The effect of inspiration on airway dimensions measured in CT images from the Danish Lung Cancer Screening Trial

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Assessing pulmonary perfusion in emphysema: automated quantification of perfused blood volume in dual-energy CTPA

Purpose: To determine whether automated quantification of lung perfused blood volume (FBV) in dual-energy computed tomography pulmonary angiography (DE-CTPA) can be used to assess the severity and regional distribution of pulmonary hypoperfusion in emphysema.

Methods and Materials: We retrospectively analyzed 40 consecutive patients (mean age 67 ± 13 years) with pulmonary emphysema, no cardiopulmonary comorbidities and a DE-CTPA negative for pulmonary embolism. Automated quantification of global and regional pulmonary PBV was performed using the syno dual-energy application (Siemens Healthcare). We further quantified the global and regional percentage of voxels with a CT density <−900 HU. Emphysema severity was rated visually and pulmonary function tests were obtained by chart review.

Results: Global pulmonary PBV showed a moderate but highly significant negative correlation with residual volume (RV) in % of predicted RV (r=−0.62, p=0.002, n=23) and a positive correlation with forced expiratory volume in 1 second (FEV1) in % of predicted FEV1 (r=0.67, p<0.001, n=23). Global PBV values strongly correlated with diffusion lung capacity for carbon monoxide (DLCO, r=0.80, p<0.001, n=23) and a positive correlation with forced expiratory volume in 1 second (FEV1) (rs=0.55) and NORMAL (rs=0.67), but with RV (rs=0.69), and RV/TLC was elevated to 7% in CF patients, but 1% in NORMAL. EI correlated well with residual volume (RV) in % of predicted RV (r=-0.62, p=0.002), 0.34 (+-0.01), 0.37 (+-0.01). Relative changes in WT were inversely related to changes in RV and generation: -0.01 (+-0.02), 0.01 (+-0.01), -0.02 (+-0.01), -0.03 (+-0.01), -0.05 (+-0.01), -0.09 (+-0.00), -0.08 (+-0.00).

Conclusion: Subjects who inspire deeper prior to scanning tend to have larger LD and smaller WT. This effect is more pronounced in higher generation Airways. Thus, adjustment for inspiration level is needed to accurately assess airway dimensions.

Author Disclosures:
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