THE EFFECTS ON THE THYROID OF EXPOSED POPULATIONS FOLLOWING THE CHERNOBYL ACCIDENT

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THE EFFECTS ON THE THYROID OF EXPOSED POPULATIONS FOLLOWING THE CHERNOBYL ACCIDENT

Report on a Symposium

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Abstract

The release of radio-iodine during the nuclear accident at Chernobyl appears to have caused a rise in thyroid anomalies, including cancer, in the exposed population. Uncertainty about the extent of this increase is causing the population some anxiety. A WHO symposium of Soviet and other scientists met to see whether a more precise assessment could be made of the effects of the Chernobyl accident on thyroid disorders. They established that a long-term, large-scale epidemiological study should be initiated: the required dosimetric data already exist, and the collection of the relevant health data should begin. To ensure the comparability of all these data, the affected Soviet republics should collaborate closely. More training for Soviet researchers and health care workers, as well as greater collaboration with foreign scientists, should maximize their capacity to launch a successful study and set up the most appropriate health care programmes.

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Introduction

After the Chernobyl disaster in April 1986, a special project was undertaken by the WHO Regional Office for Europe on the public health ramifications of nuclear accidents. A programme of collaboration was developed with the All-Union Scientific Centre of Radiation Medicine (AUSCRM) in Kiev and the Centre requested that, following a recent working group on the psychological aspects of the accident, a symposium should be organized to review the effects of radio-iodine on the thyroid of the exposed population.

This Symposium was held in Chernikov, 3-6 December 1990, and brought together experienced individuals in the fields of radiation protection, epidemiology, endocrinology, and public health. Their task was to review the information already available, appraise the present situation and analyse trends. The primary task of the Symposium was to draw up recommendations of immediate and longer-term application in relation to the Chernobyl accident.

The meeting was opened by Mr J. Ian Waddington, Project Director of the Special Project on Nuclear Accidents and Public Health, in the Regional Office. Dr A.N. Romanenko, Director of AUSCRM, was appointed Chairperson and Dr M. Sheppard Rapporteur.

Conclusions and recommendations

Dosimetry

The participants were impressed by the vast amount of detailed, good quality data on thyroid dosimetry that is available in each republic, although some is of a preliminary nature. The data presented for the Ukraine show that most children received less than 100 rads

(1 Gy), although several thousand children received over 200 rads (2 Gy). Of these, a few hundred children have had doses of over 1000 rads (10 Gy) and of these, over two hundred children have had doses of over of 1500 rads (15 Gy). The data for Byelorussia suggest that about 1000 children received over 500 rads (5 Gy) and several children have had doses in the range of 3000-4000 rads (30-40 Gy). It is understood that data of similar quality are available for the Russian SSR but these were not presented.

Many of the data are of sufficiently good quality to allow for detailed epidemiological studies using individual doses to the thyroid, although there are inevitably some uncertainties in the dose reconstruction.

It would be counterproductive to repeat the detailed audit of the dosimetry already being undertaken by the International Atomic Energy Agency (IAEA). Once the IAEA report has been produced, an international workshop should be organized under the auspices of WHO and IAEA to exchange scientific views about the methodology used in the reconstruction of doses and to identify and discuss uncertainties and gaps in that methodology.

Risk assessment

Soviet scientists have presented various estimates of the long-term risks of thyroid cancer. These suggest that an increase in cancer over the spontaneous rate will be observed but its magnitude can only be determined by a careful long-term epidemiological survey. An increase in hypothyroidism is also predicted.

Thyroid disorders

Data on children have been presented that show that alterations took place in a number of thyroid function tests in affected areas in the early months after the Chernobyl accident. These included rises in serum total

thyroxine (T4) and thyroid auto-antibody titres that generally returned to normal at subsequent testing. There is no convincing explanation for these unexpected results. There is insufficient information on the quality control of assays but these important observations should be followed up and, if possible, correlated with dose estimates. Further clinical studies should include a quality control assessment of the assay systems to be used.

A number of changes in the ultrasound appearance of the thyroid gland have been described, particularly in children in affected areas. These abnormalities require precise definition. The standardization of techniques and information on the normal age-related appearance of the thyroid are essential to interpret these findings.

Soviet and international scientists should exchange views to avoid confusion in terminology and diagnostic criteria, and to ensure the use of the most up-to-date methods of treating thyroid disease. WHO should consider arranging a workshop to discuss the investigation, diagnosis, pathological classification and treatment of thyroid disorders. In addition, WHO and governments should facilitate exchange visits between health care professionals.

Reports have been made of an apparent excess of cases of thyroid cancer in children from contaminated regions. An estimate of the size of the population from which these cases are derived and of the expected rates for that population size is essential to interpret these findings. In addition, it is important for full clinical and histological characterization to be reported, with an independent assessment of cases of borderline pathology. Where possible, an attempt should be made to estimate the dose to the thyroid.

As to the long-term cancer risk, an appropriate standardized screening programme should be developed for

the affected regions of the USSR. An effective cancer registry needs to be developed so that cases from both affected and unaffected areas can be identified. This will allow future epidemiological studies to be carried out. A careful histopathological review is essential and should be recorded. Post-mortem examination of the thyroid should be considered if clinically indicated.

Health professionals are aware of the long-term risk of hypothyroidism; screening should continue.

Many of the regions of the republics affected by the accident are thought to be deficient in dietary iodine. The extent and severity of this problem are not clear and should be clarified by pilot studies of urinary iodine excretion. The definition of endemic goitre should also be clarified. Dietary iodine supplementation should be instituted if required and, if needed on a large scale, there should be an awareness of the possible thyroid disorders that may emerge.

Neonatal hypothyroidism screening is not required solely for radiation-related thyroid disease; the institution of large-scale screening programmes would be a welcome consequence of the increased awareness of problems of the thyroid.

In the event of a nuclear accident involving radioiodine release, iodine prophylaxis should be given if the levels at which intervention is required are likely to be exceeded. Other countermeasures such as the control of contaminated food are also important. The Regional Office document entitled Guidelines for iodine prophylaxis following nuclear accidents (Environmental Health Series No. 35) should serve as a useful model for planning. The data presented from a Polish study indicate that the risk of side effects from iodine prophylaxis is very low in all population groups, including neonates, pregnant women and people with thyroid disease. In the USSR, a study of children who received long-term iodine prophylaxis should be considered.

Epidemiology

There are many conflicting and anecdotal reports of some of the adverse health effects attributable to the Chernobyl accident, in particular thyroid disorders. Both the public and some members of the medical profession believe that there is a general increase in morbidity, but there are insufficient reliable health data to make an objective assessment of the situation. This uncertainty will tend to increase the anxiety of the population.

In each republic, the ministry of health should therefore ensure that a clearly defined organizational structure exists, with named responsible individuals to collect health data, to identify and correct any deficiencies in data collection, and to ensure that reliable health data are made available.

Particular attention needs to be paid to the collection of accurate information and the development of effective registries of cancer incidence and mortality, in order to provide an accurate database for long-term epidemiological studies to assess any possible increase in cancer risk. In particular, detailed histopathological information on thyroid neoplasms, as well as the sex and date of birth of those affected, should be recorded in cancer registries. Hypothyroidism should be registered too.

Specific scientific questions that could be addressed through epidemiological studies of individuals exposed as a result of the Chernobyl accident should be identified. Collaboration between Soviet and international epidemiologists should be encouraged to ensure the optimal design, implementation and quality control of such studies and to evaluate their feasibility.

Strict definitions of the outcome of interest (whether thyroid anomalies or neoplasms) and the study and reference populations should be established.

The magnitude of the thyroid cancer risk following iodine-131 contamination can only be confirmed by a very careful, large-scale, long-term prospective study of exposed individuals based on detailed individual dosimetry. Extreme care will be needed to minimize the sources of systematic bias. The basis should be laid for case-control studies within specific cohorts where adequate dose estimates are available for each individual.

Detailed information on possible confounding and effect-modifying factors in both cases and controls will be needed. In particular, the effects of iodine prophylaxis and of the endemicity of thyroid goitre on the magnitude and temporal distribution of the cancer risk after iodine-131 contamination will need to be assessed carefully.

The quality and consistency of the dosimetry and of the disease diagnosis must be controlled. In particular, the possible differential diagnostic bias arising from the close surveillance of thyroid function in children living in contaminated areas and from the local physicians' knowledge of individual doses, may be important problems in setting up an epidemiological study.

Any thyroid cancer study should be discussed in the framework of an overall plan for the epidemiological assessment of the health consequences of the Chernobyl accident.

General

The range and depth of current studies on the effects on human health of the Chernobyl accident are impressive. They involve many institutions within the affected republics of the Soviet Union and have both international and bilateral support. The complexity of the situation as regards dosimetry, clinical aspects and epidemiology is such that the work needs greater integration.

1. The harmonization and coordination of data from the individual republics are desirable to achieve comparability and to facilitate interpretation of the data.

2. Scientists from the Soviet Union and other countries should have greater opportunities for dialogue and collaboration, by means of person-to-person meetings including exchange visits, by using modern systems of electronic communication and by publishing findings in widely read scientific journals that should be available to Soviet scientists. WHO and governments should encourage these opportunities.

3. Training and education need to be expanded to cover the specific needs of both researchers and those involved in health care related to the effects of the Chernobyl accident. Some elements of such a programme may best be developed in collaboration with international organizations and within bilateral agreements.

4. The development and implementation of the health-related programmes set up after the Chernobyl accident would be made more effective by some form of coordination, for instance the establishment of an overall clearing-house under the auspices of WHO. This would improve coordination, avoid duplication, maximize the informativeness of studies and make best use of resources. It would also enable all concerned parties to reach a better understanding of all the research carried out into the health consequences of the Chernobyl accident.

Annex 1

LIST OF WORKING PAPERS AND BACKGROUND MATERIAL

Working papers

ICP/CEH 101/8	Functional state of the pituitary-thyroidal system in children from controlled regions of the Ukraine after the Chernobyl accident by Dr N.D. Tronko et al.
ICP/CEH 101/9	Early detection of congenital hypothyroidism by Dr V.A. Mazur et al.
ICP/CEH 101/10	Thyroid condition in pregnant women and neonates exposed to radiation as a result of the Chernobyl accident by Dr N.A. Yakovlev et al.
ICP/CEH 101/11	Methodology and practice of long-term epidemiological and dosimetric investigations of risk of late effects of thyroid irradiation in children as a result of the Chernobyl accident by Dr I.A. Likhtarev et al.
ICP/CEH 101/12	Morphological and functional condition of the thyroid gland in children with determined doses of thyroid irradiation who are included in the clinical dosimetric thyroid register by Dr A.K. Cheban et al.

[a] Copies are available from the Special Project on Nuclear Accidents and Public Health, WHO Regional Office for Europe, 8 Scherfigsvej, DK 2100-Copenhagen O.

ICP/CEH 101/13	Thyroid irradiation levels of inhabitants of Byelorussia after the Chernobyl accident by Dr Yu.I. Gavrilin et al.
ICP/CEH 101/14	Clinical and functional status of the thyroid system in children and teenagers affected by radionuclides by Dr L.N. Astakhova et al.
ICP/CEH 101/15	Radioiodine dosimetry following the Chernobyl accident by Dr I.A. Zvonova & Dr M.I. Balonov
ICP/CEH 101/16	Results of a two-year follow-up of inhabitants of the Kaluga Region exposed to irradiation following the Chernobyl accident by Dr A.F. Tsyb et al.

Background material

Guidelines for iodine prophylaxis following nuclear accidents. Copenhagen, FADL Publishers, 1989 (Environmental Health Series, No. 35) (Price DKr 45).

Iodine prophylaxis following nuclear accidents: proceedings of a joint WHO/CEC workshop, July 1988. Oxford, Pergamon Press, 1990 (Price £30).

Annex 2

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