AbstractID: 6831 Title: A Recursive Differential Equation Approach towards the Problem of Estimating the Probability of m Surviving Clonogens after the ith Irradiation.


**Purpose:**

A model is developed that describes the tumor dynamics of a repopulating tumor during a fractionated external radio treatment.

**Method and Materials:**

An iterative algorithm is constructed for the calculation of the probability distribution of the surviving number of tumor cells for any point in time during the treatment and for post treatment times. This is accomplished through the assumption, that cell repopulation takes place only during the intervals between the fractions of irradiation. Thus, the processes of cell repopulation and of radiation-induced cell kill are considered decoupled and are therefore modeled separately. Binomial statistics is applied to describe the radiation induced cell damage. Natural death is ignored. Tumor repopulation is modeled through the construction of differential equations for the probability that a certain number of cells exist at a certain point in time. The differential equations are solved in a straightforward manner.

**Results:**

The probability of zero survivals is compared numerically to the Zaider-Minerbo tumor control probability (TCP) model for an arbitrarily chosen regime of treatment. An excellent agreement is found to exist between the two expressions. The Poisson approximation of the probability distribution of the number of cells is also studied and it is compared to the proposed method for several different combinations of the model parameter values.

**Conclusion:**

It is concluded that the Poisson approximation works well only for slowly repopulating tumors and for rather high cell radiosensitivity (i.e. low cell survival probability after a fraction of radiation). Therefore, the use of the exact method for the description of the radiation response of repopulating tumors is recommended.


**Conflict of Interest (only if applicable):**