

**Purpose:** To determine the spatial correlation between four-dimensional computed tomography (4DCT) ventilation and single photon emission computed tomography (SPECT) perfusion hypo-functioning pulmonary defect regions in patients with malignant airway stenosis.

**Methods:** Treatment planning 4DCT images were obtained retrospectively for 8 lung cancer patients with radiographically demonstrated airway obstruction due to gross tumor volume. Each patient also received a SPECT perfusion study within one week of the planning 4DCT, and prior to the initiation of treatment. Deformable image registration was used to map corresponding lung tissue elements between the extreme component phases, from which quantitative images representing the pulmonary specific ventilation were constructed. Semi-automated segmentation of the percentile perfusion distribution was performed to identify regional defects distal to the known obstructing lesion. Semi-automated segmentation was similarly performed by 3 independent observers to delineate corresponding defect regions depicted on 4DCT ventilation. The Dice similarity coefficient (DSC) was determined for each observer between SPECT and ventilation hypo-functioning regions to assess spatial correlation.

**Results:** Tidal volumes determined from 4DCT ventilation were evaluated versus measurements obtained from lung parenchyma segmentation. Linear regression resulted in linear fit with slope = 1.01, and  $r^2 = 0.99$ . Average DSC among all observers ranged from 0.67-0.99, with coefficient of variation for any single case < 10% (range: 0.5-9%). Linear correlation was further assessed between average DSC values and corresponding percent volume of the perfusion defect relative to the affected lung, with  $\rho = 0.59$  ( $p = 0.1627$ ) indicating correlation not significantly different from zero.

**Conclusions:** This study is the first to quantitatively assess three-dimensional spatial correlation between clinically acquired SPECT perfusion and specific ventilation from 4DCT. Results suggest high correlation between methods within the sub-population of lung cancer patients with malignant airway stenosis. Efforts are currently underway to increase the patient sample size included in this ongoing work.