Life Span Shortening in X- and Fast Neutron Irradiated Mice

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We have been interested in the specific lesions associated with life span shortening following relatively large doses of X-rays or fast neutrons to (C57LxA)F₁ hybrid mice. In non-irradiated mice (average age at death 27 months), the mortality rate appears to be the same whether or not the major known causes of death, such as leukemia, are subtracted out from the population. Fast neutron irradiation in mice (400 to 520 rads) gives a life span curve analogous to that of mice exposed to 800 r of X-rays plus injected isologous hematopoietic cells. In the neutron irradiated mice the median life span is 18 months, the maximum 30 months; in the latter group 18 and 31 months, respectively. Life span reduction in the neutron irradiated mice is associated with gastrointestinal neoplasms and hyperplasia; in the X-irradiated group with nephro-sclerosis and its sequelae, and to probable degenerative lesions in arterioles of other regions, for example stomach submucosa.

Comparing a single high dose of X-rays (690 r, an LD₅₀) to the same total dose given in a fractionated schedule (85 r given once weekly for 8 weeks), the median life span is 21 months for the former, and 15 months for the latter. In the single high dose group, the incidence of nephrosclerosis is high, that of leukemia low; in mice exposed to the fractionated X-radiation an opposite effect is

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seen, i.e., the occurrence of nephrosclerosis is greatly reduced, while the incidence of leukemia is increased, and occurs relatively earlier than in non-irradiated controls.

The question as to whether life span shortening is independent of observable specific lesions is undetermined at the present time. Although the present results indicate that fractionation of X-radiation dose greatly decreases the incidence of the vascular lesions in the kidney incident to nephrosclerosis, as compared to single high doses, it may be that more subtle effects leading to vascular degeneration may contribute to the overall ageing process at lower radiation doses.