The Effect of Anoxia on Radiation Injury and Recovery

T.L.		Phillips
G.E.		Hanks

Department of Radiology, from the University of California, San Francisco

The absence of oxygen enhancement and the absence of recovery between exposures associated with high LET radiations suggest that low LET radiations associated with hypoxic protection could cause damage having a similar absence of recovery. LAF^o Mice were irradiated with a 250 kvp. X-ray machine in an atmosphere of either 4.2% oxygen or in air. The LD 50/30 dose under hypoxic

58

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conditions was 1720 rads and for air was 845 rads, yielding a protection or enhancement ratio of 2.03. Recovery was tested by conditioning the mice with two thirds of the LD 50/30, either in air or under hypoxic conditions and redetermining the LD 50/30 in the same gas mixture. Recovery patterns in two groups differed markedly. The mice irradiated in air demonstrated a rapid initial recovery while the animals irradiated under hypoxia retained 100% of the injury at day 1 and 93% at day 3. The initial rapid recovery in the animals irradiated in air is thought to represent early repair within the bone marrow cells and the late recovery phase in both groups is thought to represent proliferation of cells. The anoxically protected mice show little early repair but seem to obtain the same level of recovery as the air irradiated mice, once proliferation begins. High mortality due to lung damage is observed from one to four months after irradiation in the anoxic groups receiving higher total doses and is due to the lack of protection in the lung.

Multiple dose irradiation was also performed using 2, 4, 5, and 10 equal doses. The multiple dose technique also showed a reduction in the protection ratio again suggesting a qualitative as well as quantitative difference in the effect of irradiation under hypoxic conditions.

could lead to a greater effect when fractionated treatments are used under anoxic conditions as compared to the results of a single treatment. Additional experiments were performed using the Till and McCulloch endogenous spleen nodule technique. Mice were given equal divided doses of radiation

either under air or hypoxic conditions. The mice irradiated in air showed an initial rapid recovery of more than two times as well as massive recovery due to proliferation at 27 hours. No early recovery was noted in the groups irradiated under anoxia.