AbstractID: 3146 Title: Iso-NTCP dose escalation with image-guided adaptive radiation therapy (IGART) for localized carcinoma of the prostate

Purpose: To evaluate the efficacy of various image-guided target localization techniques to assist in the safe dose escalation for prostate cancer radiation therapy in the presence of geometric uncertainties.

Method and Materials: Five prostate cancer patients were analyzed, retrospectively. All patients were planned with an 18MV six-field conformal technique with a 10 mm margin and an initial prescription dose of 70 Gy in 35 fractions. For the dose escalation study, the prescription dose was increased from 50 Gy in 2 Gy increments until the rectum normal tissue complication probability (NTCP) reached the level equal to that of the plan NTCP (i.e., iso-NTCP). The target localization techniques simulated were (1) laser alignment to external tattoo marks, (2) alignment to bony landmarks with daily portal images, and (3) alignment to the clinical target volume (CTV) with daily CT imaging. Techniques (1) and (3) were re-simulated with a reduced margin of 5 mm to investigate further dose escalation.

Results: The selection of the target localization technique was less critical on the treatment outcome when 10 mm margin was used. Reducing the margin size from 10 to 5 mm effectively decreased the NTCP by ~ 60 % for all patients. For iso-NTCP dose escalation, to our surprise, the average dose and TCP gain for the five patients were largest with the external tattoo technique (6.4 Gy and 7.5 %, respectively) followed by the daily CTV and the bony landmarks. The variability in gain across the five patients, however, was also largest with the tattoo registration technique and smallest with the daily CTV technique.

Conclusion: Based on these data, the best dose escalation strategy is to combine margin reduction (for increased normal tissue sparing) with the use of the daily CTV technique to localize the target volume (for consistent dosimetric coverage and escalation).