

AbstractID: 10736 Title: Biological Effects of the Radiation Dose from Volumetric Image Guided Radiation Therapy

Purpose: The radiation dose delivered from volumetric imaging guidance is normally between 1-10 cGy, depending on the imaging modalities, tumor sites and patient thickness. To correctly compensate for such doses, their biological effects on tumor and endothelial cells are investigated.

Methods and materials: A lung carcinoma cell line (H460), a breast cancer cell line (MCF-7) and a prostate cancer cell line (PC3) and a human umbilical vein endothelial cell line (HUVEC) were studied for their responses to small doses of radiation ranging from 5 cGy to 50 cGy. Specifically, a MTT assay was used to quantify their proliferation over time. To measure the impact of image guidance doses on cell survival, 5 cGy or 10 cGy were delivered to H460 cells before a 200 cGy therapeutic dose. The tumor cell survival was measured by clonogenic assay and compared with cells that received 200 cGy only.

Results: Accelerated proliferation was observed among all tumor cell lines but not the HUVEC to low dose irradiation. The acceleration was statistically significant ($p < 0.05$) for H460 and MFC7 cells but not for the PC3 cells. A 12.6% increase in the H460 cell survival was observed for cells receiving 5cGy before 200 cGy radiation compared to those that received 200 cGy alone ($p < 0.02$), while cells receiving 10 cGy prior to 200 cGy had the same survival as cells receiving 200 cGy alone.

Conclusions: Small pre-treatment doses of radiation may increase the radioresistance of tumor cells. In this study, we demonstrated that the imaging dose from image guided radiation therapy is sufficient to trigger accelerated proliferation when delivered alone and increased tumor survival when delivered prior to a therapeutic dose. Our results suggest that subtracting the imaging dose from the therapeutic dose may adversely affect the tumor control probability.