

## SURVEY OF CASE REPORTS OF RADIATION-INDUCED CANCER

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A careful and wide survey of the cases reported as radiation-induced cancer in some chief organs (the breast, the uterus, the pharynx and larynx, the colon, and the bone) was carried out (1-5).

The number of the cases which were found by this search was 130 in the pharynx and larynx, 548 in the uterus, 10 in the breast, 80 in the colon, and 256 in the bone. Most of these cases had received radiation for the purpose of treatment of non-malignant disease of the organ in question or malignant tumor of another organ, except a case due to occupational radiation exposure (6).

The criteria adopted for the diagnosis of radiation-induced cancer were as follows:

- a. There must have been certain evidence of the non-malignant of the initial condition.
- b. Irradiation must have been given and the cancer that subsequently developed must have arisen in the area included within the radiotherapeutic beam.
- c. A relatively long latent period must have elapsed after irradiation before the clinical appearance of the cancer.
- d. All cancer must have been proved histologically.

The above mentioned criteria are based on the prerequisites which Cahan et al. (7) adopted for radiation bone sarcoma.

Cases of radiation-induced cancer caused by external exposure were chosen as the subjects to this study. Cases of internal exposure, however, did not become the subjects, because of the difficulty in detailed estimation of absorbed radiation dose. Reliable information on the risk-evaluation of external exposure must be very useful for internal exposure.

The distribution and the average of the latent period between the beginning of exposure and the detection of tumor are presented in Table 1. A tendency of long latent period is worth noting from the standpoint of radiation protection and safety.

Table 2 shows histological findings of the cases found by this search.

The case received the lowest irradiation dose was carefully surveyed and estimated the dose. It was impossible to estimate the irradiation dose to the cases in the time when the concept and the measurement of radiation dose were not yet established. Table 3 represents data about the cases of the lowest dose of each organ. The lowest irradiation dose is different from "threshold dose" in the words of radiation biology, nevertheless the data must be useful information in the field of radiation

safety.

Methods of research on human radiation-induced cancer are divided into two following:

- (1) epidemiological survey
- (2) search for clinical case reports.

The results of the second type of research, to which this study belongs, give little numerical information about the dose-effect relation of radiation carcinogenesis, but are practical value to the judgement in the causal dependence of radiation in a clinical case.

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Organ	Latent Period (Years)		
	Minimum	- Maximum	Average
Pharynx and Larynx	8	- 15	27.3
Uterus	1	- 40	10.1
Breast	10	- 44	22.7
Colon	1	- 31	13.6
Bone	2	- 42	11.7

Table 1. Latent Period of Radiation-Induced Cancer

Organ	Histopathological Finding
Pharynx and Larynx	Squamous Cell Carcinoma
Uterus	Carcinoma (80%), Sarcoma (12%) Mixed Mesodermal Tumor (8%)
Breast	Duct Cell Carcinoma and Adenocarcinoma
Colon	Adenocarcinoma
Bone	Osteosarcoma (60%), Fibrosarcoma (25%) Chondrosarcoma (7%), Others (8%)

\* Cases of anal cancer were squamous cell carcinoma

Table 2. Histopathological Finding of Radiation-Induced Cancer

Organ	Latent Period (Years)	Dose	Author
Pharynx and Larynx	5	4000 R	Maier(8)
Uterus	3	1400-1600* rads	Stacy(9)
	8	1000-1450** rads	Wolfe(10)
Breast	26	1470 rads	Mareel(11)
Colon	5	460 rads	Rubin(12)
Bone	No Description	800rads***	Arlen(13)
	No Description	1800rads****	Arlen(13)

\* The case irradiated by intra-uterine radium.

\*\* The case irradiated by X-ray therapy.

\*\*\* The case irradiated for the treatment of bone disease.

\*\*\*\* The case irradiated for treatment of extra-skeletal disease.

Table 3. Data on Lowest Irradiation Dose in Case Reports of Radiation-Induced Cancer