AbstractID: 13756 Title: Prostate asymmetry about rotational axis and patient-specific rotation tolerance

Purpose: To determine the impact of prostate shape and daily intra-fraction translations and rotations on CTV coverage for PTV margins of 2, 3 and 5 mm.

Materials/Methods:
Twenty-six patients with adenocarcinoma of the prostate were treated using the Calypso System on an IRB approved protocol. IMRT treatment plans meeting RTOG0126 dosimetric criteria (Dmin=79.2 Gy to 100% of CTV) were created with 2, 3, and 5 mm CTV-to-PTV expansions, where the CTV was the contoured prostate gland on the planning CT. Daily average translations and rotations were determined from daily real-time electromagnetic tracking data. These rotations and translations were then applied to the planned dose distribution to obtain the daily and accumulated dose to structures for all fractions of each patient with 2, 3 and 5 mm PTV expansions. Dose volume histograms (DVHs) are computed on the planned and accumulated dose distributions to evaluate the PTV margin under real target motion. D_{95} and V_{79} were used to assess the CTV coverage of the accumulated dose distributions for each PTV margin. A parameter combining prostate average rotation and prostate elongation was deduced from patient data to assess the impact of non-spherical geometry on target coverage.

Results:
When daily translations and rotations are included, V_{79}>95% was only achieved in 41%, 69% and 81% of cases with 2,3, and 5 mm margins, respectively. A strong correlation was found between elongated CTVs with large rotations, about the left-right axis, and poor coverage.

Conclusions:
Rotations can cause large under-dosing of the CTV depending on how elongated the prostate is along the sagittal axis. A patient-specific geometrical parameter could be extracted from the 3D prostate structure and used to determine a PTV margin for adequate coverage within an allowed angular deviation limit.

This work supported by supported by NIH R21 CA110485-02