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THE CHARACTERISTICS OF FALLOUT MATERIAL AND THE EFFECTS OF

FALLOUT RADIATION IN HUMAN BEINGS

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A 10 minute presentation

On March 1, 1954, human beings were accidentally exposed to radiation from fallout. Approximately five hours or longer after the detonation, the fallout commenced. Marshallese and Americans were involved. The exposed individuals consisted of four groups, depending on location:

Rongelap	68 Marshallese	175 r.
Ailinginae	14 "	78 "
Rongerik	28 Americans	69 "
Utirik	159 Marshallese	14 "

(Make a slide)

The task force did not have a bio-medical program, and as soon as possible, a medical team and equipment was assembled between the Naval Medical Research Institute and the U. S. Naval Radiological Defense Laboratory, and transported to the field commencing studies on the ninth post-exposure day. Interim care and study was provided by the Medical Department, U.S. Naval Station, Kwajalein, to which all exposed people had been evacuated. On Rongelap, and to a lesser extent, on Ailinginae, the fallout was visible and was described as a light snowfall. The material consisted of flakes of CaO, incinerated coral, coated with FP. The material clung to skin, clothes, vegetation and buildings, thus producing a large planar source of gamma radiation and multiple small sources of  $\beta$  radiation when in contact with the skin. Indeterminate amounts of the material were inhaled and ingested. The overall result was the production of relatively uniform whole body irradiation, spotty  $\beta$  irradiation of the skin of varying degree, and the internal deposition of some radionuclides. I shall describe the exposure conditions, the general symptomatology and management, and others will amplify on the problems of hematologic changes, cutaneous lesions and internal deposition.

The Marshallese were exposed in the open or in thatched homes as illustrated (slide 2). The lightly constructed homes and clothing gave almost complete protection against skin lesions. Bathing during or immediately after the fallout reduced the severity of skin burns.

The gamma doses were estimated from consideration of the arrival time dose rates at various times, decay exponents, from a recording dosimeter and some film badges that were located on Rongerik. The values presented embrace all of the above factors and there was considerable internal consistency in dose estimation.

Nausea and vomiting occurred on the day of exposure in the two highest dose groups. Two-thirds of the Rongelap group were nauseated and one-tenth vomited and had diarrhea. One of the Ailinginae group was nauseated. The other groups 69 and 14 r. had no gastrointestinal symptoms.

Itching and burning of the skin occurred in 28% of the Rongelap group, 20% of Ailinginae and 5% of the Americans, but none of the Utirik group. Three of the Rongelap and one of the Ailinginae group had burning of the eyes with lacrimation. The cutaneous symptoms were most likely due to irradiation, since all of the ones with symptoms later developed skin lesions. However, the high pH of the fallout material when dissolved may have contributed to the cutaneous symptoms.

All individuals were kept under continuous medical observation. All of the gastrointestinal symptoms disappeared by the third day without therapy and there was no recurrence.

In the course of observation, miscellaneous disorders developed as listed in the next slide (slide 3). Initially, the URI caused some concern

because a granulopenia and thrombopenia was developing concomitantly. However, the incidence and severity of infectious processes in all of the dose groups, in the non-exposed Marshallese and in the American medical team was identical. A few individuals were given antibiotics at this time, but antibiotics were not used more freely than many physicians would have used them in a non-exposed population.

The decision not to use prophylactic antibiotics was based on the fact that the dose of radiation was known with fair accuracy and it was believed to be sublethal. However, as granulocytes reached  $1000/\text{mm}^3$  and some were as low as  $700/\text{mm}^3$ , some concern was felt about when and if prophylactic antibiotics should be used. However, all physicians present agreed that prophylactic antibiotics should not be instituted in these individuals because:

1. All were under continuous medical observation so that infection could be detected at onset.
2. Premature use of antibiotics might obscure indications for treatment and permit development of drug-resistant organisms in granulopenic individuals before antibiotics was needed.
3. There is no really accurate knowledge of level of granulocytes in man when infections develop and antibiotics might be needed.

Although some of the individuals had severe febrile respiratory infections of unknown etiology, they were able to resist the infections, despite their depressed hemopoiesis, as well as normal individuals.

A rather marked thrombopenia developed in all individuals from Rongelap and Ailinginae. Eleven had counts from 35,000 - 65,000 and all were below 150,000 at some time.

Four women were pregnant. No bleeding was observed. Two women menstruated excessively for several extra days with counts at 130,000 and 150,000. They were not concerned and bleeding stopped without therapy. A slight anemia was observed in 19 people; however, there were adequate physiologic explanations (repeated pregnancies, long-standing menorrhagia, childhood infestations, etc.).

SUMMARY & CONCLUSIONS:

1. 175 r. is sufficient whole-body radiation to produce a significant incidence of fleeting nausea, vomiting and diarrhea in an unsophisticated population.
2. 175 r. is a sublethal exposure.
3. The degree of granulopenia and thrombopenia induced was significant and temporarily alarming, but spontaneous uncontrollable infections and bleeding did not develop, despite skin lesions.
4. A population exposed to this amount of radiation need not be given any therapy other than what is clinically indicated.