AbstractID: 7289 Title: Estimation of Tumor Control Probability Model Parameters for Early Stage Non-Small-Cell Lung Cancer (NSCLC)

Purpose: To estimate parameters for the tumor control probability (TCP) model based on the linear-quadratic (LQ) cell survival formalism from published clinical data for early stage NSCLC and to investigate potential outcomes of alternate dose fractionation schemes.
Method and Materials: A comprehensive literature search was performed to identify studies reporting local control after conventionally fractionated 3DCRT and hypofractionated stereotactic body radiation therapy (SBRT) for T1-2N0M0 NSCLC. Parameters of the LQ-based TCP model were estimated by fitting the selected clinical data sets using the maximum likelihood method. Fits were obtained and compared for three versions of the TCP model: without the time effect, with an exponential growth of clonogens, and with delayed onset of clonogen proliferation. Obtained parameter estimates were used to compare different fractionation schemes that take advantage of increase in tumor control as the overall treatment time is reduced.
Results: A fit to the exponential growth model was significantly better ($p < 0.0001$) than a fit to the model with no time effect. Also, the model with delayed onset provided a significantly better fit ($p = 0.0142$) to the data than the exponential growth model assuming no delay in clonogen repopulation. Parameter estimates for the model with delayed onset were: $\alpha = 0.066$ Gy^{-1}, $\alpha/\beta = 21.1$ Gy, $\gamma = 1.85$ Gy/day, $T_k = 32.2$ days, and k (the number of clonogens) = 6.3. Our analysis of different hypofractionated regiments confirms observations by others and suggests that a moderate reduction in the number of fractions (with the increase in the dose per fraction) may result in better tumor control for the same level of late complications.
Conclusion: The derived TCP model parameter estimates may prove useful for biologically based treatment planning of Stage I NSCLC, especially when unconventional fractionation schemes, such as in SBRT, are employed.