AbstractID: 14036 Title: A novel combination model for target definition of lung tumors using patient specific pharmacokinetics and lung nodule motion

Purpose: FDG metabolism and the standardized uptake value (SUV) in PET-CT scans vary significantly among patients. Such information is lost in defining target based solely on SUV threshold. The aim of this research is to combine patient-specific pharmacokinetics and a nodule motion model in target delineation of lung tumor with PET imaging.

Method and Materials: Regions of interest (ROIs) for thirty patients were carefully delineated in PET-co-scanned CT (petCT). Patient-specific FDG distributions in any ROIs were determined in co-registered PET. The voxel values in PET (petVal) were converted to the SUV. Each volume element in the tumor was assumed to travel along a 3D eclipse trajectory with anisotropic axes determined by its location in the lungs. The lung background levels were then adjusted to a preset baseline of 0.6 and tumor SUV were proportionally corrected as they share the same blood feeding stream. In the petCT and simulation CT (simCT), GTVs were defined according to the ground-glass opacity and overlapping of the SUV-enhanced region. The 40% source-background ratio (SBR), threshold of 0.3<SUV>+0.6 (P3P6) or SUV=2.5 (2P5) were used for automatic contouring of the GTVs. GTV difference from petCT scans to simCT scans measured the tumor growth from the PET diagnosis to the treatment simulation.

Results: Squamous cell lung cancer has much higher SUV than that of other tumors. On average, GTVs from SBR and P3P6 methods are consistent with GTVs from petCT. The tumors grow by ~20% from PET scans to CT simulation. GTVs from 2P5 method are 40% lower which may be improved with more accurate motion and metabolism modeling.

Conclusion: The study reveals that combination of nodule motion and patient-specific pharmacokinetics in PET significantly increases the accuracy in definition of GTV. This is our first step towards correlation of the apparent SUV to the tumor-vital activity.