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

Published in:
Insights into Imaging

DOI:
10.1007/s13244-013-0228-x

Publication date:
2013

Document Version
Publisher's PDF, also known as Version of record

Citation for published version (APA):
We retrospectively analysed 40 consecutive patients. Densi-
tometry may introduce new quantitative and prognostic parameters into severity
chronic CF, which should be considered for new therapeutic approaches. Densi-
TLC (rs=0.47) in CF only (p < 0.05). Importantly, EI increased markedly with age
Results: All results were
Lung volume (LV) and emphysema volume (EV) were segmented (threshold -950
20a) and n=20 NORMAL (FEV1%=102, 30a) were subjected to densitometry.
Methods and Materials: We retrospectively analysed 40 consecutive patients
(mean age 67 ± 13 years) with pulmonary emphysema, no cardiopulmonary comor-
tibilities and a DE-CTPA negative for pulmonary embolism. Automated quanti-
tification and global regional pulmonary PBV was performed using the syngo
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 nega-
tive correlation with residual volume (RV) in % of predicted RV (r=-0.62, p=0.002,
n=23) and a positive correlation with forced inspiratory volume in 1 second (FEV1) in % of predicted FEV1 (r=0.67, p < 0.001, n=23). Global PBV values strongly corre-
lated 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=0.03, n=40). Moderate negative correlations were found between global PBV values and parenchymal hypoattenuosity 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.


## B-0162 14:18

**Densitometry on MDCT in cystic fibrosis: radiological evidence for emphysema**

M.O. Wiepwez1, O. Weinheimer2, M. Eichinger1, M. Wiebel1, J. Biederer1,
H.-U. Kauczor3, C.-P. Heussel1, M.A. Mall4, M. Puderbach4; Heidelberg/DE;
*Mainz/DE (mark.wiepwez@web.de)

**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 ap-
lication in chronic obstructive pulmonary disease (COPD). Results were validated against pulmonary function testing (PTT, i.e. forced expiratory volume in 1 s percent 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 Hounsfield units), and the emphysema index was computed (EI). All results were correlated with parallelled PFT (median gap 0d, range 0-73sd).

**Results:** Mean LV was 4681 ml in CF and 3967 ml in NORMAL (n.s). Significant EV was found in CF (mean 457 ml) compared to NORMAL (78 ml) (p < 0.05). Median EI was elevated to 7% in CF patients, but 1% in NORMAL. EI correlated well with FEV1% in CF (rs=0.55) and NORMAL (rs=0.67), but with RV (rs=0.69), and RV/TLC (rs=0.47) in CF only (p < 0.05). Importantly, EI increased markedly with age in CF (rs=0.67, p < 0.001), starting at 13a.

**Conclusion:** Our results indicate the development of progressive emphysema in chronic CF, which should be considered for new therapeutic approaches. Densi-
tometry may introduce new quantitative and prognostic parameters into severity
assessment of CF lung disease.