Radon Induced Micronuclei in Respiratory Tract Biodosimetry

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This paper uses an *in vitro/in vivo* approach to evaluate the usefulness of micronuclei as a biomarker of radiation exposure and dose and to determine the impact of physical and biological variable in the response. The study focused on high-LET alpha particle irradiation. No significant differences were observed in the frequency of micronuclei per Gy for cells exposed either *in vitro* or *in vivo.* Radon exposures was about 10-12 times more effective in producing micronuclei as acute exposure to $_{60}$Co gamma rays. When the $_{60}$Co and radon were delivered over the same time interval (3 days) the relative effectiveness of radon increases to about 65. The use of a microbeam made it possible to compare the damage induced by random alpha particle exposures, both *in vitro* and *in vivo*, to that from defined numbers of alpha traversals. It was determined that when each CHO cell received one alpha particle, there was a significant increase in the frequency of micronuclei in the cell population. Using biodosimetry it was possible to establish the relationships, which exist between radon exposures *in vivo* (WLM), does *in vitro* (mGy) and alpha traversals. The amount of damage done by one alpha traversal in each cell was similar to that induce by exposure of cell populations *in vitro* to a dose of 160 mGy from radon. The amount of damage from one alpha traversal in each CHO cell was similar to that induce by exposure of deep lung epithelial cells to 120 WLM from radon inhalation. These factors were combined to demonstrate that one WLM produces the same amount of chromosome damage to the deep lung epithelial cell or fibroblast as 1.3 mGy or 0.79 mGy of alpha dose, respectively. Biomarkers of dose are thus very useful in helping validate physical models and in evaluating the influence of both physical and biological variables on the induction of cytogenetic damage. The influence of carrier aerosol particle size and number on the deposition and dose from radon was measured. It was determined that inhalation of radon a monodisperse was aerosol with a small mass median aerodynamic diameter (MMAD) of (0.2 um) resulted in four times as many micronuclei per WLM than was produced per WLM using either carries aerosols of cigarette smoke (0.65 um) or uranium ore dust (0.5 um) MMAD. Finally, using the same carrier aerosol, it was determined that Syrian hamsters had more micronuclei produced in deep lung fibroblasts per WLM of radon exposure than the Wistar rat, even thought the rats were much more sensitive than hamsters for radon induce lung cancer, this suggests that micronuclei may be a good indicator of dose but are not a good indicator of risk.

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