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

Petersen, Jens; Wille, Mathilde; Thomsen, Laura; Feragen, Aasa; Dirksen, Asger; de Bruijne, Marleen

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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) 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 diffusing lung capacity for carbon monoxide (DLCO; r = 0.80, p < 0.001, n = 15). Pulmonary PBV values decreased with visual emphysema severity (r = 0.46, p = 0.003, n = 40). 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.