AbstractID: 8203 Title: Feasibility Study of Parallel-Opposed GRID Therapy Using a Multileaf Collimator

Purpose: Parallel-opposed approach of megavoltage spatially fractionated (GRID) radiation therapy for deep-seated tumors was demonstrated using a multileaf collimator (MLC GRID). Its therapeutic advantage was assessed based on dosimetric measurements using a linear quadratic model.

Materials and Methods: A Varian Clinac 2100EX linear accelerator equipped with an MLC was used for the MLC GRID therapy test. Two MLC GRID blocks denoted by MLC5 and MLC10 representing 5×5 and 10×10 mm openings projected at isocenter, respectively, were assessed in both single and parallel-opposed (POP) setups. 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 an MLC GRID to that under equivalent open field for both single and POP setup.

Results: Beam profiles from MLC5 and MLC10 GRIDs created using 6 MV and 18 MV x rays were found to show a GRID field feature of spatially periodic intensity modulation for both single and POP setups. Their dose distributions measured at different depths using a film dosimetry were used to determine therapeutic gain. Therapeutic ratios varied from 1 to 45 for a wide range of tumor sensitivities at single fraction doses of up to 30 Gy. MLC GRID therapy with POP setup showed a higher therapeutic gain than one with single MLC GRID.

Conclusion: Dosimetric properties of MLC GRIDs allowed for therapeutic evaluation using a modified LQ model. With high, single-fraction doses, POP MLC GRID radiotherapy exhibited a significant therapeutic advantage over the single field radiotherapy when the tumor cells were more radioresistant.