemiological investigations for understanding of this fact are necessary.

Introduction

There is a big area of Belarus was contaminated with radioelements (incl. short-lived radioiodine and long-lived radiocaesium) due to the Chernobyl accident. Increase of incidence of the different types of cancer was supposed. A dramatic increase in thyroid carcinomas, especially in those who were children at the time, was later observed [2,4]. Among the most radiosensitive tissues is the red bone marrow. The increased risk of AML and of chronic myelogenous leukemia was registered in survivors in Japan who were exposed to excessive doses of ionizing radiation [3,5]. However, investigations performed in ten years after Chernobyl accident did not reveal an increase of incidence rates of childhood leukemia in Belarus and in the most contaminated areas of Belarus as well [1]. The goal of this study was the analysis of incidence of childhood (0-14) acute myeloid leukemia (AML) in Belarus for period 1989-2003 years and observed survival as well.

Materials and Methods

Analysis was performed on the data of Children cancer-subregistry of Belarus which has verified base of cases back to 1989 year. All cases of AML were revised according to
Results

General number of childhood (0-14) de novo leukemia cases are 1156 for period 1989-2003 years, acute lymphoblastic leukemia (ALL) – 919 (80%), acute myeloid leukemia (AML) – 163 (16%). Additionally 16 cases of secondary AML have been registered: after intensive chemotherapy – 3, after chronic myeloid leukemia – 9, after juvenile myelomonocytic leukemia – 2, after myelodysplastic syndrome – 2.

Age-standardized incidence rate of childhood (0-14) de novo leukemia for Belarus for this period is 3,909+0,118 per 100 000, ALL – 3,159+0,107, AML – 0,499+0,040. Standardized incidence ratio (SIR) in 1989-1994/1998-2003 was 93,388+4,848 for all leukemia (incidence decreased; n.s.), 87,035+5,211 for ALL (incidence decreased; p<0,05), 136,59+16,564 for AML (incidence increased; p<0,05) (figure 1). We supposed that increase of AML incidence can be connected with improved diagnostic of AML in Belarus after the year 1993. However, SIR in 1994-1998/1999-2003 also showed a significant increase of AML incidence in boys at the time for 1999-2003 comparing to 1994-1998.

Distribution of AML cases according to FAB-classification was as following: M0 – 9, M1 – 32, M2 – 45, M3 – 24, M4 – 20, M5 – 7, M7 – 1, ND – 25. Age distribution was as following: group of 0 year (y) – 13 children, group of 1-4y – 28, group of 5-9y – 46, group of 10-14y – 76. There was 102 males and 61 females between patients with AML (M/F ratio is 1,67). M/F ratio increased last five years from 1,26 in the time for 1994-1998 to 2,0 in the time for 1999-2003. Standardized incidence ratio (SIR) in 1994-1998/1999-2003 was 102,37 for girls (incidence remains stable for this period) and 159,83 for boys (incidence increased; p<0,05).

Age-specific incidence rate for boys with de novo AML was as following (per 100 000): 0y – 0,811; 1y - 0,755; 2y - 0,637; 3y - 0,409; 4y - 0,197; 5y - 0,284; 6y - 0,641; 7y - 0,714; 8y - 0,609; 9y - 0,498; 10y - 0,674; 11y - 0,503; 12y - 1,081; 13y - 0,581; 14y – 1. Age-specific incidence rate for girls with de novo AML was as following (per 100 000): 0y – 0,737; 1y – 0,117; 2y – 0; 3y – 0,43; 4y – 0,413; 5y – 0,198; 6y – 0,287; 7y – 0,465; 8y – 0,362; 9y – 0,178; 10y – 0,349; 11y – 1,041; 12y – 0,43; 13y – 0,429; 14y – 0,344.

Overall survival of children (0-14) with de novo AML has been improved last ten years from 0,22±0,06 (in 1989-1993) to 0,49±0,05 (in 1994-2003) due to new protocols of treatment.

Conclusion

The incidence rate of general number of de novo childhood leukemia decreases during the last 15 years due to decreasing of the incidence of ALL. Oppositely, incidence of de novo AML increased last years in children, mainly in boys. The age specific incidence is highest in 10-14 years. Exposure predisposing children to develop AML more often last years is unclear and may be connected with possible influence of low-dose rate exposure. Additional epidemiological investigations for understanding of this fact are necessary.

Acknowledgement

We would like to thank the present and former investigators from Children cancer-subregistry of Belarus (S. Petrovich, L. Lukashevich, M. Kibok, E. Sergeev) and from Belorussian Cancer-Registry (Belorussian Center for Medical Technology).
References


Figure 1. Incidence trends of *de novo* childhood leukemia (0-14) in Belarus for the time 1989-2003 years.
Figure 2. Standardized incidence ratio (SIR) for *de novo* childhood AML (0-14) in Belarus (1994-1998/1999-2003).

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* p<0.05