

AbstractID: 10745 Title: Is offline adaptive planning necessary for online image-guided radiotherapy of prostate cancer?

Purpose: In online image-guided radiation therapy of prostate cancer, the inter-fractional translational motion is corrected at each fraction. However, rotation and deformation can only be accounted for using planning margins. Offline adaptive strategy has been shown to be able to correct the systematic components of inter-fractional organ motion. The purpose of this study is to investigate whether offline adaptive planning is necessary for online image guidance protocol for inter-fraction motion management.

Methods and Materials: Total 692 CBCTs taken before (pre-CBCT) and after (post-CBCT) each fraction from 16 prostate cancer patients was used in this study. The inter-fraction motion were measured by registering these CBCTs to planning CT using 6 degree-of-freedom using implanted radio-opaque visicoils. Rigid motion was performed by couch translational correction. The relative displacements and rotations in pre- and post-CBCTs were measured and statistically analyzed. The persistence of the systematic rotation was evaluated by the correlation between the pre- and post-CBCTs. The representativeness of the rotations in the first 5 fractions for subsequent treatments was studied by comparing variances and means in pre- and post-CBCTs severally.

Results: Out of 16 patients, 10, 10 and 11 had significant non-zero mean rotations (t -test $p < 0.05$) around left-right (rX), superior-inferior (rY), and anterior-posterior (rZ) axes, respectively. Good correlations in rotations between pre- and post-CBCTs were observed. For both pre- and post-CBCT images, the mean and variance of rX , rY and rZ of the first 5 days are not significantly different from those of the subsequent treatment fractions in majority of the patients.

Conclusion: The prostate rotation is systematic, patient-specific, and persistent in each fraction (intra-fractional) and whole treatment course (inter-fractional). They can be potentially corrected offline. It is possible to use the first 5 fractions information in adaptive planning, and further reduce planning margins for online image guidance.

Conflict of Interest: None.