

#### Purpose:

Air-filled rectal balloon have been used most commonly for prostate irradiation to reduce rectal dose. However this creates a dose inhomogeneity at the air-tissue interface. In this study we evaluate the effects of rectal balloon fillings on the dose distribution to prostate, PTV, rectum and overlap of PTV to rectum.

#### Methods:

Nine prostate IMRT plans with a 7-field technique were generated with 6MV on the Eclipse treatment planning system, subject to the same optimization criteria. Final dose calculation was performed with the AAA algorithm including inhomogeneity corrections. The Hounsfield units (HU) of the rectal balloon were changed from -1000 HU to 1000 HU in intervals of 250 HU for each IMRT plan, and the corresponding change in the relative electron density (RED) were calculated.

#### Results:

For the nine IMRT plans, the prostate, PTV and rectal mean dose decreased as the RED in the rectal balloon increased. The mean dose of PTV and prostate are respectively 107.0 % and 108.0 % with an air-filled rectal balloon vs. 102.5 % and 102.7 % respectively with a water-filled balloon. A larger dose inhomogeneity in PTV and prostate coverage occurred with an increase in max rectal dose was noted for air filled compared with values of water-filled balloons. About 5% more MUs are required with the air-filled balloon than for a water-filled balloon for the same dose coverage.

#### Conclusions:

Our study showed that there is significant underdosage in the target volume at the rectum-prostate interface with an air-filled balloon as compared to that with a water-filled balloon for 6 MV photon IMRT plan. Dose inhomogeneity in the target volume is increased with an air-filled rectal balloon with a higher rectal mean dose. Thus a water-filled rectal balloon is preferred to an air-filled rectal balloon in EBRT of prostate.