AbstractID: 12918 Title: Adaptive Image-Guided Radiation Therapy (AIGRT) for Hypo-fractionated Prostate Cancer Treatment

Purpose: The large fractional dose of hypo-fractionated prostate treatment requires high accuracy of daily treatment delivery. This study analyzes the performance of an adaptive IGRT (AIGRT) technique, which combines image guidance and adaptive re-planning to maximize the efficiency and accuracy of such treatment.

Method and Materials: 18 patients were studied retrospectively with the hypo-fractionated treatment regime of 4.4 Gy x 10 fractions. The CTV (prostate + seminal vesicles) and OARs (bladder and rectum) of the planning CT and daily CBCT were contoured by attending physician to maintain consistency in contouring. For each fraction, the AIGRT initiates an automated "soft-tissue matching" process to find the best fit for the "anatomy-of-the-day" in the patient-specific plan-pool (all delivered plans). The matching is successful if the previous smallest PTV can cover current CTV (i.e. minimum deformation and OAR overexposure). If the matching fails, a re-planning process will re-optimizes the fluence maps to generate an adaptive plan, which will be used to treat the patient for that fraction. Furthermore, this adapted plan is added to the plan-pool.

Daily DVHs and key dosimetric parameters for the CTVs and OARs were analyzed. The AIGRT technique is compared to soft-tissue matching ("Soft-Plan", current standard), and the daily re-planning treatments ("Re-Plan", the most conformal treatment).

Result: (1) Daily $D_{99\%}$ to CTVs for all patients ranged from 99.3%-105.1% (AIGRT), 99.9%-105.1% (Re-Plan), 72.6%-104.7% (Soft-Plan), respectively, indicating Soft-Plan is the only technique fails to deliver consistent daily dose to CTV (p=0.0194).

(2) $V_{100\%}$ and $V_{65\%}$ volumes (representing high and medium dose regions) of the bladder and rectum using AIGRT and Re-Plan techniques were 2.4%-8.3% smaller than those using Soft-Plans (p<0.0001).

(3) AIGRT reduced re-planning frequency by 43% averaged for all patients.

Conclusion: AIGRT improves the efficiency compared to Re-Plan and the accuracy compared to Soft-Plan.

(Research sponsored by Varian Medical Systems)