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

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We retrospectively analysed 40 consecutive patients with chronic CF, which should be considered for new therapeutic approaches. Densitometry may introduce new quantitative and prognostic parameters into severity assessment of CF lung disease.

**Method 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 embo1ism. 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.

**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 predicted [FEV1%], residual volume [RV] and total lung capacity [TLC]). Patients without lung disease (NORMAL) served as controls.

**Methods and Materials:** MDCT from n=41 CF (median FEV1%=46, median age 20a) and n=20 NORMAL (FEV1%=102, 30a) were subjected to densitometry. Lung volume (LV) and emphysema volume (EV) were segmented (threshold -950 HU) and quantified 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. Mixt 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.

**Author Disclosures:**
M. de Bruijne; Grant Recipient; AstraZeneca.