AbstractID: 7775 Title: Investigation of planning and delivery techniques for stereotactic body radiation therapy in lung tumors

Purpose: SBRT dose calculation must consider deforming and moving anatomy and heterogeneous tissues. The goal of this work is to calculate the delivered dose resulting from SBRT delivery in lung cancer using elastic registration of 4DCT images.

Materials and Methods: Five patients with lung cancer were selected for this retrospective study. Patients underwent a 4DCT simulation. Treatment plans were performed according to the RTOG 0236 with 54Gy delivered in 18Gy fractions. Four treatment plans were performed for each case: (1) free-breathing using composite tumor volume determined from 4DCT, (2) free-breathing using a standard margin, (3) gating at end-exhale, (4) gating at end-inhale.

Plans were normalized such that 54Gy was prescribed to 85% isodose line. The plan parameters were superimposed onto each 3DCT, the dose was recalculated using a convolution/superposition algorithm with consideration of heterogeneities. Using elastic image registration, each 3DCT was registered to the reference CT. The transformation fields were used to warp the recalculated dose to the reference CT. Warped doses were weighted by temporal probability to calculate the composite 4D dose.

Results: After heterogeneity correction, dose received by 100% of the ITV increased by 8.57±3.04%. V10 and V20 of the lung increased by 3.71±0.57% and 11.12±4.09% respectively. For all of the plans, the PTV was large enough to compensate for tumor motion. Treatment plans created with the knowledge of tumor motion information used smaller margins, which reduced the ipsilateral lung dose. The EUD of the ipsilateral lung gated at end-exhale was the lowest, which was 21.76±4.53% of the EUD of plan 2.

Conclusions: Treatment plans using homogeneity assumption underestimated tumor dose by about 9%. For all of the plans, PTV was large enough to compensate tumor motion. Plans including tumor motion information used smaller PTV, which could reduce the ipsilateral lung dose by about 22%.