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

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Purpose: To determine whether automated quantification of lung perfused blood volume (PBV) 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 analysed 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) (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 diffusing 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) (r=0.67, p<0.001, n=23). Moderate negative correlations were found between global PBV values and parenchymal hypodensity in a per-patient (r=-0.63, p<0.001, n=40) and per-region analyses (r=-0.62, p<0.001, n=40).

Conclusion: DE-CTPA allows simultaneous assessment of lung morphology, parenchymal density and pulmonary PBV. In patients with pulmonary emphysema, automated quantification of pulmonary PBV in DE-CTPA can be used for a quick, reader-independent estimation of global and regional pulmonary perfusion, which correlates with pulmonary function tests.

Author Disclosures:

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Densitometry on MDCT in cystic fibrosis: radiological evidence for emphysema

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Purpose: The present study was conducted to employ computational densitometry based on multi-detector computed tomography (MDCT) of the chest to characterise and quantify emphysema in cystic fibrosis (CF), identical to its routine clinical application in chronic obstructive pulmonary disease (COPD). Results were validated against pulmonary function testing (PFT, i.e. 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 diffusing 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) (r=0.67, p<0.001, n=23). Moderate negative correlations were found between global PBV values and parenchymal hypodensity in a per-patient (r=-0.63, p<0.001, n=40) and per-region analyses (r=-0.62, p<0.001, n=40).

Conclusion: DE-CTPA allows simultaneous assessment of lung morphology, parenchymal density and pulmonary PBV. In patients with pulmonary emphysema, automated quantification of pulmonary PBV in DE-CTPA can be used for a quick, reader-independent estimation of global and regional pulmonary perfusion, which correlates with pulmonary function tests.

Author Disclosures:

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

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Purpose: Airway dimensions measured from CT images from the Danish Lung Cancer Screening Trial (DLCST) can be used to assess differences in airway wall thickness (AWT) and lumen diameter (LD) between and within subjects with and without chronic bronchitis (CB) symptoms. The study purpose is to determine differences in AWT and lumen diameter (LD) between and within subjects with and without chronic bronchitis (CB) symptoms. The study purpose is to determine differences in AWT and lumen diameter (LD) between and within subjects with and without chronic bronchitis (CB) symptoms. The study purpose is to determine differences in AWT and lumen diameter (LD) between and within subjects with and without chronic bronchitis (CB) symptoms. The study purpose is to determine differences in AWT and lumen diameter (LD) between and within subjects with and without chronic bronchitis (CB) symptoms.

Methods and Materials: We selected from the Danish Lung Cancer Screening Trial 978 subjects without COPD who were scanned annually for 5 years with low-dose multi-slice CT. Using in-house developed software, the lungs and airways were automatically segmented and corresponding airway branches were found in all scans of the same subject using image registration. Mixed effect models were used to predict the relative change in lumen diameter (LD) and wall thickness (WT) in airways of generation 0 (trachea) to 6 based on relative changes in the segmented total lung volume (TLV).

Results: On average, 1.0, 2.0, 3.9, 7.6, 15.0, 25.0 and 27.3 airways per subject were included from generations 0, 1, 2, 3, 4, 5 and 6, respectively. Relative changes in LD were positively related to changes in TLV and coefficients increased with generation: 0.20 (±0.02), 0.19 (±0.02), 0.21 (±0.01), 0.25 (±0.01), 0.29 (±0.01), 0.34 (±0.01), 0.37 (±0.01). Relative changes in WT were inversely related to changes in TLV 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.

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