

AbstractID: 4879 Title: Radiobiological Concerns on Prolonged IMRT Delivery for Head-and-Neck Carcinoma

**Purpose:** Radiobiological effect of the prolonged IMRT delivery time on head-and-neck cancer has remain to be defined. The purpose of this work is to estimate a plausible set of radiobiological parameters ( $\alpha/\beta$ , sublethal damage repair halftime, potential doubling time) for squamous cell carcinomas of head-and-neck (SCCHN) based on in vitro measurement and clinical data, and to examine the potential radiobiological influence due to the prolonged delivery time using the newly estimated parameters of SCCHN.

**Methods and Materials:** In vitro cell survival measurements were performed for two cell lines of SCCHN irradiated by a series of specially-designed single and split dose regimens using a 6 MV machine. The obtained survival data were fitted to the Linear-Quadratic (LQ) model using the least  $\chi^2$  technique. Other radiobiological models, such as equivalent uniformly dose (EUD) and tumor control probability (TCP), were used to analyze published clinical outcome to validate the parameters estimated from the in vitro data.

**Results:** Based on the present in vitro measurements, we have estimated a set of radiobiological parameters for SCCHN: repair half-time  $T_r = 16 \pm 21$  min, the potential doubling time  $T_d = 48 \pm 10$  hours, radiosensitivity parameters  $\alpha/\beta = 7.9 \pm 4.5$  Gy,  $\alpha = 0.22 \pm 0.08$  Gy. This set of parameters was found to be able to fit the available clinical data. The calculation based on these parameters indicated that prolonged delivery time, if comparable/longer with the repair half-time, would result in noticeable reduction in treatment effectiveness. For example, an IMRT delivery time of 30 minutes would result in a reduction of 11% in tumor EUD (compared to a 5-minute fraction).

**Conclusions:** The present measurement and analysis show that the repair half-time and potential doubling time for head-and-neck cancer are relatively short, indicating that optimal IMRT delivery time needs to be clinically considered.