AbstractID: 8154 Title: Potential lung dose reduction for minimally-moving lung lesions

Purpose: To evaluate the potential of lung sparing with IMRT for patients whose lung tumor motion range is less than 0.5 cm treated with respiratory gating at inhale.

Method and Materials: A retrospective investigation on 8 patients with 4DCT scans was performed. For each patient a maximum intensity projection (MIP) data set, over 10 uniformly distributed breathing phases, was generated. The MIPs were used in contouring of GTVs, heart, and spinal cord. IMRT optimization was performed on a single phase CT data set (Average Phase or APh), representing an average mid-ventilation phase. An average phase CT data set within 30% gating window (Average Inhale Phase or AInPh) in the proximity of the full inhale was also generated. GTVs, heart and spinal cord contours were kept the same for the APh and AInPh, while the lungs were independently contoured. The IMRT plans consist of 5-to-11 coplanar and/or non-coplanar 6MV and/or 18MV beams. The dose was escalated to the maximum allowed by the organs at risk, which are spinal cord, heart and lungs. The APh optimized plan was transferred to the AInPh and dose was recomputed. Dose indices (DI) and generalized equivalent uniform doses (gEUDs) between APh and AInPh were cross-compared. The DIs are $D_{98\%}^{GTVs}$, $D_{95\%}^{PTVs}$, $D_{20\%}^{lungs}$ and $D_{30\%}^{lungs}$, $D_{33\%}^{heart}$, and $D_{1\%}^{spinal\ cord}$.

Results: All DIs and gEUDs over the APh and AInPh for the targets, the spinal cord, and the heart are within ±1%. The DI differences in the lungs show a dose reduction ranging from 1% to over 9% for the gated plans.

Conclusions: A reduction in lung dose of up to 9% is possible when gating at inhale is utilized for treatment of lung tumors with less than 0.5cm motion as seen on 4DCT. Alternatively, 9% target dose escalation shows an increase in TCP in excess of 30%.