AbstractID: 3519 Title: Mono-energetic Brachytherapy Sources

Purpose: Determination of the energy dependence of human cell inactivation (i.e., loss of reproductive capacity) following exposure to β radiation.

Method and Materials: A dipole magnet was constructed from two 5.08cm x 5.08cm x 2.54cm niobium permanent magnets separated by a distance of about 2cm. This dipole has a highly non-uniform field that reaches about 5 kG at the center. A 1cm x 1cm collimated electron beam exiting a ^{137}Cs radioactive source (300 Ci, max energy: 662 keV) was placed at the entrance face of the dipole magnet. Separation of the different energies was ensured by placing a second identical collimator perpendicular to the dispersive plane. The setup provides an energy resolution of about 10%. Four normal human fibroblast (AGO1521, AGO1522, GM06419 and WI-38) and one human breast cancer (MDA231) cell line were exposed to electrons of defined energy for approximately 1 hour (~3.5 Gy). Radiation induced changes in clonogenic survival were determined and protein samples collected for subsequent proteomic analysis using 2D gel electrophoresis, coupled with Mass Spectroscopic identification of candidate proteins.

Results: Examination of the Relative Biological Effectiveness of the various electron beam energies on human cell lines indicates an energy dependence of cell inactivation. The radiation exposure time variation and the type of cell lines play a non-negligible role in the experimental outcome. Preliminary Monte Carlo simulation data of the process at the molecular level compare fairly well with experimental results.

Conclusion: This work indicates the potential efficacy of providing mono-energetic radioactive sources for Brachytherapy treatments. Characteristic responses of tumor cells to well defined kinetic energies of β particles could reduce the incidence of unwanted side effects associated with ineffective radiation dose. The methodology will be used in future investigations on small animals to establish in-vivo applicability of the technique.

Conflict of Interest (only if applicable):