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Brief Summary of Medical Findings in the Marshallese Accidentally Exposed to Radioactive Fallout in 1954 (May, 1977)

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The accidental exposure occurred on March 1, 1954, following detonation of a thermonuclear device on Bikini in the Pacific Proving Grounds. A shift in wind resulted in fallout on the following inhabited islands:

Island	Distance from Bikini	No. of People	Estimated Gamma Dose
Rongelap	105 miles	64	175 rads
Ailingnae*	110 miles	18	69 rads
Rongerik	135 miles	28**	70 rads
Utirik	275 miles	158	14 rads

*Rongelap people visiting Ailingnae atoll
**American servicemen

There were no deaths but certain acute effects were noted, particularly in the Rongelap people. Transient depression of blood cells was followed by recovery to near normal levels by one year. Fallout deposited on the body resulted in skin burns and spotty loss of hair in the Rongelap, Ailingnae and Rongerik groups. The burns healed and the hair regrew without complications in several months. Urine analyses revealed that internal absorption of radioactive material had occurred from inhalation and ingestion of contaminated food and water, but no acute effects were observed from this source. (As will be seen below late effects did occur.)

Follow-up examinations during the first decade showed few findings that could be related to radiation exposure.* About twice the number of miscarriages and stillbirths occurred in the exposed compared with unexposed Rongelap women, but this finding cannot definitely be related to radiation exposure. This difference was not seen after 5 years.

During the second decade, some Rongelap children showed growth retardation which was later realized to be associated with a hypothyroid condition due to radiation injury to the thyroid gland, largely from radioactive iodine absorbed at the time of the fallout. The thyroid dose was estimated to be 335 rads for Rongelap adults and 700-1400 rads for children, the higher dose in children being due to the small size of their thyroid glands. The dose calculated for the Utirik group varied between about 30 rads to adults to 60-90 rads for young children.

In 1963 tumors of the thyroid began to appear in Rongelap children and to a lesser extent in adults. As of April 1977 33 of the original population of 86 on Rongelap and Ailingnae (38%) have developed abnormalities of the thyroid gland, including 18 of the 22 persons (70%) who were less than 10 years of age at the time of exposure in 1954. A lesser number of tumors have developed in the Utirik population (Table 1). A small number of thyroid tumors have also been seen in the unexposed populations examined.

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* The American servicemen exposed on Rongerik have not been followed by the Brookhaven medical team.

TABLE I

Group	Age at Exposure	No.	Thyroid Abnormalities (and % of age group)*	Surgery	Cancers
Rongelap, Ailingnae	< 10	29**	20 (70%)	17	1
Rongelap, Ailingnae	> 10	57	10 (17.5%)	8	3
Utirik	< 10	58	1 (1.7%)	1	1
Utirik	> 10	100	10 (10.0%)	6	2

* Among 653 unexposed Marshallese examined there were 31 thyroid tumors (4.7%).

** 4 of these were exposed in utero, one of whom had nonmalignant thyroid tumors removed.

The above table shows that of the 30 people who have developed thyroid abnormalities in the Rongelap-Ailingnae group, 25 (including 20 of 29 children) have had thyroid surgery in the United States with 4 of the tumors proving to be cancer. In the Utirik group, of the 7 with surgery 3 had cancers. Most of thyroid tumors in the Rongelap group must unquestionably be related to radiation exposure. The relation to radiation exposure in the Utirik group is more puzzling. The occurrence of 3 cases of cancer of the thyroid in that group is considerably greater than expected based on normal occurrence in unexposed populations, and association with radiation exposure must be considered possible. However, based on the estimated thyroid doses in the Utirik group compared with the Rongelap group, the incidence of thyroid cancer in the Utirik group is considerably greater than would be expected and, conversely, the number of benign lesions is considerably less than would be predicted. In both groups, tumors are continuing to appear. Appendix 1 lists people in both Island groups who have had thyroid surgery. Appendix 2 lists those who developed thyroid nodules, but in whom surgery was not indicated. In addition there are some people (not listed), in whom, based on palpation, thyroid changes are suspected, but not definite enough to list as positive.

In the past few years sensitive tests of thyroid function have become available. These tests have shown the presence of decreased thyroid function below normal levels (hypothyroidism) not only in those who have had tumors removed but also in a number of exposed Rongelap people who have not shown any tumors of the gland. This finding would seem to be associated with radiation-induced injury to the gland. Appendix 3 lists these people. The exposed Rongelap people have been treated with thyroid hormone since 1965 and this treatment has been important in (1) maintaining normal metabolism in the exposed people, particularly those who have had part or all of their thyroids removed, and (2) in enhancing growth and development in children who had shown growth retardation. Unfortunately, the role of the hormone treatment in preventing the development of tumors of the thyroid is questionable since, as pointed out, a few tumors continue to appear in the exposed people.

Other malignancies, in addition to the thyroid, have been documented with sufficient frequency, particularly in the Japanese exposed at Nagasaki and Hiroshima, to warrant positive correlation with radiation exposure. These are leukemia and cancers of the breast, lung and gastrointestinal tract. In 1972, a 19-year-old Rongelap man who had been exposed at one year of age died of acute leukemia. He had extensive treatment at the clinical center of the National Institutes of Health. In 1974, a 64-year-old exposed Rongelap man died of cancer of the stomach. At this time, these are the only known malignancies, other than thyroid, that may be related to radiation exposure among the Marshallese. (Appendix 4).

The annual medical examinations of the exposed Marshallese people continue with a team of highly qualified medical specialists. In addition, there are other visits to the islands for health care.

Medical Department
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APPENDIX 1

Exposed Rongelap and Utirik People with Thyroid Surgery

A. Rongelap (original number 86; includes Ailingnae group)

No.	Name	Sex	Age (1977)
2		M	25
3		M	24
5		M	24
8		F	24
15		F	30
17		F	26
18		F	43
19		M	28
20		M	30
21		F	26
23		M	27
33		F	25
36		M	30
40		M	52
42		F	26
45		F	55
51		F	48
54		M	
59		F	
61		F	31
64		F	53
65		F	24
69		F	27
70		F	38
72		F	30
74		F	40
75		F	35
83		M	23

*Numbers 3 and 5 had myxedema with stunted growth (no thyroid surgery).

**Deceased. #54 died of leukemia.

***Parents of #54.

****This case has been included for compensation since she had surgical removal of a tumor (neurofibroma) in the neck though it proved to be not in the thyroid gland.

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B. Utirik (original number 158)

Those with Thyroid Surgery

No.	Name	Sex	Age (1977)
2229		F	41
2208		F	60
2212		F	57
2194		F	58
2221		F	75
2160		F	27
2150		M	35

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APPENDIX 2

Exposed Rongelap and Utirik People with Thyroid Nodules but No Surgery

A. Rongelap

No.	Name	Sex	Age (1977)
63		F	59
67		F	37
37		M	43
63		F	31
41		M	67

*Nodules no longer palpable under treatment. Also has reduced thyroid function.

**Found in 1977. Under treatment and observation.

B. Utirik

No.	Name	Sex	Age (1977)
2258		M	
2248		F	38
2261		M	50
2200		F	66

*Died 1970

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APPENDIX 3

Exposed Rongelap-Ailingnae People Developing Reduced Thyroid Function - Without Thyroid Tumors*

No.	Name	Sex	Age (1977)
4		M	61
6		M	24
7		M	59
9		M	45
16		M	62
32		M	27
47		M	31
71		F	51
76		M	34
78		F	60
81		F	31

*There are several other borderline cases not included. As time goes on the number of people on this list will probably increase. This finding not apparent in Utirik group.

APPENDIX 4

No.	Name	Sex	Age (1977)	Malignancy
54		M	19	Acute leukemia
68		M	64	Ca of stomach

*Died 1972. Also on thyroid list.

**Died 1974.

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