402670

252

BROOKHAVEN NATIONAL LABORATORY
ASSOCIATED UNIVERSITIES, INC.
UPTON, L.I., N.Y. 11973
TEL. AREA CODE 516 YAPHANK 4-6262

REFER:

MEDICAL DEPARTMENT

August 1, 1966

Dr. H. David Bruner
Division of Biology and Medicine
U. S. Atomic Energy Commission
Washington 25, D.C.

Dear Dave:

The five Marshallese cases arrived at Brookhaven the latter part of May and were given extensive thyroid examinations. It was decided that surgery was indicated, and all five cases were transferred to the New England Deaconess Hospital in Boston, where Dr. Bentley P. Colcock of Lahey Clinic carried out thyroid surgery, removing the nodules in all cases. The pathological report on the surgical tissues was done by Dr. William A. Meissner at the New England Deaconess Hospital, and his report indicated that all nodules were benign and of the adenomatoid goiter type, except that one case had a small Hurthle's cell adenoma which was also benign. Recovery from surgery was uneventful, and the five Marshallese were returned to the Marshall Islands, arriving around July 20.

Enclosed is a hospital summary on each case, which will give the findings in more detail.

Sincerely,

Bob

Robert A. Conard, M.D.

RAC:bb

Encs: 5

P.S. Enclosed also are copies of Lee Evans' reports you wanted. I saw Dennis Patterson about them and he was going to contact Tachi —

~~[illegible]~~

6049

THYROID ABNORMALITIES IN A MARSHALLESE POPULATION EXPOSED TO RADIOACTIVE FALLOUT IN 1954

Progress Report, ~~August 31~~ Nov., 1966

During the past three years the development of thyroid nodules and hypothyroidism has been noted in a number of Marshallese people of Rongelap Island in the Pacific who had been exposed to radioactive fallout 12 years ago in 1954. This development is believed to be a late effect of irradiation of the thyroid gland from internal absorption of radioiodines and external gamma radiation at the time of the fallout. There were 64 people (54 now living) who received a whole body dose of gamma radiation of 175 rads, extensive direct irradiation of the skin from deposition of fallout thereon and internal absorption of radionuclides in the fallout. Eighteen other Rongelap people (14 now living) received a lesser exposure of 69 rads gamma along with less dose to the skin and internal absorption of less amounts of radioelements.

During the 2-day period following the accident before the evacuation of the people occurred, the inhabitants absorbed radionuclides in the fallout by inhalation and ingestion of contaminated food and drinking water. Based on radiochemical analyses of pooled urine samples taken several weeks after the accident it was estimated that the adult thyroid gland received about 160 rads from the radioiodine plus another 175 rads from the external gamma radiation. Taken into consideration in those calculations were the time and length of the fallout period, the isotope energies of the various iodine nuclides, and the yield of the isotopes. Extrapolation to thyroid doses that the smaller thyroid glands of the young children received was in the range of 700-1400 rads in the more heavily exposed group. Though "beta burns" were prevalent in the neck

region, it is believed the beta energies were too weak to have contributed significantly to the thyroid dose.

In 1963, 9 years after exposure to fallout, the first thyroid nodule was detected in a 12 year old girl in the more heavily exposed group. Subsequently there have been increasing numbers detected. In 1964, 2 further nodules were detected; in March, 1965, 5 other cases were noted and in addition hypothyroidism in two boys who had shown growth retardation. In September, 1965, 5 further cases were detected and this past March five more cases were found. This makes a total now of 16 cases with nodules plus two cases of hypothyroidism. Only one nodule has been found to be malignant. Table I summarizes the incidences of thyroid abnormalities in the various populations examined. Note that there have been 79% of children in the more heavily exposed group exposed at less than 10 years of age with thyroid abnormalities, in comparison with no thyroid pathology noted in children of the same age range of the nonexposed population or in the lesser exposed populations. The incidence in those exposed at a greater age is considerably lower and not much higher than that seen for the unexposed population or less exposed population. It should be noted that the only nodules noted in the unexposed population were in the older age group, that is, greater than 50 years of age.

Thyroid surgery has been performed on 11 cases with nodules. Ten of these cases, 9 children (and one adult) were all found to have benign nodules and one 41 year old woman had cancer. Four other children in the exposed group will have their thyroid nodules reevaluated in September 1966. A thyroid nodule in one adult male disappeared while on hormone therapy.

In most cases the thyroid glands contained multiple nodules ranging in diameter from a few millimeters to a few centimeters. All were nontender, some firm, others cystic, and sometimes even hemorrhagic. No lymphadenopathy was noted. The microscopic sections of the benign lesions showed quite bizzare appearance with a wide variety of different sized follicles, some small and

atrophic, others large with hyperplasia or cystic formation. The hyperplastic changes were characterized in some cases by infolding of the epithelium giving an aborrheal appearance. These changes resemble those seen in iodine deficiency goiter, (adenomatoid goiter). The one case of cancer of the thyroid occurred in a 42 year old woman and was of the mixed papillary and follicular type. *

A hypothyroid etiology for growth retardation noted in children in the exposed group is strongly suggested by the recent findings of definite hypothyroidism in two of the most retarded boys who had atrophic glands but no nodules. Their protein bound iodine levels have dropped below 2 μg%. Two other children with thyroid nodules showed low values also.

During the past 6 months these people have been under treatment with thyroid hormone and though the analysis of the growth data in the children is incomplete, it appears that the two boys showing most growth retardation have had a spurt in growth during the past 6 months on this therapy. It is too soon yet to evaluate the beneficial effects of this therapy in reducing the incidence of nodules of the thyroid gland.

The radiation etiology of these thyroid lesions appears to be reasonably certain in view of the following facts. (1) The thyroid glands received a substantial dose of radiation from radioiodines and external gamma radiation. (2) Only a few older people in the unexposed or low exposure groups have shown any nodules of the thyroid gland. (3) The diet is not lacking in iodine and there are no known goitrogenic foods. (4) Furthermore, the correlation of radiation exposure with later development of thyroid abnormalities has been well documented in animal and clinical studies. The development of thyroid tumors in children whose thymic regions or neck were exposed during infancy is now well substantiated. Adenomatous lesions of the thyroid in children have also been reported 5 to 11 years after treatment with I^{131} for thyrotoxicosis. Though the dose range in the Marshallese is similar to those

* Sept, 1966 Exam at Tripler showed no metastasis.

reported in these studies, the incidence of thyroid abnormalities appears to be higher in this group than would be expected. However, dose calculations in the Marshallese are subject to considerable uncertainty, and variability of dose among the exposed people must have been marked. A reevaluation of the thyroid doses will be undertaken in the near future based on more precise information regarding urinary iodine excretion in the Marshallese.

As a result of the present findings, it will be necessary to revise upwards the seriousness of the internal hazard associated with fallout. Secondly, it has become increasingly evident that late effects of radiation of the thyroid gland, (neoplasias, hypothyroidism) are much more common sequelae than had been previously supposed. The high incidence of thyroid lesions in the Marshallese emphasizes the caution with which radiation must be used clinically, particularly in regard to the use of radioiodine in children.

Robert A. Conard, M.D.
Chief, Marshall Island Medical Surveys
Medical Research Center
Brookhaven National Laboratory

mb

TABLE I

THYROID ABNORMALITIES IN EXPOSED RONGELAP PEOPLE, 1965

Abnormality Noted

Case No. and Sex	Present Age	Age at Exposure		Years	Age	Findings
3, M	13	(1)		1965	12	Hypothyroid, PBI less than 2 µg% March, 1965; retardation of growth preceded these findings by a number of years. 3/66 growth spurt and improved appearance on hormone. Not Tumor
5, M	13	(1)		1965	12	Hypothyroid, PBI less than 2 µg% March, 1965; retardation of growth preceded these findings by a number of years. 3/66 growth spurt and improved appearance on hormone. Not Tumor
17, F	15	(3)		1963	12	Adenomatous goiter, complete thyroidectomy, 1964. No recurrence.
21, F	15	(3)		1964	13	Adenomatous goiter, complete para- and thyroidectomy, 1964. No recurrence.
69, F	16	(4)		1964	14	Adenomatous goiter, partial thyroidectomy, 1964. No recurrence.
2, M	13	(1)		1965	12	Adenomatous goiter, partial thyroidectomy, 1965. No recurrence.
20, M	19	(7)		1965	18	Adenomatous goiter, partial thyroidectomy, 1965. No recurrence.

PRIVACY ACT MATERIAL REMOVED

TABLE I (Continued)

THYROID ABNORMALITIES IN EXPOSED MARSHALLESE PEOPLE, 1966

Abnormality Noted

Case No. and Sex	Present Age	Age at Exposure	Years	Age	Findings
64, F	42	30	1965	41	Mixed papillary and follicular carcinoma, thyroidectomy--surgical and with radioiodine, 1965, No recurrence noted.
72, F	18	6	1965	17	3 mm. nodule left lobe. No exam 3/66.
* 42, F	15	3	1965	14	2 mm. nodule ~~right~~ left lower lobe; 3/66--nodular enlargement entire gland; firm 5 mm. nodule right lobe. 7/66 subtotal thyroidectomy. Adenomatous goiter.
* 61, F	20	9	1965	19	6-8 mm. smooth nodule left lower pole; 3/66 1 cm. nodule left lobe. Subtotal thyroidectomy 7/66. Adenomatous goiter.
40, M	41	29	1965	40	2 mm. nodule right lower pole; 3/66 no nodules detected.
* 59,** F	46	34	1965	45	5 mm. nodule midline; 3/66 same. Subtotal thyroidectomy 7/66. Adenomatous goiter.

* Original

13

PRIVACY ACT MATERIAL REMOVED

TABLE I (Continued)

[illegible], 196[illegible]

[illegible]

PRIVACY ACT MATERIAL REMOVED

Case No. and Sex	Present Age	Age at Exposure	Years	Age	Findings
54, M	13	(1)	1966	13	Nodular enlargement left lobe and [illegible] with 2 cm. firm nodule.
19, M	17	(5)	1966	17	Multinodular soft goiter--gland 1½ normal size; 1 cm. nodule right lower pole.
36, M	19	(7)	1966	19	About 1 cm. nodule--not clearly demarked--right lower pole. Many tiny nodules surface of gland.
33, F	13	(1)	1966	13	In 9/65 questionable irregular gland. 3/66 definite 5 mm. nodule left lobe. Subtotal thyroidectomy 7/66. Adenomatous goiter, Hürthle cell adenoma.
65, F	13	(1)	1966	13	In 9/65 questionable small nodule; 3/66 a 5 mm. nodule right lobe. 7/66 right subtotal thyroidectomy. Adenomatous goiter.

18

*Exposed to only 69 r [illegible] whole body radiation and presumably proportionately less thyroid dose.

PRIVACY ACT MATERIAL REMOVED