

AbstractID: 3164 Title: Intra-fractional Variations of Anatomy During IMRT Treatment of Prostate Cancer

Purpose: The main goals of this study are to quantify the variations of pelvic anatomy during a single treatment fraction and to analyze the relationship of prostate and seminal vesicle (SV) motion relative to the bladder and rectum.

Materials and Methods: Twenty-six patients with locally advanced prostate cancer elected to participate in an IRB-approved intra-fractional motion study. Each patient received two CT scans with an integrated CT-linac system, one before and one immediately after a daily IMRT fraction including an ultrasound alignment. The pair of CT images was registered based on bony structure in the pelvic region using an in-house CT-to-CT 3D image registration software. The center of volume for both the prostate and SVs was used to assess the displacement of the same structure after the treatment fraction.

Results: Over the duration of one treatment fraction (20 ± 3 minutes) both the prostate and SVs showed statistically significant systematic trends in the superior and anterior directions of the patient's anatomy. The net change in bladder volume was huge ($133 \pm 78 \text{ cm}^3$), yet this increase did not directly coincide with large target shifts. Although the mean shifts in either direction were fairly small (1.8 mm and 1.3 mm for the prostate and SVs in the anterior direction), a few patients had shifts as large as 8.4 mm and 15.6 mm for the prostate and SVs respectively. These large shifts were highly correlated ($p=0.002$ and $p<0.001$) with large rectal volume increases caused from gaseous build-up in the rectum.

Conclusion: Although the mean intra-fractional motion may not be clinically significant during an IMRT fraction, some treatment fractions could potentially miss portions of the target structures and/or include a larger volume of the anterior rectal wall for a small subset of patients (~20%) with large gaseous build-up.