AbstractID: 5880 Title: Can Functional Imaging be Used to Individualize Adaptive Radiation Therapy for Non-Small Cell Lung Cancer?

Background/purpose: To determine the changes in tumor and lung function during the course of radiation and their potentials in adaptive radiation therapy for non-small cell lung cancer (NSCLC).

Materials/Methods: FDG-PET-CT and Ventilation/perfusion (V/Q) SPECT were acquired prior to and after the delivery of 45 Gy during the course of radiation in 15 patients with NSCLC. Tumor activity was measured by relative standard uptake value (RSUV). V/Q SPECT was evaluated blindly by radiobiologist, through comparing to healthy normal controls.

Results:

After 45 Gy radiation, the mean RSUV decreased from 4.6$\pm$1.9 to 2.1$\pm$1.0 for primary tumors ($p<0.0001$) and from 3.2+1.3 to 1.7+0.5 for nodal diseases ($p=0.0008$). Mean reduction in PET tumor volume was 78% (67-100%). There was 28% (4/15) and 0% (0/15) complete responders on PET and CT, respectively. Three patients achieved a complete CT response at 3 month follow-up, all of them were PET complete responders at 45 Gy. Boosting after 45 Gy, normal tissue complication probability (NTCP) could be reduced by 50%, V20 by 28%, and mean lung dose by 29% while keeping the total dose constant. Keeping the NTCP constant, dose could be escalated by 50%.

Lung functional mapping also changed remarkably at 45 Gy during radiation. Fifteen of 15 patients had V/Q defects at or adjacent to tumor on the baseline SPECT, while 14/15 patients had at least one defect located remotely from tumor. For those defects located adjacent to tumor, 79% improved remarkably, while only 7.9% of the others had notable change ($p<0.001$). Lung NTCP adjusted by V/Q SPECT obtained during radiation was significantly different from those generated from the pretreatment V/Q SPECT and simulating CT.

Conclusions:
Tumor and lung functional imaging during the course of radiation may provide useful information for adaptive radiation therapy in patients with NSCLC.