

## AbstractID: 7793 Title: Problems Associated with IMRT Combined with a Single Fraction, 4D, High Dose Partial Prostate Boost

**Purpose:** There is a growing body of evidence that suggests that dose escalation will be beneficial in the treatment of prostate cancer. Specifically, dose escalation to areas of the prostate demonstrating high clonogenic cell density through MR spectroscopy or direct biopsy may improve treatment outcome. However, the surrounding normal structures and the movement of the prostate during treatment limit the dose that can be delivered safely. The purpose of this work is to describe a method to limit the dose to critical structures, namely, the rectum, during routine IMRT delivery to the prostate allowing for a dose escalated boost to be delivered to the areas in need.

**Methods & Materials:** Patients are being accrued to an in-house protocol in which 76 Gy is delivered to the entire prostate PTV via IMRT. An IMRT boost to the high disease density region(s) is then delivered in a single fraction that brings the dose to a biological equivalent of 94 Gy. Active tracking is employed throughout using implanted Calypso Beacons. This allows for a decrease in the PTV margins for the initial IMRT regime and subsequent increased rectal sparing. To evaluate the effects on the rectum a series of 8 prostate CT data sets were chosen for varying CTV volume (38-214 cc). The original, clinically used plans were compared to those generated by decreasing the PTV margins from our standard 8mm (5mm posteriorly) to uniform 3mm expansions. The number of beam directions as well as input constraints for the rectum was kept constant. Our routine clinical acceptance criteria were applied to all. Isoeffective dose calculations ( $EQD_2$ ) were employed to determine the appropriate boost dose. Appropriate composite plans were generated assuming 2 Gy fractions for the entire treatment. Additionally,  $EQD_2$  calculations were performed and composite plans generated for cumulative rectal dose.

**Results:** For the initial IMRT plans the average volume of rectum receiving 65 Gy and 40 Gy decreased from 14.9 to 6.3% and 33.1 to 23%, respectively, by decreasing the PTV margins to 3mm. A review of our initial data for patients implanted with Calypso transponders indicates that the prostate drifts during treatment by >3 mm for 103 seconds per average treatment (8-17 minutes). Assuming an  $\alpha/\beta$  of 2.0 for the prostate, a single fraction boost dose of 7.5 Gy results in an equivalent of 94 Gy. This boost will also effect the rectum in a similar manner, assuming appropriate  $\alpha/\beta$  corrections.

**Conclusions:** It is possible to deliver a high dose, single fraction boost to high tumor density regions of the prostate by using active tracking and PTV reduction. However, the effects on critical structures such as the rectum need to be evaluated with respect to our routine acceptance criteria and known side effect rates. It is hoped that this technique will result in improved outcome for patients with unfavorable disease characteristics.

Educational Objectives:

- 1) To understand issues related to combining "boost" plans to conventional IMRT plans
- 2) To be exposed to active organ tracking and the implications for normal tissue sparing