

Variations in the Radiosensitivity of T-lymphocytes of different Individuals to a Therapeutic Neutron Beam

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Purpose: Variations in the radiosensitivity of different tumours pertain to the potential for therapeutic gain for treatment with high energy neutrons. In this work the radiosensitivities of T-lymphocytes of different individuals to the clinical neutron beam at iThemba LABS were measured. The objective of this investigation was to establish if a relationship between neutron RBE and resistance to conventional gamma radiation could be determined.

Materials and Methods: Peripheral blood samples were collected from five healthy donors. Whole blood was exposed to different doses of ⁶⁰Co gamma rays (1-5 Gy) and p(66)/Be neutrons (0.5-2.5 Gy). One sample per donor was not exposed to radiation and served as a control. From each sample, lymphocytes were separated and cultured to induce micronuclei in cytokinesis-blocked cells. The micronuclei yield and nucleation index were assessed using fluorescent microscopy. Radiosensitivities and RBE values were calculated from the fitted dose response micronuclei frequency data.

Results: Dose limiting RBE values for the clinical neutron beam were found to range from 1.8 to 11.2 with a mean value of 6.5 ± 3.4 . A clear reduction in neutron RBE is noted for donors with lymphocytes more sensitive to gamma rays ($p = 0.05$, $R^2 = 0.9$).

Conclusion: The correlation between neutron RBE and cellular radioresistance to photons suggests a potential for therapeutic gain for some patients treated with the high energy neutron beam at iThemba LABS.