AbstractID: 2464 Title: Individual Target Volume Definition in NSCLC Using PET

Purpose: To determine whether quantitatively segmented PET images could be used to identify the volume containing a tumor and its total motion. If possible, PET could provide individualized internal target volumes (ITV) in lung cancer.

Method and Materials: A physiological phantom containing background level of Na-22 was used. Two spheres filled with 0.5 mCi/ml of Na-22 were used to simulate tumors; each was oscillated within one lung of the phantom with 4 preset motion extents in S/I, A/P, and M/L directions. PET and CT imaging were performed on an integrated PET/CT scanner. A CT-based GTV was generated using a threshold of –850 HU. A population-based margin of 15 mm, reflecting both motion and set-up uncertainties, was added to generate a CT-based PTV. A PET-based ITV was defined using a threshold of three standard deviations above normal lung background. A set-up margin of 7.5 mm was added to PET-based ITVs to create PTVs. Image-based PTVs were compared to ideal PTVs. Clinical validation of this methodology was performed on 7 patients with parenchymal lung lesions with the addition of digital fluoroscopy. 18-FDG was used for patient PET scanning.

Results: For the phantom study, PET-based PTVs were closer to the ideal PTV than those based on CT. While the PET-based PTVs were approximately half the size of the CT-based PTVs, in no case would the PET-based PTVs have resulted in geographical miss. For majority of the patients, PET accurately predicted or slightly over-predicted the tumor motion extents compared to fluoroscopy; differences were within 2 voxels.

Conclusion: Based on the phantom study and initial clinical validation, we have found that quantitatively segmented PET images can provide an accurate individualized ITV that correlates with a tumor and its motion.

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