

The “post-Chernobyl” childhood leukemia study (ECLIS STUDY)

Luc Raymond, Hyma Schubert

Geneva Cancer Registry and Department of Social and Preventive Medicine, Geneva

A cancer registry based study is currently under way in Europe to evaluate the possible consequences of the Chernobyl catastrophe for the frequency of childhood leukemia (0–14 years). The study is co-ordinated by the International Cancer Research Centre at Lyon. The primary objective is to seek to establish whether the accident has really produced an increase in the number of cases in the regions affected by the “plume”, and if so, to what extent. The pooled data should also permit a better statistical evaluation of any clusters, like those already reported, which might be manifested later. Finally, the study may contribute to the elucidation of the causes of childhood leukemia.

Many reasons can be given to justify this study. Even though the hypothesis that there will be an increase in incidence large enough to be perceived is improbable, one should not forget the pressure of public opinion. Both the general public and the media have expressed the desire to be informed about the negative effects on the environment of all technological developments, and especially about the exact consequences of ecological catastrophes. From this point of view, a discussion of whether unforeseen clusters (here or there) are caused purely by chance, or are caused by the influence of new factors of risk, is very important. Secondly, it should be mentioned that the reassuring remarks made during the aftermath of Chernobyl, by the authorities and also by the scientific community, could actually reveal themselves to be unfounded. The estimation of the external or internal levels of exposure (by direct deposition or by the intake of irradiated food items) could have been inaccurate.

The possible specific effects of long-term exposure to cesium have never been studied under environmental conditions, and the models used for the extrapolation of the effects caused by small doses should only be used with caution. Finally, the low cost of the study should be emphasized, since a permanent network of cancer registries, which routinely gather information on the incident cases, already exists.

The choice of childhood leukemia as an indicator of the increase in the number of cancers was made for obvious reasons. Leukemia is a malignancy which manifests itself relatively rapidly after exposure. Its minimal latency period is accepted to be around 2 years. Ionising radiation

seems to play a leading part in its causation and is, in any case, the only factor of risk that has been adequately identified. Moreover, the frequency of childhood leukemia is low, and its incidence is relatively stable and uniform from one country to another. Its treatment is relatively centralised, and thus an ad hoc recording of the clinical dossiers in the regions affected by the “plume”, but which do not have a permanent cancer registry, could also be considered.

The study protocol is simple. It deals essentially with the rules and definitions to be used in the enumeration of incident cases, and in the collection of diagnostic and personal characteristics. We should mention that the study has been extended to the recording of non-Hodgkinian lymphoma, since it is known that it is sometimes difficult to distinguish high-grade cases from the leukemias. Procedures for validation of the data have been provided for. The statistical analysis aims essentially to test the hypothesis of an increase in the incidence from 1986 onwards, relying on spatio-temporal correlations between observed variations in incidence in the regions considered and the supplementary level of exposure that they received after the accident. Whenever possible, the analysis will take into account the place of birth, where the exposure could have been determinant, and not only the place of residence at the moment of diagnosis.

The number of expected cases has been calculated from the estimations of the American Committee on Biological Effects on Ionizing Radiations¹ based on the following multiplicative model:

$$RR = 1 + (0.243 d + 0.271 d^2) e^{4.885}$$

where *d*, the dose equivalent, is expressed as Sv. According to this model, 0.8% supplementary cases will be expected per year for a dose equivalent of 250 μSv, on average, for the European regions covered by the study. Table 1, adapted by Parkin, provides the detailed results by region for the supplementary cases expected². It also shows which regions are participating, especially those of the Soviet Union.

Summary

Numerous European cancer registries are working together to evaluate the current trends in the inci-

Tab. 1. Average first year effective dose equivalent of radiation and estimated excess of cases of leukemia post-accident (Children 0–14). Adapted from Parkin².

| | Dose (μ Sv) | Pop (mill) | Estimated excess of annual cases (2 years post-accident) |
|------------------------|---------------------|---------------|---|
| Austria | 670 | 1.3 | 1.3 |
| Czechoslovakia | 350 | 3.8 | 1.7 |
| Denmark | 30 | 1.0 | 0.0 |
| Finland | 460 | 0.9 | 0.6 |
| France (part) | 155 | 1.6 | 0.3 |
| German Dem. Republic | 210 | 3.1 | 0.8 |
| Fed. Rep. of Germany | 130 | 9.6 | 1.7 |
| Hungary | 230 | 2.4 | 0.6 |
| Italy (part) | 370 | 1.3 | 0.7 |
| Netherlands | 58 | 2.5 | 0.2 |
| Norway | 230 | 0.8 | 0.3 |
| Poland | 270 | 9.4 | 2.4 |
| Sweden | 150 | 1.5 | 0.3 |
| Switzerland (part) | 270 | 0.5 | 0.2 |
| UK: | | | |
| England and Wales | 27 | 11.1 | 0.4 |
| Scotland | 27 | 1.3 | 0.0 |
| USSR: | | | |
| Byelorussia | 1950 | 2.5 | 5.8 |
| RFSFR (3) ¹ | 440 | 1.6 | 0.8 |
| RFSFR (4) ² | 135 | 2.3 | 0.4 |
| Estonia | 135 | 0.2 | 0.0 |
| Lithuania | 135 | 0.8 | 0.1 |
| Yugoslavia (Slovenia) | 625 | 0.5 | 0.4 |
| Total | | 60 | 19.0 |

¹ Brjanskaya, Smolenskaya, Orlovskaya, Tulsckaya and Kaluzhskaya oblasts.

² Leningrad, Karelian A.R. and Leningradskaya, Pskovskaya and Novgorodskaya oblasts.

dence of childhood leukemias after the Chernobyl accident. The study is coordinated by the International Agency for Research on Cancer. The primary objective is to establish whether the accident has resulted in an increase in the number of cases. The results will also allow an evaluation of the clusters which could be reported. According to the provisional estimations, the accident could lead to an increase of an average of 0.8% of the frequency of new cases in the European regions covered by the study. For the whole of Switzerland, this increase would correspond to 0.5 supplementary cases per year.

Résumé

L'étude «post-Tchernobyl» des leucémies infantiles
De nombreux registres du cancer européens se sont associés pour évaluer avec précision les ten-

dances actuelles de l'incidence des leucémies infantiles, suite à l'accident de Tchernobyl. L'étude est coordonnée par le Centre international de recherche sur le cancer. L'objectif premier est d'établir si l'accident provoque une augmentation du nombre de cas. Les résultats permettront également d'évaluer les clusters qui seraient signalés. D'après les estimations, l'accident pourrait conduire à une augmentation de 0.8% de la fréquence des nouveaux cas, en moyenne, dans les régions européennes couvertes par l'étude. Pour l'ensemble de la Suisse, cette augmentation correspondrait à 0.5 cas supplémentaires par an.

Zusammenfassung

Die Inzidenz der Kinderleukämien in Europa: Eine gemeinsame Krebsregisterstudie im Gefolge von Tschernobyl

Im Gefolge des Kernkraftunfalls von Tschernobyl hat sich die Grosszahl der Europäischen Krebsregister dahin geeinigt, die Inzidenz der Kinderleukämien in Europa in einer gemeinsamen, von der Internationalen Krebsforschungsagentur (IARC) koordinierten Studie genauer zu verfolgen. Als erstes gilt es zu eruieren, ob im Gefolge des Unfalls mehr Kinderleukämien aufgetreten sind; es wird auch möglich sein, vermutliche Häufungen ("Clusters") von Kindheitsleukämien zu überprüfen. Aus der Zusatzstrahlung nach Tschernobyl ergibt sich die Schätzung, dass die Anzahl Neuerkrankungen in den von der Studie erfassten Gebieten um 0,8% zunehmen könnte. Für die Schweiz würde das je eine zusätzliche Kinderleukämie in zwei Jahren bedeuten.

References

- 1 National Research Council, Committee on Biological Effects of Ionizing Radiations. Health Effects of Exposures to Low Levels of Ionizing Radiation, BEIR V. Washington D.C. National Academy Press, 1990.
- 2 Parkin DM. The European Childhood Leukemia/Lymphoma Incidence Study (on behalf of ECLIS Study Group), Radiation Research 1990; 124: 370–371.

Address for correspondence:

Luc Raymond
Geneva Cancer Registry
and Dept. of Social and Preventive Medicine
55, Blvd. de la Cluse
CH-1205 Geneva/Switzerland