Purpose: To evaluate a simple, semi-automated lung mass estimation method on CT scans from a variety of acquisition techniques for mass correction of MIRD dose estimates.

Methods: CT scans from ten patients undergoing stereotactic body radiation therapy treatment planning on a GE DST PET/CT scanner were analyzed retrospectively. For each patient, free-breathing (FB) and respiratory gated 4D-CT scans were acquired. 4D-CT scans were reconstructed and sorted into ten phases representing one complete respiratory cycle. An average CT (ACT) was derived from the ten phase reconstructions. Half the patients also had breath-hold (BH) scans.

Scans were analyzed using Osirix MD's V 1.3 (Pixmeo, Geneva Switzerland) Grow Region segmentation tool. Lung volume; average lung, tissue (~1cm ROI in the descending aorta), and air (~1cm ROI in the trachea) HU's were recorded for each acquisition type. Lung mass was calculated by assuming each voxel is a linear combination of only air and tissue. The fraction of total lung volume consisting of lung tissue is assumed to be (lung HU - air HU) / (tissue HU - air HU), and mass = total volume X fraction X 1 g/cm3.

Results: 4D-CT mass estimates showed variability, with a minimum at end-expiration and a maximum just after end-inspiration. ACT generally produced the highest estimate. FB and BH estimates were near the median.

Conclusions: Although calculated mass increased with increasing total lung volume, the difference between minimum and maximum population means in the 4D-CT data was 5.5%. FB and BH estimates fell within that 5.5%, while the ACT mean was 9.8% above the global mean. The range of estimated masses (524 g to 977 g) suggests the value of lung mass estimates for more patient-specific MIRD dose assessment. Excluding ACT, the results indicate that any of the acquisition techniques can provide a reasonable lung mass estimate.

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