

Purpose/Objective: To investigate the change in rectal dose during the treatment course for prostate IMRT with image-guidance.

Materials & Methods: Ten prostate cancer patients treated with IMRT were included in this study. Each patient was administered an enema prior to CT- and MRI simulations. MR and CT were fused for target delineation. IMRT treatment planning was performed on the CT image. Prostate motion during the treatment course was corrected using a CT-on-Rails system. Rectal contours were generated on both simulation CT images and subsequent treatment CT images. IMRT plans were generated based on our clinical acceptance criterion. The subsequent treatment CT images for each patient from the CT-on-Rails system were used to recompute the patient dose distributions with the same leaf sequences used for treatment. The isocenter was shifted relative to the simulation CT, as required by the protocol, to ensure appropriate target coverage. The rectal doses based on the subsequent treatment CT were compared with the original doses planned on the simulation CT scans using our clinical acceptance criteria.

Results:

Based on ten patients with 84 treatment CT sets, 14% of the subsequent treatment dose distributions did not meet our criterion of $V_{40} < 35\%$ ($V_{40}=36\% \sim 50\%$), and 7% did not meet our criterion of $V_{65} < 17\%$ ($V_{65}=18\% \sim 36\%$). The inter-fractional rectal volume variation is significant for some patients. The minimum changes in rectum volume are between 31 and 39.8cc while the maximum changes are between 50.2 and 161.7 cc. In general, IMRT planning with an empty rectum results in better subsequent treatment dose distributions to the rectum.

Conclusions: Due to the large inter-fractional variation of the rectal volume it is more favorable to plan prostate IMRT based on an empty rectum.