

AbstractID: 4840 Title: The Dosimetric Impact of Intrafractional Motion on IMRT Treatment of Prostate Cancer

Purpose: To quantify the dosimetric impact of intrafractional motion on reduced-margin IMRT treatments of prostate cancer.

Methods and Materials: CT images were acquired immediately before and after a daily treatment for 46 prostate cancer patients. These CT sets were registered to the bony anatomy of the patient using an in-house 3D image registration software. To test the hypothesis that a 3-mm isotropic target margin would adequately cover the target over the duration of the treatment, an 8-field IMRT plan was designed on the pre-treatment CT and subsequently copied and re-calculated on the post-treatment CT. For convenience of comparison, dose plans were designed to receive a full course of treatment (75.6Gy). Dosimetric impact was assessed with comparisons of prostate, seminal vesicle (SV), rectum, and bladder volumes receiving several dose levels as well as the minimum and maximum doses to 0.1cc of the prostate and SV. Anatomic variations were also quantified.

Results: Over the duration of one treatment fraction (21.4 \pm 5.5 minutes), there were systematic reductions in the volumes of the prostate and SV receiving the prescription dose (1.8 and 7.2 % respectively, $P<0.001$) as well as the minimum dose to 0.1cc of their volumes (2.1 and 6.4Gy, $P<0.001$). Of the 46 patients, 4 patients' prostates (91%) and 8 patients' SVs (83%) did not maintain dose coverage above 70Gy. Rectal dose increased and dose to the percentage-volume of the bladder decreased at all dose levels. Rectal volume filling was correlated with a decrease in percentage-volume of the SV receiving 75.6, 70, and 60Gy ($P<0.001$, $P<0.001$, $P=0.02$).

Conclusion: With a 3-mm intrafractional margin, a considerable percent of patients will not receive full dose coverage. The rectal volume increase during a treatment fraction has significant dosimetric impact on SV dose coverage and rectal sparing. Proactive immobilization of the rectum during treatment may be warranted.