

AbstractID: 8293 Title: Second cancer risks following proton therapy and intensity modulated x-ray therapy for prostate cancer

**Purpose:** To assess the risk of second cancers from proton therapy for a typical prostate patient relative to 6-MV IMXT, taking into account contributions from both primary and secondary (i.e., scatter and leakage) sources of radiation

**Methods and Materials:** A 250-MeV proton plan and a 6-MV IMXT plan were constructed for a typical prostate patient using a commercial treatment planning system. Doses from the primary fields delivered to organs at risk of a developing a second cancer were taken from dose-volume histograms provided by the planning system. Secondary doses from the proton plan were determined in a computerized anthropomorphic phantom using a detailed Monte Carlo model of the double-scattering beamline at the M. D. Anderson Proton Therapy Center. Secondary doses from IMXT of the prostate were determined from published thermoluminescent detector measurements in an anthropomorphic phantom. Second cancer risks were estimated from primary and secondary doses on an organ-by-organ basis using modified risk coefficients from Report 116 of National Council on Radiation Protection and Measurements.

**Results:** Proton therapy *reduced* risk of a second cancer by 17% compared to IMXT. This reduction was attributed the substantial reduction of dose to the rectum and bladder provided by the proton plan. Secondary doses from proton therapy were smaller than IMXT near the field, but larger far from the field. Much of the risk for both modalities emanated from the in-field organs, i.e., the rectum and bladder. However, the risks from the in-field organs were considerably lower from the proton plan (0.98%) compared to the IMXT plan (1.40%). The risks from secondary doses to out-of-field organs were similar for both plans (1.05% and 1.04% for the proton and IMXT plans, respectively).

**Conclusions:** When considering primary and secondary doses, proton therapy can reduce the incidence of radiation-induced cancers in prostate patients compared to contemporary IMXT.