AbstractID: 9694 Title: Functional lung preservation using four-dimensional computed tomography and intensity-modulated radiation therapy for lung cancer

Purpose: The goal of this work is to reduce irradiation to functional lung using the four-dimensional computed tomography (4D CT) derived images. The proposed technique is incorporated into intensity-modulated radiation therapy (IMRT) to minimize radiation damage to healthy lung and pulmonary toxicity.

Methods and Materials: Fifteen patients with non-small-cell lung cancer (NSCLC) were selected for this study. A BSpline deformable registration was employed to map each tissue element across the 4D CT data set to establish the correspondence of each voxel. Based on the changes in voxel intensities of each patient, functional image set was generated using pairs between expiration phase and other phases using the equalized histogram technique which equalizes the lung volume under each pixel intensity bin. All functional images were imported into the treatment planning system. The highly functional lung volumes formed by the percentile functional volumes were chosen to be the regions of interest (ROIs) for avoidance in IMRT treatment planning. Two IMRT plans with (fIMRT) and without (aIMRT) the functional image constraint were created and dose distributions including dose volume histograms (DVHs) and dose function histograms (DFHs) and other dosimetric parameters for the planning target volume (PTV) and critical structures in both plans were computed and compared.

Results: Compared to aIMRT, the mean dose in fIMRT at 90 and 50 percentile levels were reduced by 2.5 Gy and 4.3 Gy, respectively. The mean reductions in the percentage of irradiated volume of 5 Gy (V5) and 20 Gy (V20) were significantly reduced from that of fIMRT.

Conclusions: The dynamic functional images derived from 4D CT was used to guide IMRT planning and it was shown to be effective in preserving normal lung function for NSCLC cancer patients.