AbstractID: 8408 Title: Daily CT guidance in liver stereotactic body radiation therapy; impact of a non-rigid patient anatomy on OAR dose

Purpose: To investigate the influence of daily tumor-based setup corrections, derived from pre-treatment CT-scans, on the organs-at-risk (OARs) dose distributions in stereotactic body radiation therapy (SBRT) of liver tumors.

Method and Materials: Fifteen patients diagnosed with liver metastases and treated with SBRT were included in this study. Patients were positioned in a stereotactic body frame and abdominal compression was applied to decrease the respiratory tumor displacement. A total dose of 37.5 Gy at the 65% isodose was delivered in three fractions. Sixty CT data sets, corresponding to the planning and consecutive treatment days, were reviewed. Relevant OARs were delineated on all CT sets. Daily 3D dose distributions were calculated using the daily CT sets, both without and with taking the clinically applied setup correction into account. Dose-volume histograms and relevant dosimetric parameters for the PTV and all OARs were calculated.

Results: Large shape and volume variations were seen for OARs (especially the oesophagus, duodenum and stomach), causing large variations in the dose to these organs. In 27% of the treatment fractions, it was seen that after setup correction the dose to an OAR exceeded the constraints, while the planning was within constraints; in one case , the constraint was exceeded by a factor of two. Setup correction yielded a significant increase in PTV coverage, but for the OARs no significant dosimetric effect was seen.

Conclusion: Daily tumor-based CT-guidance is effective to increase PTV coverage, but does not significantly affect dose to the OARs. This is due to their non-rigid motion and volume variations. Both may cause substantial OAR constraint violations, even after set-up correction. However, for most fractions the dose to the OARs is within constraints. To obtain optimal sparing of OARs, adaptive treatment explicitly accounting for non-rigid anatomy may be required, especially when the tumor dose is escalated.