AbstractID: 10081 Title: Can an addition of a simple constant to linear quadratic formula improve cell survival curve fits for some cell lines?

Purpose: To investigate the effect of an unrecognized hyper radio-sensitivity on radiobiological parameters α and β of the linear quadratic model.

Methods and Materials: A Chinese hamster cell line designated "choaa8" and a lung cancer cell line designated "ncih226" were fitted to the linear quadratic (LQ) model ($\ln S = -\alpha D - \beta D^2$) and to a simple constant plus linear quadratic (CLQ) model ($\ln S = -c - \alpha D - \beta D^2$). The χ^2/df of each fit was compared to determine which model gives the best fit to the cell survival curve.

Results: The linear quadratic χ^2/df for the "choaa8" and the "ncih226" are 1.55 and .095 respectively. The simple constant plus linear quadratic χ^2/df for the "choaa8" and the "ncih226" are 1.18 and .075 respectively. So the addition of a simple constant to the linear quadratic formula provides greater than 20% improvement to the survival curve fits. The α/β ratio for the LQ "choaa8" is 11.0, whereas the α/β ratio for the CLQ "choaa8" is 5.4. The α/β ratio for the LQ "ncih226" is 5.1, whereas the α/β ratio for the CLQ "ncih226" is 0 indicating $\alpha = 0$. So the addition of a simple constant in the linear quadratic formula can have a dramatic effect on the α/β ratio.

Conclusion: CLQ provided superior fits compared to the LQ for the two data sets mentioned above. The value of the α/β ratio was heavily dependent on whether or not an addition of a simple constant to linear quadratic formula was used. Further work is required to determine if the improved fit is due to actual physical phenomena such as hyper radio-sensitivity or an alternative explanation like experimental error or noise in the data.