

**Purpose:**

Moving structures cause uncertainty in dose calculation when different CT imaging techniques are employed. This study determines the variations of structure densities shown on free breathing simulation CT and respiration-gated 4D CT.

**Methods:**

16 consecutive cases of lung SBRT for non small cell lung cancer (NSCLC) with tumor motion range from 0.5-1.2 cm (mean, 0.7 cm) were selected for this study. Each case had a free breathing simulation CT immediately followed by a respiration-gated 4D CT using a Siemens Sensation Open scanner. The mean CT Hounsfield units (HU) of ITV and both lungs outside PTV were measured separately using the simulation CT (SCT), Maximal Intensity Projection (MIP) and Mean Intensity Projection (AIP) of 4D CT.

**Results:**

The mean HU of lungs in SCT, MIP and AIP were measured as  $-707.8 \pm 47.9$ ,  $-516.4 \pm 49.7$ , and  $-682.9 \pm 40.7$  respectively. Meanwhile, the corresponding mean HU of ITV were  $-329.5 \pm 145.1$ ,  $-151.6 \pm 118.4$ , and  $-337.4 \pm 138.7$ . Comparatively, the mean HU of lungs and ITV based on SCT were  $-1.1 \pm 1.0$  (rang, -3.4 to +0.4) % and  $+0.1 \pm 1.7$  (rang, -3.2 to +2.1) % respectively, deviating from those measured with AIP. In the similar comparison using MIP against AIP, higher mean HU were detected for both lung ( $+8.3 \pm 1.0$  %) and ITV ( $+9.3 \pm 1.8$  %).

**Conclusions:**

In this study, MIP over-estimated the HU for key structures by more than 8%. When free breathing SCT is used, the respiration-induced HU deviations from measurements of AIP were as small as  $-1.1 \pm 1.0$  % for the lungs and  $+0.1 \pm 1.7$  % for ITV. The impact of the HU deviations on the calculated radiation dose is expected within tolerance, but shall be further investigated.