AbstractID: 8865 Title: On-line CT-guided adaptive re-planning based on deformed original dose distributions

Purpose: Daily image-guided setup based on soft tissue target may improve target coverage. However, when significant anatomical changes occur, a simple isocenter shift may not be adequate. In this study, we propose an on-line IMRT replanning strategy for prostate cancer which uses the deformed dose distributions from the original treatment plan as its objective.

Method and Materials: The replanning procedure used was as follows: (1) the dose distribution on the planning CT was deformed to the daily CT and used as the reference objective dose distribution for IMRT replanning; (2) the prescription isodose line on the reference dose distribution was auto-segmented and used as the fictitious "target volume" to set the initial MLC leaf positions; (3) we developed and implemented a voxel-by-voxel dose-based cost function. The IMRT treatment plan was optimized using the direct machine parameter optimization algorithm to achieve the following goals: (a) inside the region enclosed by the original prescription dose line, the replanned dose distribution was optimized to match with the reference objective; (b) outside this region, the objective function was chosen to lower the dose value and to penalize the dose value exceeding the reference dose for each voxel. The replanning process does not need re-auto-segmentation of patient's anatomy, although re-segmented anatomic contours were used to evaluate the effectiveness of this approach.

Results: We compared the dose distributions and the DVHs of the original plan and the daily plans using (1) image-guided setup based on prostate alignment, (2) deformed dose distribution from the original plan, and (3) our re-planning method. We found that our re-planning strategy matched well with the original plan.

Conclusion: The replanning strategy using the original dose distribution as the goal for optimization produces dose distributions similar to the original approved plan and is an effective approach for on-line CT-guided adaptive radiotherapy.