AbstractID: 6411 Title: Therapeutic Advantage of GRID Therapy Using a Multileaf Collimator

Purpose: Dosimetry of megavoltage spatially fractionated (GRID) radiation therapy using a multileaf collimator (MLC GRID) was carried out using films. Its therapeutic advantage was assessed based on dosimetric measurements by a linear quadratic model. Therapeutic advantages obtained from MLC GRIDs were compared with a Cerrobend GRID.

Materials and Methods: A Varian Clinac 2100EX linear accelerator equipped with an MLC was used for the MLC GRID therapy. The two MLC GRID blocks were denoted by MLC5 and MLC10, representing 5×5 and 10×10 mm openings projected at isocenter, respectively. Cerrobend GRID blocks were used for comparison with MLC GRIDs. 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.

Results: 5×5 and 10×10 mm GRIDS (*i.e.*, MLC5 and MLC10 GRIDs) were created using a MLC using 6 MV and 18 MV x rays. Their dose distributions were measured at different depths using a film dosimetry. The peak-to-valley dose ratios at the depth of maximum dose at 100cm SSD were found to be 19% for MLC5 and 17% for MLC10. Therapeutic ratios varied from 0.9 to 45 for a wide range of tumor sensitivities at single fraction doses of up to 30 Gy. MLC10 GRID therapy showed a higher therapeutic gain than MLC5 and an 8mm Cerrobend GRID block.

Conclusion: With high, single-fraction doses, MLC GRID radiotherapy exhibited a significant therapeutic advantage over the open field radiotherapy when the tumor cells were more radioresistant. Dosimetric properties of MLC GRIDs allowed for therapeutic evaluation using a modified LQ model. One of the GRIDs investigated, MLC10 showed a great increase in therapeutic benefit compared to MLC5 and a Cerrobend GRID block with 8mm apertures.