AbstractID: 12811 Title: Can the Linear Quadratic (LQ) model predict the biological response of cells to simple dose heterogeneity for single and multiple fraction irradiation?

Purpose: Can the α and β values derived from uniform irradiation be used in the Summed Dose Method to predict cell survival for single or multiple fraction irradiation with a heterogeneous dose distribution?

Method and Materials: A549 non-small cell lung cancer cells were investigated by clonogenic assay in a NUNC 6-well plate using single and multiple fractions up to 10Gy. The plate contains two uniformly irradiated wells and two heterogeneously irradiated wells. The α and β values measured in the uniformly irradiated wells were used to predict the survival for a sharp and shallow dose distribution. The experimental survival was compared with that predicted by the Summed Dose Method.

Results: The Summed Dose Method cannot predict in the total well survival of A549 cells for either dose distribution at single fraction doses. The total well survival cannot be predicted for the sharp distribution at fraction 4 and 5, for any fraction in the irradiated region, for the shallow dose distribution at fractions 3 and 5 in the unirradiated region or any fraction in the irradiated region or total well. The Summed Dose Method can predict the survival of the sharp distribution at all single fraction doses in the unirradiated region and up to 2 Gy in the irradiated. The survival can be predicted at 5 Gy in the unirradiated region and 1 and 5 Gy in the irradiated for the shallow dose distribution. The survival is predicted at fractions 1, 2 and 4 in the unirradiated regions for the shallow dose distribution and is predicted for the sharp distribution at all multiple fractions in the unirradiated region, and fractions 1 to 3 in the total well

Conclusion: The Summed Dose Method is still limited in predicting cell survival for single or multiple fraction irradiation with a heterogeneous dose distribution.