AbstractID: 9064 Title: Risk Assessment of Secondary Malignancies from IMRT Treatments

Patients undergoing radiation therapy are exposed to secondary radiation that may induce secondary malignancies. For high-energy photon beams (above 8MV), the secondary radiation field contains neutrons and photons; neutrons have a high relative biological effectiveness. Additionally, secondary radiation is a function of beam-on time. Step-and-shoot IMRT treatments require significantly more MU's than conventional treatments.

Out-of-field photon and neutron dose equivalents were measured for a variety of prostate treatment approaches: 6MV, 15MV, and 18MV step-and-shoot IMRT treatments with a Varian 2100 accelerator, and 6MV and 15MV step-and-shoot IMRT treatments with a Siemens Primus accelerator. A conventional treatment at 18MV was also done with the Varian accelerator. IMRT treatment planning was done with the Corvus treatment planning system. Photon doses were measured with TLD in an anthropomorphic phantom. Neutron dose equivalents were measured with gold foils in neutron moderators following the McCall approach.

The dose equivalent from each treatment approach was converted to a lifetime risk of fatal secondary malignancy based on the risk coefficients of the NCRP (report 116). The likelihood of secondary fatal malignancy was 1.5% for the conventional treatment. For IMRT with a Varian accelerator, the likelihood of fatal secondary malignancy was 2.9% for 6MV, 2.8% for 15MV, and 3.7% for 18MV. The 15MV and 18MV treatments had less photon dose equivalent than the 6MV treatment, however the increasing neutron contribution resulted in equal or greater total risk. Similarly, the likelihood of fatal secondary malignancy from IMRT with a Siemens accelerator was 3.5% for 6MV and 3.6% for 15MV.