AbstractID: 3130 Title: Evaluation of image-guided radiation therapy (IGRT) technology and their impact on the outcome of hypofractionated prostate cancer treatments: A radiobiological analysis

Purpose: To evaluate various image-guidance technologies and their potential impact on the outcome of hypofractionated prostate cancer radiation therapy to mitigate against geometric uncertainties.

Method and Materials: Five prostate cancer patients were analyzed. All patients were planned twice with an 18MV six-field conformal technique with a 10 and 5 mm margin sizes, with various prescription doses (35 to 70 Gy) of equal late complications (assuming normal tissue α/β = 3 Gy). The various target localization techniques simulated were (1) laser alignment to external tattoo marks, (2) alignment to bony landmarks with daily portal images, (3) alignment to the clinical target volume (CTV) with daily CT imaging, and (4) the repeat of technique (3) with daily monitor unit updates to account for patient shape changes. The impact of uncertainty in the assumed α/β value for the prostate was also assessed.

Results: For all treatment schedules simulated, technique (4) achieved the ideal condition most closely (i.e., $\Delta TCP = TCP_{technique} - TCP_{plan} \approx 0$ %), then followed by (3), (2) and (1). As the number of fractions decreased (i.e., increasingly hypofractionated), the ΔTCP generally decreased for all techniques. Because the hypofractionated schedules were designed to keep late complications constant, the NTCP values were also relatively constant for all treatment schedules. Generally, the average NTCP values were lower than the plan for all techniques. However, the most effective way to reduce NTCP was to reduce the margin size from 10 to 5 mm. Overall, the uncertainty in α/β values had a far more influence on the outcome of the hypofractionated treatment than would the geometric uncertainties.

Conclusion: This study suggests that, although the impact of geometric uncertainties increases as the number of fractions decrease, the reduction in TCP due to the uncertainties does not significantly offset the expected gain in TCP by hypofractionation.