AbstractID: 6370 Title: Physical and Radiobilogical Analysis on Single and Parallel-Opposed Spatially Fractionated Radiation Therapy

Purpose: Dosimetric characteristics were used to evaluate therapeutic advantage for megavoltage spatially fractionated (GRID) radiation therapy by a linear quadratic model. GRID radiotherapy was compared with uniform dose delivery on tumor and normal tissues using single and parallel-opposed configurations with different GRID parameters for a single high-dose fraction.

Method and Materials: Three different GRID blocks designed for a Varian Clinac 2100EX linear accelerator were investigated. These blocks were made of cerrobend molded into a block of 7.5 cm and mounted into the accessory tray. The GRID blocks had aperture diameters 6.0, 8.0, and 8.5 mm (9, 14, and 14 mm projected at isocenter). Dosimetric measurements were done using films, TLDs and an ionization chamber. A linear-quadratic (LQ) model was used to calculate the survival fraction (SF) of tumor and normal tissues. Therapeutic gain was obtained by the SF ratios of normal tissues under GRID to that under equivalent open field.

Results: The output, beam profiles, and isodose of a GRID field versus field size and energy were obtained. Therapeutic ratios varied from 0.9 to 51 for a wide range of tumor sensitivities at single fraction doses of up to 30 Gy for the single GRID setup. The average ratio of dose at d_{max} (normal tissue) to dose at midplane (tumor volume) was reduced from about 200% for a single field to 115% for parallel-opposed fields. The parallel-opposed GRID setup showed a higher therapeutic gain than a single GRID field.

Conclusion: GRID parameters posed a remarkable impact on therapeutic characteristics. Using parallel opposed GRID setups resulted in a significant increase in therapeutic advantage and a substantial decrease in dose delivered to the normal tissues for the same prescribed tumor dose. With single-fraction doses, GRID radiotherapy exhibited a significant therapeutic advantage over the open field when the tumor cells were more radioresistant.