AbstractID: 10382 Title: Perfusion-based plan optimization for lung cancer using an anatomy-based aperture inverse planning system

Purpose: To implement SPECT-based plan optimization in an anatomy-based aperture inverse planning system (IPS) for the avoidance of functional pulmonary regions for cases of lung cancer.

Method and Materials: The IPS allows simultaneous optimization of beam orientations and weights from apertures defined by an anatomy-based segmentation. SPECT perfusion information has been integrated in the dose-volume-based cost function of the inverse planning system through a voxel-by-voxel linear spatial modulation of the importance factors (IFs) according to local perfusion score. For two cases of lung cancer, plans have been generated by the IPS using four non-coplanar incidences (gantry and couch angles optimized) using a purely anatomical approach and the SPECT-based approach. Planning target volume (PTV) coverage and lung avoidance (both volumetric and functional) have been compared.

Results: Maximum dose to PTV is usually increased when increasing importance of functional lung regions in the optimization, creating boost regions. For the first case, the functional volume of lung receiving 20 Gy (F20) decreases from 28.4% to 22.0% while the mean lung perfused dose (MpLD) decreases from 16.5 Gy to 13.7 Gy. For the second case, the F20 does not vary (26.5%) and the MpLD decreases from 17.4 Gy to 16.6 Gy. All plans produced are simpler than typical IMRT plans, with few segments (5 or 10) and few monitor units (range 285-375) used.

Conclusions: The system allows generation of simple aperture-based IMRT plans with the addition of functional lung sparing when considering SPECT-based information. However, the extent of the benefit is patient-dependant and varies according to the perfusion pattern and proximity of other critical structures to the PTV. Boost regions created by the redistribution of dose might prove useful in the context of dose escalation in lung irradiation.