AbstractID: 6706 Title: Dosimetric Evaluation of Daily Rigid and Non-Rigid Geometric Correction Strategies During On-Line Image-Guided Radiation Therapy (IGRT) of Prostate Cancer

Purpose: To evaluate a geometric image guidance strategy that simultaneously correct for various interfractional rigid and non-rigid geometric uncertainties in an on-line environment, using field shape corrections (by modifying MLC). This technique was dosimetrically compared to simpler and more popular image guidance strategies (e.g., linear corrections).

Method and Materials: Five prostate cancer patients with daily CT studies were analyzed. All patients were planned with a simplified intensity modulated radiation therapy (SIMAT) technique. A uniform 5-mm margin was used. The image-guided geometric correction strategies simulated were (1) translational correction based on daily gross CTV registration ("CTV"), (2) translational correction with daily MU re-calculation ("MU-CTV"), and finally, (3) translational correction with MU re-calculation and daily MLC corrections to account for prostate deformations ("MU-MLC"). Deformable image registration was performed on all treatment CT studies for dose accumulation. Generalized equivalent uniform dose (gEUD) index was used for dosimetric comparisons.

Results: As expected, some dosimetric differences in the target volume were observed between the three image guidance strategies. For example, up to ± 2% discrepancy in prostate minimum dose were observed among the techniques. Of them, only the "MU-MLC" technique did not reduce the prostate minimum dose for all patients (i.e., ≥ 100%). However, the differences were clinically not significant to indicate the preference of one strategy over another, when using a uniform 5-mm margin size. For the organ-at-risks (OARs), large rectum sparing effect (≤ 5.7 Gy, gEUD) and bladder overdosing effect (≤ 16 Gy, gEUD) were observed.

Conclusion: The results suggest that a linear translational correction (i.e., "CTV") is adequate to maintain target coverage, for margin sizes at least as large as 5 mm. In addition, due to large fluctuations in OAR volumes, innovative image guidance strategies are needed to minimize dose and maintain consistent sparing during the whole course of radiation therapy.