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

Document license:
CC BY

Citation for published version (APA):
FWMH and EI both showed statistically significantly lower values using IR instead of standard FBP (FWMH: B30/30=111.3 vs. 92.1; B50/50=167.6 vs. 115; B70/170=197.8 vs. 137.5; EI: B30/30=4.8 vs. 2.8; B50/50=11.3 vs. 5.8; B70/170=20 vs. 6.6). There was a significant lower variation between the different kernels using IR when compared to FBP. Image noise was reduced by 27% when compared to FBP.

**Conclusion:** Variation of quantitative emphysema chest CT parameters between different reconstruction kernels is significantly reduced with IR when compared to FBP and may increase the robustness for therapy planning.

### B-0161 14:09

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

**F.G. Meinel, A. Graef, S. Neume, F. Barnberg, C. Neurohr, M.F. Reiser, T.R.C. Johnson; Munich/DE (felix.meinel@med.uni-muenchen.de)**

**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 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 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 negative correlation with residual volume (RV) in % of predicted RV (r=-0.67, p < 0.001), starting at 13a.

**Conclusion:** TLC (rs=0.47) in CF only (p < 0.05). Importantly, EI increased markedly with age

### B-0163 14:27

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

**J. Petersen, M.M.W. Willer, L.H. Thomsen, A. Feragen, A. Dirksen, M. de Brujine; Copenhagen/DK, Hellevad/DK, Rotterdam/NL (j.petersen@diku.dk)**

**Purpose:** Airway dimensions measured from CT are increasingly being used to investigate diseases such as chronic obstructive pulmonary disease (COPD). In this study, we investigate the effect of differences in inspiration level on such measurements in voluntary inspiration breathhold scans.

**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 airmasses 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 Brujine: Grant Recipient; AstraZeneca.

### B-0164 14:36

**Chronic bronchitis in large airway: airway wall measurements on thin-slice low-dose CT**

**X. Xie, A.E. Dijkstra, J.M. Vonk, M. Oudkerk, H.J.M. Groen, R. Vliegenthart; Groningen/NL (x.xueqian@rad.umcg.nl)**

**Purpose:** Chronic bronchitis (CB) is usually caused by smoking and characterised by chronic inflammation and remodelling of the airway wall, commonly in large airways. The study purpose is to determine differences in airway wall thickness (AWT) and wall area percentage (WA%) between subjects with and without CB symptoms.

**Methods and Materials:** 50 heavy smokers with CB symptoms (cough, mucus, dyspnoea and wheezing) and 50 heavy smokers without CB symptoms were randomly selected from 1,413 participants in a lung cancer screening trial. Airway walls were measured on images in thin-slice low-dose CT with a dedicated software tool, for airways with a luminal diameter >15 mm in 5 selected bronchi (RB1, RB4, RB10, LB1+2 and LB10). Differences in measurements between the groups were assessed by t-test. The association between CB symptoms and AWT and WA% was analysed using multiple linear regression adjusted for age, body mass index, smoking habit, amount of emphysema, and lung function.

**Results:** Mean AWT measured at 5 bronchi was 1.55±0.44 mm and 1.76±0.44 mm in subjects with and without CB symptoms, respectively (P < 0.001). WA% was 47±12% and 43±11%, respectively (P < 0.001). WA% was rated visually and pulmonary function tests were obtained by chart review.

**Conclusion:** In patients with chronic bronchitis symptoms, thicker airway walls. 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 Brujine: Grant Recipient; AstraZeneca.

### B-0165 14:45

**Value of inspiratory and expiratory lung volume und lung density for detection of bronchiolitis obliterans syndrome (BOS): a feasibility study**

**S. Dettmer, O. Otten, C. de Wall, J.-M. Kuhnigk, F. Wacker, H.-O. Shin; Hannover/DE, Bremen/DE (sabine-dettmer@t-online.de)**

**Purpose:** To evaluate whether quantitative assessment of lung density and volume in computed tomography (CT) show differences in patients with and without BOS after lung transplantation.

**Methods and Materials:** 210 CT examinations were carried out in lung transplant patients in full inspiration/expiration using a 64 row MDCT (120 kVp, rotation time 0.8 s, pitch 0.984, collimation 1.25 mm, reconstruction increment 1 mm, standard reconstruction kernel). 26/184 examinations were performed in patients with/wit-