AbstractID: 13202 Title: The Puzzle of Repair Half-time in Mouse Lung Irradiation – Application of the gLQ Model

Purpose: The repair half-time of radiation damage for mouse lung remains controversial. To solve the puzzle, we reanalyzed the existing data using the generalized LQ (gLQ) model that was developed to address the dilemma of LQ model in high dose region.

Method and Materials: An animal dataset of mouse lung irradiation (Vegesna *et al. IJRB* 1985;47:413) was studied. In this experiment, mouse lung was irradiated with repeated dose from 1.15 Gy to 13.43 Gy. The endpoint was death due to radiation pneumonitis. A repair half-time of 1.5 hour derived from the data of reciprocal of LD50 (lethal dose for 50% mortality) vs. dose-per-fraction was much longer than the repair half-time of 0.4 hour published in the literature. In this study, the same data set was reanalyzed using both the LQ and the gLQ models. The χ^2_{min} method was adopted to fit the data and to evaluate the figure of merit for the two models.

Results: Fixing the repair half-time to 0.4 hour, the gLQ model fit the data much better than the LQ model: the reduced χ^2_{min} is 0.39 vs. 2.8 respectively. The α/β ratio was also quite different: 1.7 Gy for the gLQ model, and 3.3 Gy for the LQ model. While the gLQ model correctly predicted the high dose response based on low dose data, the LQ model could not reproduce the downward curvature shown in the LD50 plot.

Conclusion: Our results indicate that the gLQ model provides a consistent interpretation of the mouse lung data across fraction sizes up to 13 Gy and naturally solves the puzzle of repair half-time faced by the LQ model. Therefore, the gLQ model is useful to extend our clinical experience accumulated from conventional low-dose fractionation to high dose irradiation schedules, including SRS/SBRT and HDR brachytherapy.