AbstractID: 5351 Title: Prostate IMRT dose escalation with urethra sparing: dose painting with IGRT

Purpose: With IGRT, the geometric uncertainty in treatment can be reduced, which makes it feasible to implement IMRT dose painting with a reasonable resolution. In this cancer center, an on-line realignment protocol is utilized for prostate cancer patients. This IGRT protocol is based on use of implanted gold fiducial markers and EPI. In this study, dose escalations with urethra sparing have been tested by using IMRT dose painting.

Method and Materials: CT scans of three patients were chosen from the IGRT group. The original 3D-CRT plan (74Gy/37fr, 10mm PTV margin) was used as a reference. In test IMRT plans two PTVs were generated. PTV1 was defined as 5mm extension of prostate. PTV2 was generated from PTV1 with 5mm margin subtracted for bladder, rectum, and urethra. Two raw plans were generated. Plan 1 was 74Gy/37fr to PTV1, and Plan 2 was 74Gy/37fr to PTV2. Then, the urethra sparing IMRT boost plan was generated as a weighted sum of the two raw plans, e.g. Real Plan=w_1×Plan1+ w_2×Plan2. Different combinations of weighting factors were tested: $w_1 \in [0.6, 1]$, $w_2 \in [0.1, 0.5]$. The dose to each organ was calculated with organ motion simulated based on actually recorded EPI image mismatches. The tumor control probability (TCP) and effective dose were used to evaluate the plans.

Results: To achieve the same urethra D50 (minimum dose to 50% volume) as the reference plan, the highest weighting combination was w_1=0.7, w_2=0.5 (Prescription Dose= (0.7+0.5) ×74Gy=88.8Gy). This yields significant dose reduction in bladder and rectum. For the considered patient the TCP increases from ~74% to ~95%.

Conclusion: With IGRT, the urethra sparing IMRT dose painting is superior to the 3D-CRT plan. The total prescription dose can be as high as 88Gy, with TCP of ~95% and lower GI complication. Since urethra has been spared, the GU complication will be less.