

## AbstractID: 4848 Title: Using SPECT-guidance to reduce intensity modulated radiation therapy (IMRT) dose to functioning lung

**Purpose:** Single photon emission computed tomography (SPECT) provides a map of the spatial distribution of lung perfusion. Thus, SPECT guidance can be used to deliberately divert dose away from higher functioning lung, thereby potentially reducing lung toxicity. This work presents an algorithmic methodology for achieving this aim, and tests it in intensity modulated radiotherapy (IMRT) treatment planning of five randomly selected lung cancer patients.

**Method and Materials:** IMRT treatment plans were generated with and without SPECT guidance and compared. Both sets of plans were made to adhere to the same dose-volume constraints. The SPECT-guided process works by segmenting healthy lung into four regions on the basis of SPECT intensity, and sequentially allowing dose to the target via regions of increasing SPECT intensity. This process results in reduction of dose to functional lung, reflected in the dose-function histogram (DFH). DFHs quantify the percentage of total function above dose levels. The plans were compared using DFHs and  $F_{20} / F_{30}$  values ( $F_x$  is the functional lung receiving dose above  $x$  Gy; 20/30 Gy are significant thresholds for radiation pneumonitis).

**Results:** In all cases, the SPECT-guided plan produced a more favorable DFH compared to the non-SPECT guided plan. Additionally, the  $F_{20}$  and  $F_{30}$  values were reduced for all patients by an average of  $13.6\% \pm 5.2\%$  and  $10.5\% \pm 5.8\%$ , respectively. In all patients, for the SPECT-guided plans, DFHs of the two highest functioning SPECT regions were reduced while DFHs of the two lower functioning regions were increased, illustrating the dose “give-take” between SPECT regions that is inherent to the redistribution process.

**Conclusion:** SPECT-guided IMRT shows potential for reducing the dose delivered to highly functional lung regions. This dose reduction could reduce the number of high grade pneumonitis cases that develop after radiation treatment and improve patient quality of life.