

The Neoplastic Transformation Potential of Mammography X Rays and Atomic Bomb Spectrum Radiation

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ABSTRACT

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Considerable controversy currently exists regarding the biological effectiveness of 29 kVp X rays which are used for mammography screening. This issue must be resolved to enable proper evaluation of radiation risks from breast screening. Here a definitive assessment of the biological effectiveness of 29 kVp X rays compared to the quality of radiation to which the atomic bomb survivors were exposed is presented for the first time. The standard radiation sources used were (a) an atomic bomb simulation spectrum and (b) 2.2 MeV electrons from a strontium-90/yttrium-90 (⁹⁰Sr/⁹⁰Y) radioactive source. The biological end point used was neoplastic transformation *in vitro* in CGL1 (HeLa × human fibroblast hybrid) cells. No significant difference was observed for the biological effectiveness of the two high-energy sources for neoplastic transformation. A limiting relative biological effectiveness (RBE_M) of 4.42 ± 2.02 was observed for neoplastic transformation by 29 kVp X rays compared to these two sources. This compares with values of 4.67 ± 3.93 calculated from previously published data and 3.58 ± 1.77 when the reference radiation was 200 and 220 kVp X rays. This suggests that the risks associated with mammography screening may be approximately five times higher than previously assumed and that the risk–benefit relationship of mammography exposures may need to be re-examined.

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