AbstractID: 13118 Title: : Identifying patients who will potentially benefit from functional-guided lung avoidance in thoracic radiotherapy

Purpose: Single photon emission computed tomography (SPECT) may be used to guide thoracic radiation therapy planning by reducing the dose to highly-perfused (i.e.functional) regions of lung. We herein investigate whether it is possible to a priori predict the extent of functional lung sparing possible with SPECT guidance, which can then be used to select patients who would most benefit from functional planning.

Method and Materials: IMRT plans were generated with and without SPECT-guidance for 6 patients. The dose-perfusion (function) histograms were compared to quantify the degree of sparing of perfused lung afforded by inclusion of SPECT, i.e., the percent of perfusion at ≥ 20 Gy (F_{20}) and 30 Gy (F_{30}) were compared. In order to correlate the spatial distribution of SPECT intensity to the degree of dose sparing, three different SPECT-descriptor metrics were considered as possible candidates: (a) second-order moment invariants (J1, J2, J3), which are shape descriptors of the SPECT intensity; (b) overlap function histogram (OFH), which measures the perfusion within increasing concentric expansions of the PTV; (c) the percent of perfused lung within the beam outlines (F_{BEV}).

Results: The mean reductions in $\%F_{20}$ and $\%F_{30}$ from SPECT-guidance were 11.20 (1.44–18.69) and 12.46 (-1.66–21.68), respectively. The correlation coefficients of $\%F_{20}$ reduction vs. J1, J2, J3, OFH and F_{BEV} were -0.9272 (p=0.008), -0.8924 (p=0.055), -0.5910 (p=0.22), 0.5866 (p=0.22) and -0.1412 (p=0.79), respectively. The corresponding correlations for $\%F_{30}$ reduction were -0.9134 (p=0.011), -0.7332 (p=0.097), -0.5194 (p=0.29), 0.7262 (p=0.10) and 0.01371 (p=0.98), respectively. The strongest correlated metric, J1, may be used to predict $\%F_{20}$ and $\%F_{30}$ reductions as -0.1431*J1+35.147 (p=0.008) and -0.1719*J1+41.24 (p=0.011), respectively.

Conclusion: J1, which sums the product of the SPECT intensity and square of the distance from the isocenter, can accurately predict those patients who will benefit from SPECT-guided IMRT.