

**Purpose:**

To investigate the reproducibility of lung tumors motions and their characteristics during the course of the treatment.

**Materials and Methods:**

Two 4DCT scans were obtained at an interval of about three weeks with a GE-scanner and Varian's RPM System under free breathing for 13 patients. Each respiration cycle had 10 phases. 14 GTVs and 10 lungs in all phases were contoured. Geometrical characteristics of these structures were obtained with Eclipse TPS for the motion reproducibility analysis.

**Results:**

The GTVs of the initial scans ranged from 2.0cc to 280.5cc with a median of 50.3cc. Their median relative change in the second scan was a 28% decrease. The 3D extent of the respiration-induced motion of the GTVs' centroids in the first scan ranged from 0.34cm to 1.78cm with a median of 0.90cm. For the second scan it was 0.13cm, 1.99cm, and 0.89cm, respectively. The largest motion was in a projection on a sagittal plane. The overall displacements of the GTVs' edges exhibited same trend. These motion tracks from two scans overlapped along DICOM directions. The median change of phase 50 lung volumes in both scans relative to the tidal volume at the first scan was -12% for ipsilateral and -11% for contralateral lungs. The median tidal volume change between scans relative to the first scan volume was 8% for ipsilateral and 4% for contralateral lungs.

**Conclusion:**

Most of the patients results show reproducible patterns of motion. The hysteresis of the motion varies between scans. This might be due to GTV changes during the treatment. A large and anisotropic shape change perturbs the initial motion trajectory, however general patterns appear repetitive. The respiratory changes of lung volumes were similar. They are not indicative of the GTVs motion reproducibility.

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