Environmental factors in childhood leukaemia

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Various factors have been suspected of influencing childhood leukaemia; this in itself indicates how limited and uncertain is our understanding to date of the epidemiology of the disease. In this case-control study an attempt was made to examine the various hypotheses that have been proposed.¹

Material and methods

Two hundred and eight children with acute leukaemia were diagnosed in nine "départements" around Lyon (France) between 1 January 1977 and 31 December 1982; for seven of these cases, information on identity or on the disease was insufficient, and for this reason they were excluded.

The control group consisted of an equal number of children with a severe, life threatening disease; they were matched for sex, age, and month of diagnosis.

The parents of all the children were asked to answer an extensive list of questions designed to test the hypotheses under scrutiny. The overall participation rate was 89% (84% for cases, 95% for controls); a further 6% were interviewed by telephone. For the remaining 11 cases, information available in the medical files was used.

The age-sex distribution of the cases appears in the table. The annual incidence rates observed are close to the mortality rates observed in the region and in

France over the same period. There were slightly more boys than girls (sex ratio: 1.16). Most cases had acute lymphoblastic leukaemia (158, 79%). There was no indication of any excess incidence for any of the six years of the study, nor any indication of seasonality. The proportion of parents belonging to the higher socioeconomic groups was greater than in the population of the region; there was also a significantly higher proportion of fathers originating from Spain or Portugal (16 v 5.0 expected) and mothers from the same countries (12 v 4.25 expected).

Results

For a large number of factors no difference was found between cases and controls. These included: trisomia 21, consanguinity, rank in birth order, maternal miscarriages, HLA group, and diagnostic or therapeutic exposure to x rays.

Among close family members (2 degrees) the existence of another case of leukaemia or of a case of lymphoma was noted for 10 cases against four controls.

The source of water used in the family was more often a local well among cases (18) than among controls (5).

The age distribution of the mothers was identical for children with leukaemia and for controls, but 20 fathers were over 40 for the cases and only five for the controls.

Occupational exposures of father or mother were carefully scrutinised but failed to show any significant difference, with the exception of two—namely, exposure to pesticides (12 cases v 3 controls) and jobs related to meat production or sale (12 v 2). The occupation was verified case by case: 12 fathers were butchers (5), "charcutiers" (5), or slaughterhouse workers (2), against one such occupation for one control father.

Discussion

The interviewing of parents, most of whom had lost a child through leukaemia or some other severe disease,

Distribution of the leukaemic children in this study by age and sex

Age (years)	Boys		Girls		Together
	No of cases	Annual rate per 100 000	No of cases	Annual rate per 100 000	No of cases
0-4	56	5.8	48	5.3	104
5-9	38	3.2	28	2.5	66
10-14	14	1.0	17	1.3	31
All ages	108	—	93	—	201

was a painful and sometimes distressing task. By selecting as controls children with a severe disease, we sought to adjust for the psychological stress experienced by the parents; despite this, it was our strong impression that parents of children with leukaemia remembered the details of the children's life or of their own life much better than control parents. Some other biases could not be avoided, possibly resulting in misleading differences. This was the case for exposure to pesticides, which may have been due to differential recruitment of cases and controls: cases with severe diseases (controls) do not all reach the big central hospitals as do leukaemic children.

Clearly, in a study of limited size some of the classic hypotheses were unlikely to be confirmed. The lack of confirmation does not exclude their validity; it may be attributed to the lack of statistical power inherent to the small numbers concerned.

Despite these limitations, some factors emerged. The age of the father is one; it has been observed by other authors and might suggest genetic alterations of the spermatozooids; this hypothesis has been mentioned in relation to trisomia 21.

With regard to the occupation of the father, the jobs relating to the manipulation of meat are so clearly defined that it excludes any bias of recollection or

other. When Johnson *et al* studied a large cohort of slaughterhouse workers they observed a significant increased incidence of Hodgkin's disease in men,² which they attributed to the bovine leukaemia virus. In women they observed an excess of myeloid leukaemia and non-Hodgkin's lymphomas.³ One cannot help thinking that our observations contribute some support to the association of meat related occupations with leukaemia.

This work was carried out while Dr G Laval was attached to the Unité d'Hématologie et d'Oncologie Pédiatrique, Hôpital Debrousse, 69005 Lyon, France.

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References

- 1 Laval G. *Environnement et leucémie aiguë chez l'enfant*. Thèse Université Claude Bernard, Lyon I, 1984.
- 2 Johnson ES, Fischman HR, Matanoski GM, Diamond E. Cancer mortality among white males in the meat industry. *J Occup Med* 1986;28:23-32.
- 3 Johnson ES, Fischman HR, Matanoski GM, Diamond E. Occurrence of cancer in women in the meat industry. *Br J Ind Med* 1986;43:597-604.