

AbstractID: 3922 Title: Comparison of breath-hold and free breathing approaches for 4DCT data acquisition.

Purpose:

The objective of this study was to compare two separate respiratory techniques available for four-dimensional computed tomography (4DCT). Regional lung density and spatial displacement of airway tree bifurcations (BPs) were studied and compared between regulated (breath hold) and free breathing techniques.

Method and Materials:

Fifteen normal adult participants were subjected to CT scanning triggered by the lung volume controller system using breath hold and free breathing respiratory techniques. Lung volumes were compared using pneumotachometers (PNT) and respiratory inductance plethysmography. A LabVIEW-based lung volume controller system that allows monitoring/control of lung volumes and provides gating capabilities for CT image acquisition was built. Each subject's slow vital capacity was measured and lung CT images were obtained at two volumes: ~65% vital capacity and the end expiratory phase of tidal breathing (~20% vital capacity). For the free breathing, these represent end inspiration and end expiration.

Results:

The mean difference in location of BPs between inspiration and expiration using breath hold technique [$15.3 \pm 5.0\text{mm}$] and free breathing techniques [$18.5 \pm 7.3\text{mm}$] were large but similar. Regional mean lung density differences between breath hold and free breathing was insignificant using paired t-test ($p > 0.05$). The BPs spatial uncertainty between breath hold and free breathing, both at end inspiration and end expiration were small: the mean difference in the distance between the carina and any other branch point pair matched was 2.0 mm (± 2.0 mm) at end inspiration and 2.8 mm (± 2.0 mm) at end expiration.

Conclusion:

Both breath hold and free breathing respiratory techniques significantly (~50%) reduce the uncertainty in branch point localization. In addition, both techniques produce similar regional lung densities. The uncertainty in branch point location with respect to the carina is reduced by 2-3 mm for breath hold compared to free breathing techniques.

Conflict of Interest (only if applicable):