

AbstractID: 3641 Title: Dose Reconstruction and Adaptive Radiation Therapy in Prostate Cancer

Purpose:

The purpose of this work was 1.) Perform dose reconstruction for prostate patients imaged and treated with helical tomotherapy and 2.) Calculate the minimum treatment margins for non-adaptive treatment delivery.

Method and Materials:

Megavoltage CT (MVCT) images are acquired prior to each treatment fraction for prostate patients. The daily corrections were recorded for each treatment fraction and used to calculate the random positional setup errors between setup marks on the skin and internal anatomy. Dosimetric error from organ deformation was calculated by contouring the prostate, seminal vesicles, and rectum on each MVCT image. Dose volume histograms were then calculated for each fraction. In addition to the initial margin 10-mm/5-mm (*5-mm posterior, and 10-mm in all other directions*) that was used clinically, treatment plans were also created with 8-mm/4-mm, 6-mm/3-mm, 4-mm/2-mm, and 2-mm/0-mm. These treatment plans were used to assess the minimum margins that could be used for each fraction.

Results:

The total shifts from the external laser marks were measured for over 1200 treatment fractions. The standard deviation was ± 4.1 mm in the AP direction, ± 3.9 mm in the lateral direction, and ± 2.9 mm in the SI direction. Without CT-based IGRT, an addition 6 to 8-mm of margin would be required to account for random setup variations. Treatment plans with 6-mm/3-mm of margin would have covered the prostate and seminal vesicles in 7 out of the 10 patients analyzed. Two patients would have required the 8-mm/4-mm margins, and one patient's seminal vesicles would not have been adequately covered with the 10-mm/5-mm.

Conclusion:

A dose reconstruction analysis has been performed for patients treated with CT based IGRT. Treatment margins of 6-mm/3-mm would have been acceptable for 70 percent of the analyzed patients. Patients with large fluctuations in bowel gas will require larger planning margins, even with IGRT.