

Latency Period of Malignant Lesions in Mice Exposed to Continuous Low Dose-rate Gamma-rays – Pathological Study –

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Abstract

Late effects of low dose and low dose-rate (LDR) ionizing radiation are potential hazards, and have become a serious concern since the nuclear accident at the Fukushima Dai-ichi Nuclear Power Plant. Chronic exposure of 4000 mice to LDR gamma-rays showed that the average life span of female mice irradiated at 21 mGy/22 h/day (909 μ Gy/h) for 400 days (total dose: 8000 mGy) were shortened by about 120 days due to premature death from various neoplasms including malignant lymphomas. This suggested that long-term exposure to LDR gamma-rays causes early onset or increased progression of neoplasms. A cross-sectional experiment is underway for the purpose of studying the development and progression of neoplastic and non-neoplastic lesions.

There were significantly increased incidences ($p<0.05$) and shortened latency periods of malignant tumors of liver and lung origins in the irradiated group (20 mGy/22 h/day). Malignant lymphomas and benign tumors of the liver appeared at the same age in both irradiated and non-irradiated groups. The numbers of non-neoplastic lesions (ovarian atrophy) increased significantly ($p<0.01$) in mice exposed for 200 days (total dose: 4000 mGy). These suggested that the effects of LDR irradiation on neoplastic and non-neoplastic lesions vary depending on the organ and/or tissue.

Table 1 Summary of lesion occurrence

Lesion	Compared to Non-irradiated control
Neoplastic lesions	
Malignant lymphoma	Higher incidence
Lung and Liver benign neoplasms	Higher incidence
Lung and Liver malignant neoplasms	Earlier and higher incidence
Ovary, Adrenal and Harderian gl. neoplasms	Earlier and higher incidence
Pituitary and thyroid gl. neoplasms	No change
Non-neoplastic lesions	
Lymphoid hyperplasia	No change
Liver fatty degeneration	Earlier and increase in severity
Ovary atrophy and hyperplasia	Earlier and higher incidence
Adrenal hyperplasia	Increase severity
Ovarian hyperplasia	Earlier and higher incidence
Heart Valvular degeneration	No change
Uterus, Cystic endometrial hyperplasia	Decrease incidence