INTRODUCTION

The degree of radiation exposure to the thyroids of children who originally lived in Chernobyl contaminated areas is of concern in Israel, because of the many immigrants who arrived from such areas in a wave of immigration from the CIS countries since 1990. Of the 650,000 people who emigrated to Israel since that time, our estimate is that about 20% came from regions of the Ukraine, Russia and Belarus that were contaminated with various amounts of radionuclides.

Children from these areas are a population that could be at higher risk because of their high past consumption of radioiodine-containing dairy products, the relatively high prevalence of goiter in these iodine deficiency region, the higher sensitivity of children to ionizing radiation and recent reports of elevated rates of childhood thyroid cancer which were described initially in Belarus, followed by the Ukraine and the southern Russian republic (1-3).

METHODS AND POPULATION STUDIED

Examination of 383 immigrant children from these areas was initiated in self referred volunteer families by face to face interviews, physical examinations (particularly of the thyroid), blood sampling and ultrasound examinations. Measurements were made of total
serum tri- and tetra-iodothyronine, thyroid stimulating hormone (TSH), thyroglobulin, antithyroid and antimicrosomal antibodies. The results of measurements of TSH levels in these children are reported in this preliminary study.

Of 383 subjects, 291 were examined for TSH levels by the chemiluminescent third generation assay (4). The group included 123 boys and 168 girls ranging in age from 5 to 24 (who were 0-16 at time of the Chernobyl accident). A natural comparative experiment was suggested by the identification of subjects coming from "more contaminated" and "less contaminated" areas, as defined by the 1991 IAEA soil radiocontamination maps (5). The group was therefore divided into those who had originally resided in regions of higher and lower Cs-137 exposures, and on the assumption that I-131 dispersal and deposition would be expected to have a similar distribution. High and low exposure areas are defined as those areas with Cs-137 concentrations greater or less than 37 GBq (1 Ci) per sq. km.

RESULTS

The distribution of TSH levels in girls was higher in the children who came from high exposure areas, although almost all results lay within the normal range (0.4-4.0 µIU/ml). For TSH levels less than 0.8 µIU/ml, there were half as many children from high compared to low exposure regions (24% compared to 42%), but for TSH values between 1.2 and 2.0 µIU/ml, there were more than twice as many children from the high exposure regions (35% compared to 15%). There was no difference at TSH levels higher than 2.0 µIU/ml. The shift to higher TSH levels was statistically significant at p=0.023 by the χ² test. Boys showed a similar trend, but their results did not reach statistical significance.

The other parameters examined - total serum T3 and T4, thyroglobulin, antithyroid and antimicrosomal antibodies - did not show noticeable differences between the groups coming from high and low exposure regions. Three of 199 children had high antithyroid microsomal antibody levels but no evidence was found for differences in autoimmune status for either group.

The prevalence of palpated enlarged thyroids in both groups of children was about 40%, presumably due to the goiterogenic areas of their original communities, but no difference in prevalence of thyroid enlargement was observed for children coming from low or high exposure areas (measurements both by palpation and by ultrasound). In a parallel study which compared the measurement of thyroid size by palpation and by ultrasound, it was found that there was a significant correlation (p <0.01), but that the two methods evaluated the thyroid differently. Thyroid seemingly normal by palpation was sometimes found to be enlarged by ultrasound measurement, but ultrasound may not always detect a palpably enlarged thyroid.

In the entire group examined only one nodule was found. Fine needle aspiration revealed a malignant papillary carcinoma in a 12 year old Gomel girl. She was treated by thyroidectomy followed by ablation of remaining thyroid tissue with I-131 and appears to have good health 4 years later. Approximately 11% of the children had palpable irregularities of the thyroid, that is to say, a tactile sensation of variable volume or densities within the thyroid that are not discrete nodules. There was no difference in the incidence of these thyroid irregularities between subjects coming from high or low exposure areas.

DISCUSSION

The assumption that the radioiodine thyroid dose (in 1986) can be correlated with recent measurements of Cs-137 distribution in the soil is probably inaccurate. The short lived radioiodines (such as I-132, I-133, I-135) have been estimated to be 4 to 10 times more destructive per rad than I-131 (6). These isotopes may well have caused radiation exposures in excess of that due to I-131 to a degree related to the distance from Chernobyl in the direction of the atmospheric dispersion, due to their physical decay by the time the radioactive cloud had passed some distance from its origin. Hence, there is reason to expect that children living nearer the reactor accident and in the path of the dispersion had relatively higher exposures to short-
lived radio-iodines, which may have been involved in the reported increase of the incidence of childhood thyroid cancer. Retrospective dosimetry has been carried out based on the initial monitoring of radioiodine levels in thyroid glands (7,8). It would be useful to be able to correlate the results of dose reconstruction with actual evidence of past radiation exposure.

The present results demonstrate a shift in the distribution of serum TSH to higher values for girls who emigrated from areas with relatively increased levels of Cs-137 contamination.

Possible explanations for this include (a) radiation damage to the thyroid with resultant homeostatic increase of TSH, (b) greater iodine deficiency in the more exposed areas, or (c) an artifactual apparent increase, because we have found that healthy teenage girls from the regions tested have lower levels of TSH than do boys (9). However, since the proportion of teenage girls in both series was the same in both groups, this explanation seems unlikely.

In order to test for the second possibility, we examined the incidence of enlarged thyroids by direct palpation and ultrasound. There was no change in the incidence of enlarged and/or palpable thyroids. These results therefore do not support the possibility of greater iodine deficiency in the higher exposure areas as an explanation for the elevated TSH levels.

Our working hypothesis is therefore that children who came from these areas had subclinical radiation damage to the thyroid leading to compensatory homeostatic increase in TSH. We are not aware that has been reported and therefore present these preliminary results, bearing in mind that large scale studies in CIS countries might be able to test the hypothesis with larger numbers of subjects from areas that were radio-contaminated. Such a test would desirably involve the correlation of TSH values with reconstructed thyroid doses.

ACKNOWLEDGEMENTS

The authors are grateful to the Israel Ministry of Health for financial support. They wish to express their appreciation to Elscint Ltd. for the loan of an ultrasound machine at no cost for the assessment of thyroids in children. Thanks are due to the Israel Ministry of Education for permitting the examination of schoolchildren. The expert laboratory assistance of Mrs. Alicia Snopik and Mrs. Sylvia Peremuter for the measurement of serum thyroid hormone levels is gratefully acknowledged. The support of the administration of the Soroka Medical Center and use of its facilities in this study has been much appreciated.

REFERENCES


9. Unpublished data