

Airway morphometry in COPD with bronchiectasis: a view on all airway generations

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Summary 186/256:

Although terminal bronchioles were equally reduced in COPD lungs with and without bronchiectasis, significantly more large and small airways were found in COPD lungs with bronchiectasis.

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DATA SUPPLEMENT

Materials and methods: Air-dried whole-lobe microCT

These dried lobes were scanned with HECTOR, a custom designed microCT set-up developed at the Ghent University Centre for X-ray Tomography (UGCT) (25). The setup consisted of an open-type X-ray tube with directional target (X-RAY WorX, Garbsen, Germany) and a PerkinElmer amorphous-Si flat panel detector (2048x2048 pixels of $200^2 \mu\text{m}^2$ each) with a CsI scintillator. The X-ray tube and flat panel detector were static, while the lobe was rotated over 360° and two thousand projection images were recorded. The tube was operated at 80keV and 200 μA target current, and the reconstruction was performed with Octopus Reconstruction (XRE, Ghent, Belgium) (1) resulting in datasets of around $2000 \times 2000 \times 1500$ voxels with a resolution of approximately $140 \mu\text{m}$ (Figure 1B).

1. Vlassenbroeck J, Dierick M, Masschaele B, Cnudde V, Van Hoorebeke L, Jacobs P. Software tools for quantification of X-ray microtomography at the UGCT. Nucl Instrum Methods Phys Res A 2007;1:442-445.

Figure E1: Segmented airway models of all lobes

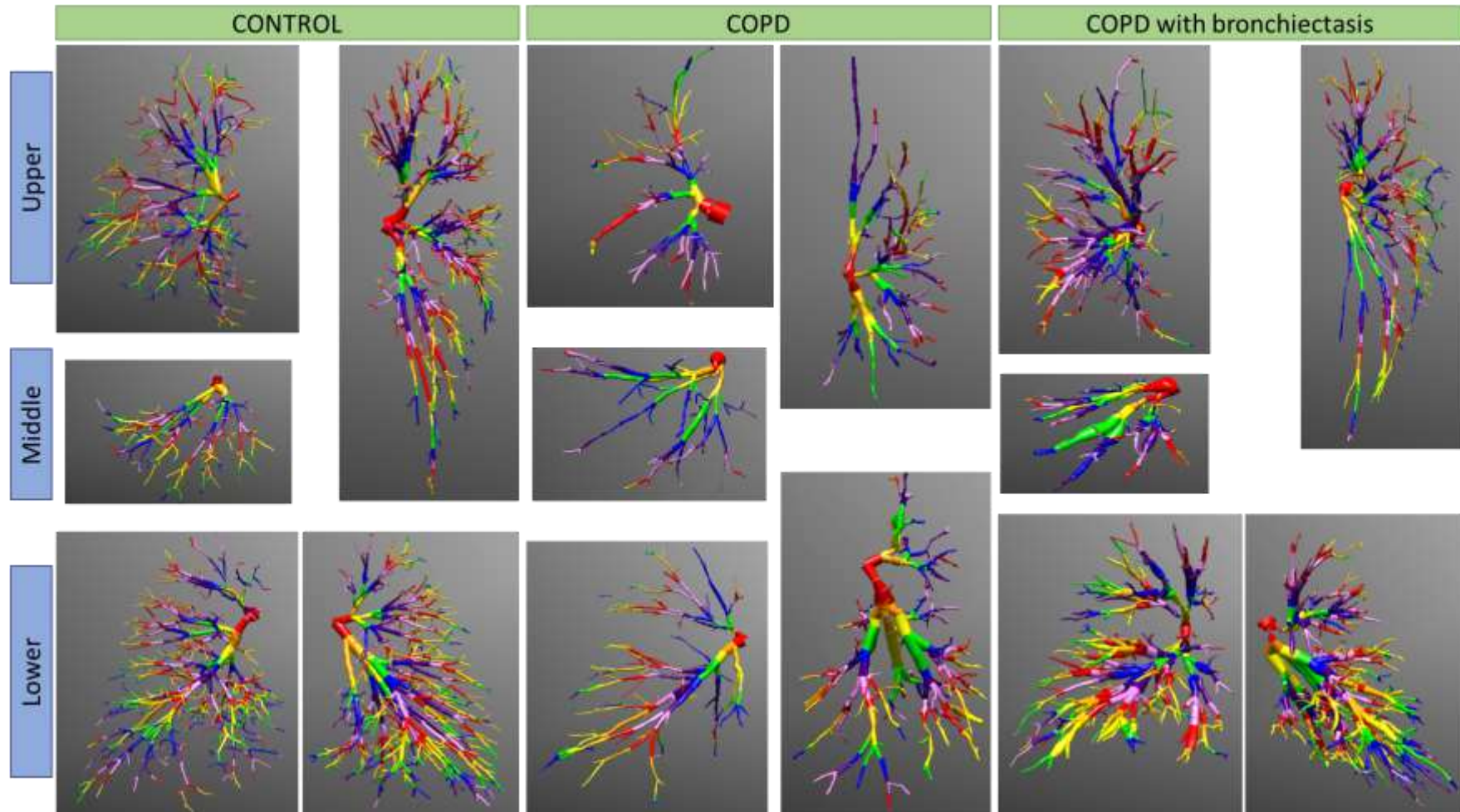
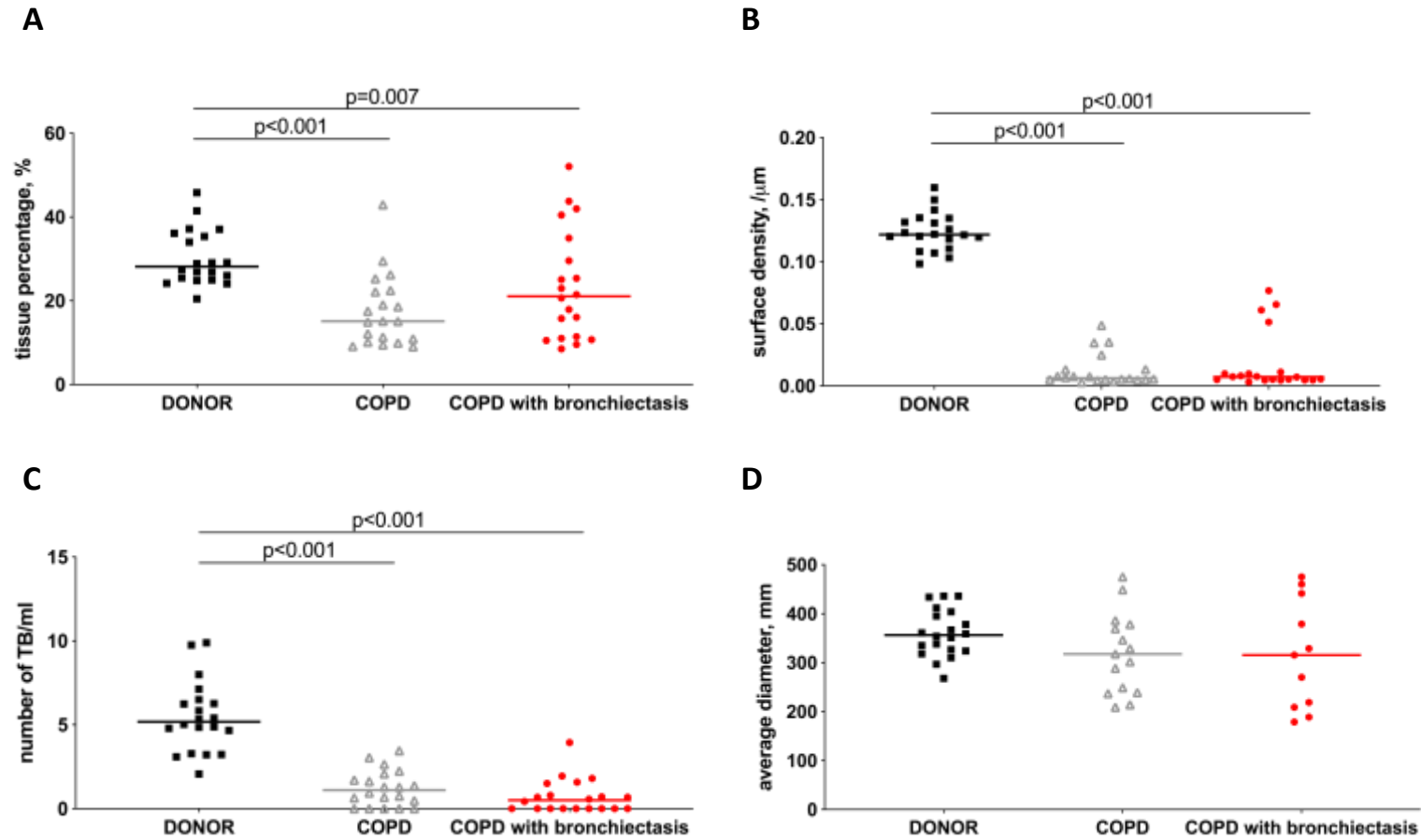


Figure E2: MicroCT analysis of tissue cores



Results of measurements on images of tissue core microCT ($n=4$ per lung, 5 lungs per group) of control lungs, COPD lungs and COPD lungs with bronchiectasis.

(A) Tissue percentage, (B) surface density, (C) number of terminal bronchioles per ml and (D) average diameter of visible terminal bronchioles. p -values were obtained by mixed models applied on individual core data with lung as random effect, comparing with the control group. The same model was performed for comparison of each group to COPD with bronchiectasis, no significant difference was found between COPD without versus with bronchiectasis.

Table E1: Cause of donor death and reason for lung decline

Donor	Cause of death	Reason for rejection
1	Cardiac arrest	Kidney tumor
2	CVA	Recipient died
3	CVA	Suspicion of beginning fibrosis in contralateral lung
4	CVA	Emboli
5	CVA	Emboli
6	CVA	Suspicion of infection in contralateral lung
7	CVA	Emboli

CVA: cerebrovascular accident

Table E2: Results of tissue core microCT measurements

	COPD LUNGS			COPD LUNGS with BRONCHIECTASIS		
	estimate	lower-upper limit	<i>p</i> -value	estimate	lower-upper limit	<i>p</i> -value
Tissue percentage, %	-11.32	-17.33 - -5.30	<0.001	-8.70	-14.94 - -2.47	0.007
Surface density, / μm	-0.11	-0.12 - -0.098	<0.001	-0.11	-0.12 - -0.10	<0.001
Visible TB, n/ml	-4.14	-5.050 - -3.22	<0.001	-4.99	-5.93 - -4.046	<0.001
Diameter of TB, μm	-34.75	-87.70 - 18.20	0.19	-58.63	-118.75 - 1.49	0.056

Results are presented as estimates with upper and lower limits. *p*-values were obtained by mixed models applied on individual core data with lung as random effect, comparing with the control group. The same model was performed for comparison to COPD with bronchiectasis, no significant difference was found between COPD without versus with bronchiectasis.

Table E3: MicroCT results of upper versus lower lobes and bronchiectatic versus non-bronchiectatic regions

	Upper lobe	Lower lobe	p-value
CONTROL cores, n	15	5	
Tissue percentage, %	26.88 (24.99 - 35.35)	29.13 (25.78 - 41.46)	0.43
Surface density, / μm	0.12 (0.12 - 0.13)	0.12 (0.11 - 0.15)	0.93
TB/ml, n	5.028 (3.28 - 6.27)	5.84 (3.94 - 8.88)	0.60
COPD cores, n	10	10	
Tissue percentage, %	11.72 (9.80 - 18.66)	20.59 (13.73 - 26.33)	0.11
Surface density, / μm	0.0053 (0.0041 - 0.012)	0.0077 (0.0056 - 0.019)	0.11
TB/ml, n	0.38 (0 - 1.84)	1.33 (0.67 - 2.22)	0.18
COPD with bronchiectasis cores, n	8	12	
Tissue percentage, %	24.01 (20.87 - 49.54)	16.87 (10.82 - 32.58)	0.25
Surface density, / μm	0.0079 (0.0060 - 0.048)	0.0052 (0.0046 - 0.041)	0.20
TB/ml, n	0.28 (0 - 0.77)	0.56 (0 - 1.57)	0.78
	Non-bronchiectatic region	Bronchiectatic region	
COPD with bronchiectasis cores, n	10	10	
Tissue percentage, %	24.01 (11.27 - 45.85)	20.83 (10.66 - 27.77)	0.49
Surface density, / μm	0.0077 (0.0052 - 0.024)	0.0066 (0.0047 - 0.052)	0.68
TB/ml, n	0 (0 - 0.82)	0.097 (0.033 - 1.58)	0.088

Results are presented as n or median (Q1-Q3). P-values were obtained by Mann-Whitney test

