

Thyroid cancer after Chernobyl

SIR — We would like to report a great increase in the frequency of thyroid cancer in children in Belarus, which commenced in 1990 and continues. Table 1 shows the incidence of thyroid cancer in children in the six regions of Belarus and Minsk City from 1986 to the end of the first half of 1992. It can be seen that the overall incidence rose from an average of just four cases per year from 1986 to 1989 inclusive, to 55 in

problems, and is placing great strains upon the health services of our new country. It also provides an opportunity, which we hope will not be repeated, to study the consequences of major exposure of a population to isotopes of iodine from fallout. We are collaborating with several international groups and are preparing detailed reports of various aspects of the problem.

We believe that the only realistic

TABLE 1 Incidence of thyroid cancer in children in Belarus

Region of Belarus	1986	1987	1988	Years				Total
				1989	1990	1991	1992*	
Brest	0	0	1	1	6	5	5	18
Vitebsk	0	0	0	0	1	3	0	4
Gomel	1	2	1	2	14	38	13	71
Grodno	1	1	1	2	0	2	6	13
Minsk	0	1	1	1	1	4	4	12
Mogilev	0	0	0	0	2	1	1	4
Minsk City	0	0	1	0	5	2	1	9
Total	2	4	5	6	29	55	30	131

* Six months of 1992.

1991 and is projected to be not less than 60 in 1992. This increase is not uniformly distributed across the country: for example, there is no significant increase in Mogilev, Minsk City or Vitebsk. By far the greatest increase is seen in the Gomel region, from one or two cases per year to 38 in 1991, and a less obvious increase is seen in the Brest and Grodno regions.

The Gomel region lies immediately to the north of Chernobyl and is known to have received a high level of radioactivity as fallout after the breakdown of reactor number 4 on 26 April 1986. The plume passed first over the Gomel region in the first few hours after the major release of radioactivity, and then over the Brest and Grodno regions. The fallout contained large amounts of ^{131}I and significant amounts of the short-lived isotopes of iodine, although these were too short-lived to be measured.

We have classified the tumours according to the World Health Organisation classification (2nd edn) and find that virtually all are papillary carcinomas (128 of 131). They are, however, relatively aggressive, as can be seen from Table 2. Fifty-five of the 131 cases showed direct extension to the perithyroid tissues and six distant metastases, mostly in the lungs. It can be seen that only about 23 per cent were less than 1 cm in diameter. One of the children has died at seven years of age and ten others are seriously ill.

The occurrence of this increase in thyroid cancer in children within a few years of exposure to radioactive isotopes of iodine is unexpected, but real. It poses both humanitarian and scientific

explanation for the increase in the frequency of thyroid cancer is that it is a direct consequence of the accident at Chernobyl.

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SIR — We have recently visited Belarus under the auspices of the WHO regional office for Europe and the Swiss government, and have had the opportunity to see some of the children with thyroid cancer, to study the pathology of the cases and to examine the relevant data.

We examined 11 children who had had operations for thyroid carcinoma and were now hospitalized for post-operative management or evaluation of metastatic disease. We were shown the complete records for these patients, including X-rays and echograms before and after treatment. All were diagnosed during the past 3 years, eight having been living in the Gomel region at the time of the Chernobyl accident and two in the Brest region. The age at diagnosis of the six females and five males was between 4 and 13 years of age; the youngest was born two days after the accident.

We have studied the histological slides from 104 cases of children from Belarus in whom the diagnosis of thyroid carcinoma had been made since January 1989. We agree both with the diagnosis of malignancy and of the type of malignancy in 102 of the cases. We also examined the data on the incidence of thyroid carcinoma in Belarus. There is a marked increase in frequency from 1990 onwards over the average for the years from 1986 to 1990. This increase started only 4 years after the Chernobyl accident, a surprisingly short time by comparison with studies of thyroid carcinoma that have followed exposure to external radiation in infants^{1,2}. Of the children with thyroid carcinoma in Belarus since 1990, the eight youngest at exposure were *in utero*, but were more than 3 months of fetal age at the time of Chernobyl. The fetal thyroid is known to start concentrating iodine at 12–14 weeks of gestation.

We do not believe that increased ascertainment of cases could have played more than a minor role in the recorded incidence of thyroid carcinoma. The proportion of resected nodules that are malignant is high and the type of tumour is aggressive. The ratio of thyroid carcinoma in children to that in adults has increased dramatically, although there are now signs that the incidence in patients over the age of 15 is beginning to increase. The rate is greatly in excess of the reported incidence of this disease

TABLE 2 Extent of spread (TNM classification) of thyroid cancer in children

TNM symbol	Total number of cases	Lymph node metastases			
		None (N 0)	Ipsilateral (N 1a)	Other (N 1b)	
Tumour size					
<1 cm	T1	30	17	10	3
1–4 cm	T2	33	17	8	8
>4 cm	T3	7	3	4	0
Extending to surrounding tissues	T4	55	14	18	23
Distant metastases	M1	6	1	1	4
Total		131	52	41	38

Classification as in *TNM Atlas* 3rd edn, eds Spiessl, B. et al., UICC (Springer, Berlin, 1990).

in children under 15 years of age, which is of the order of 1 per million per year³⁻⁶. In the Gomel region (total population about 2.5 million), the region of Belarus that received the highest fallout from Chernobyl, the incidence in 1991 and the first part of 1992 is approximately 80 per million children per year.

It is generally accepted that external radiation to the neck is associated with an increased incidence of thyroid carcinoma in man, and there is an increased sensitivity of the infant thyroid to the carcinogenic effect of radiation⁷. In some animal studies, but not all^{7,8}, external radiation is found to be a more effective carcinogen for the thyroid than ¹³¹I. Clear evidence that the diagnostic or therapeutic use of radioiodine in man carries a carcinogenic risk is lacking^{9,10}, and ¹³¹I has provided a safe and effective treatment of Graves' disease in adults, although it is rarely used in young children.

The combination of the high level of exposure to radioactive fallout and the numbers exposed within a short time after its release makes the Chernobyl accident an unprecedented event. In the Marshall Islands, although the doses were probably comparable, the number of people exposed was several orders of magnitude smaller¹¹. In the case of the accident at Windscale (now called Sellafield), the number exposed was substantial but the doses were smaller¹², and no adequate study of any long-term thyroid effects has yet been reported. Other studies of fallout from weapons and of nuclear accidents (such as on Three Mile Island) have yielded inconclusive evidence. A close relationship between radiation dose and the incidence of thyroid carcinoma has been documented in atomic bomb survivors in Japan¹³, but the radiation received was mostly external and the contribution from fallout is uncertain.

We believe that the experience in Belarus suggests that the consequences to the human thyroid, especially in fetuses and young children, of the carcinogenic effects of radioactive fallout is much greater than previously thought. Studies of the Marshall Islanders, of the atomic bomb survivors and of the effects of external radiation on the thyroid suggest that the incidence of thyroid cancer in Belarus will be raised for many years.

The accident and its impact on Belarus poses a challenge to the international community to help, both in dealing with the extensive present and future public health consequences, and in promoting research for the understanding of the basic processes underlying the phenomenon. Understanding the consequences of Chernobyl will provide an important basis for preventative action in future.

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