Centrilobular emphysema and airway dysanapsis: Factors associated with low respiratory function in younger smokers

Online supplement

Contents

Table S1. Interobserver agreements for visual assessments of each emphysema subtype

Observer	Number of cases	Weighted kappa coefficient for PSE	Weighted kappa coefficient for CLE
Observer 1 vs Observer 2	132	0.90	0.84
Observer 3 vs Observer 4	40	0.87	1.00

Abbreviations: CLE, centrilobular emphysema; PSE, paraseptal emphysema.

Table S2. Correlations between lung function and parameters

	FEV_1/FVC	*P* value	FEV_1 % predicted	*P* value
Sex, male	0.80 ± 0.06	0.039	94.4 ± 12.0	0.602
female	0.83 ± 0.05		95.9 ± 11.2	
Smoking status, current	0.81 ± 0.06	0.770	94.4 ± 12.3	0.583
former	0.80 ± 0.06		95.8 ± 9.8	
Asthma, Yes	0.80 ± 0.07	0.737	92.8 ± 10.5	0.708
No	0.81 ± 0.06		94.7 ± 12.0	
Diabetes, Yes	0.85 ± 0.03	0.136	98.9 ± 5.6	0.419
No	0.81 ± 0.06		94.5 ± 12.0	
Dyslipidaemia, Yes	0.83 ± 0.07	0.102	94.3 ± 11.2	0.925
No	0.80 ± 0.06		94.6 ± 12.0	
Hypertension, Yes	0.82 ± 0.06	0.320	93.0 ± 13.6	0.556
No	0.81 ± 0.06		94.8 ± 11.7	
Arrhythmia, Yes	0.82 ± 0.04	0.623	93.0 ± 12.0	0.661
No	0.81 ± 0.06		94.7 ± 12.0	
Coronary artery disease, Yes	0.74 ± 0.15	0.101	87.2 ± 3.3	0.380
No	0.81 ± 0.06		94.7 ± 12.0	

Data are presented as the means ± standard deviations.
Abbreviations: FEV_1, forced expiratory volume in 1 second; FVC, forced vital capacity.

Table S3. Correlations between lung function and CT parameters

	FEV_1/FVC		FEV_1 % predicted	
	r	*P* value	*r*	*P* value
WT segment	0.04	0.64	-0.10	0.19
subsegment	0.16	0.04	-0.02	0.80
ALR	0.35	<.0001	0.26	0.0007

Abbreviations: ALR, airway-to-lung ratio; FEV1, forced expiratory volume in 1 second; FVC, forced vital capacity; WT, wall thickness.

Table S4. The comparison of lung function in two groups divided by 5% threshold of LAA%

	LAA% <5%	LAA% ≥5%	*P* value
N (%)	143 (83.1)	29 (16.9)	
FEV_1/FVC	0.81 ± 0.05	0.77 ± 0.07	0.0004
FEV_1, % pred	94.4 ± 11.8	95.6 ± 12.4	0.61

Abbreviations: FEV_1, forced expiratory volume in 1 second; FVC, forced vital capacity; LAA% = the percentage of low attenuation area at -950 Hounsfield Units divided by the total lung capacity on a CT scan.

Table S5. Multivariable regression analysis for FEV_1/FVC

	Model 1	Model 2	Model 3	Model 4
Visual emphysema +	-0.83 (-1.69, 0.03)			
CLE +		-1.57 (-2.58, -0.57)**		-1.60 (-2.66, -0.54)**
PSE +			-0.35 (-1.27, 0.56)	0.08 (-0.86, 1.02)
WT segmental per 1 mm increase	0.48 (-7.93, 8.89)	1.57 (-6.72, 9.87)	-0.50 (-8.94, 7.93)	1.52 (-6.83, 9.87)
ALR per 0.01 increase	6.96 (4.41, 9.50)****	7.02 (4.52, 9.53)****	6.82 (4.25, 9.39)****	7.04 (4.52, 9.55)****
Age, per 1-year increase	-0.15 (-0.45, 0.15)	-0.11 (-0.41, 0.19)	-0.17 (-0.47, 0.14)	-0.11 (-0.41, 0.19)
Male	-1.93 (-3.27, -0.59)**	-2.10 (-3.41, -0.78)**	-1.94 (-3.30, -0.59)**	-2.11 (-3.44, -0.78)**
BMI, per 1-kg/m^2 increase	0.03 (-0.23, 0.29)	0.00 (-0.26, 0.25)	0.07 (-0.19, 0.34)	0.00 (-0.26, 0.26)
Smoking status, current	0.20 (-0.91, 1.31)	0.16 (-0.93, 1.25)	0.15 (-0.97, 1.28)	0.15 (-0.95, 1.25)

Data are presented as the estimate (95% confidence interval). **$p < 0.01$; ***$p < 0.001$; ****$p < 0.0001$.
Abbreviations: ALR, airway-to-lung ratio; BMI, body mass index; CLE, centrilobular emphysema; FEV_1, forced expiratory volume in 1 second; FVC, forced vital capacity; PSE, paraseptal emphysema; WT, wall thickness.

Table S6. Multivariable regression analysis for FEV_1 % predicted

	Model 1	Model 2	Model 3	Model 4
Visual emphysema +	-1.82 (-3.67, 0.04)			
CLE +		-2.79 (-4.98, -0.60)*		-2.63 (-4.93, -0.32)*
PSE +			-1.19 (-3.16, 0.77)	-0.48 (-2.52, 1.56)
WT segmental per 1 mm increase	-11.8 (-30.0, 6.31)	-10.5 (-28.5, 7.59)	-13.4 (-31.6, 4.72)	-10.1 (-28.3, 8.06)
ALR per 0.01 increase	11.1 (5.66, 16.6)****	11.2 (5.79, 16.7)****	10.8 (5.26, 16.3)***	11.1 (5.68, 16.6)****
Age, per 1-year increase	-0.27 (-0.92, 0.38)	-0.20 (-0.85, 0.44)	-0.31 (-0.96, 0.34)	-0.21 (-0.86, 0.44)
Male	-0.77 (-3.65, 2.11)	-1.09 (-3.95, 1.77)	-0.74 (-3.65, 2.17)	-1.01 (-3.90, 1.87)
BMI, per 1-kg/m^2 increase	-0.17 (-0.74, 0.39)	-0.20 (-0.76, 0.35)	-0.11 (-0.67, 0.46)	-0.23 (-0.79, 0.34)
Smoking status, current	-0.34 (-2.73, 2.06)	-0.44 (-2.82, 1.93)	-0.37 (-2.80, 2.05)	-0.38 (-2.77, 2.01)

Data are presented as the estimate (95% confidence interval). *p <0.05; ***p < 0.001; ****p < 0.0001.
Abbreviations: ALR, airway-to-lung ratio; BMI, body mass index; CLE, centrilobular emphysema; FEV_1, forced expiratory volume in 1 second; PSE, paraseptal emphysema; WT, wall thickness.

Table S7. Multivariable regression analysis for FEV_1/FVC predicted including interaction term between CLE and ALR

	Model 1	Model 2
Visual emphysema +		
CLE +	-1.53 (-2.51, -0.56)**	-1.52 (-2.56, -0.48)**
PSE +		-0.05 (-0.97, 0.88)
WT subsegment per 1 mm increase	9.87 (-1.47, 21.2)	9.88 (-1.50, 21.3)
ALR per 0.01 increase	5.34 (2.50, 8.19)***	5.33 (2.45, 8.20)***
Age, per 1-year increase	-0.10 (-0.40, 0.19)	-0.11 (-0.40, 0.19)
Male	-2.32 (-3.58, -1.05)***	-2.31 (-3.59, -1.03)***
BMI, per 1-kg/m^2 increase	-0.06 (-0.31, 0.19)	-0.06 (-0.31, 0.19)
Smoking status, current	0.20 (-0.87, 1.26)	0.20 (-0.88, 1.28)
CLE+*ALR	-2.73 (-5.53, 0.07)	-2.75 (-5.58, 0.08)

Data are presented as the estimate (95% confidence interval). **p < 0.01; ***p < 0.001.
Abbreviations: ALR, airway-to-lung ratio; BMI, body mass index; CLE, centrilobular emphysema; FEV_1, forced expiratory volume in 1 second; PSE, paraseptal emphysema; WT, wall thickness.

Table S8. Multivariable regression analysis for FEV_1 % predicted including interaction term between CLE and ALR

	Model 1	Model 2
Visual emphysema +		
CLE +	-2.87 (-5.03, -0.71)**	-2.57 (-4.87, -0.28)*
PSE +		-0.79 (-2.84, 1.25)
WT subsegment per 1 mm increase	-4.78 (-29.9, 20.3)	-4.59 (-29.7, 20.5)
ALR per 0.01 increase	8.42 (2.13, 14.7)**	8.14 (1.80, 14.5)*
Age, per 1-year increase	-0.21 (-0.86, 0.44)	-0.23 (-0.88, 0.42)
Male	-1.62 (-4.43, 1.18)	-1.49 (-4.31, 1.34)
BMI, per 1-kg/m^2 increase	-0.28 (-0.83, 0.27)	-0.31 (-0.86, 0.25)
Smoking status, current	-0.56 (-2.92, 1.81)	-0.45 (-2.83, 1.94)
CLE+*ALR	-5.02 (-11.2, 1.17)	-5.33 (-11.6, 0.91)

Data are presented as the estimate (95% confidence interval). *p <0.05; **p < 0.01.
Abbreviations: ALR, airway-to-lung ratio; BMI, body mass index; CLE, centrilobular emphysema; FEV_1, forced expiratory volume in 1 second; PSE, paraseptal emphysema; WT, wall thickness.

Table S9. Multivariable regression analysis for FEV_1/FVC in subjects without a history of asthma

	Model 1	Model 2	Model 3	Model 4
Visual emphysema +	-0.76 (-1.62, 0.09)			
CLE +		-1.63 (-2.61, -0.65)**		-1.72 (-2.77, -0.68)**
PSE +			-0.26 (-1.17, 0.66)	0.26 (-0.69, 1.20)
WT subsegment per 1 mm increase	10.1 (-1.56, 21.7)	11.0 (-0.41, 22.4)	9.49 (-2.24, 21.2)	10.9 (-0.48, 22.4)
ALR per 0.01 increase	6.33 (3.78, 8.89)****	6.41 (3.92, 8.91)****	6.19 (3.62, 8.77)****	6.45 (3.94, 8.95)****
Age, per 1-year increase	-0.15 (-0.45, 0.15)	-0.11 (-0.40, 0.19)	-0.17 (-0.47, 0.14)	-0.10 (-0.40, 0.20)
Male	-2.12 (-3.48, -0.75)**	-2.25 (-3.58, -0.92)**	-2.14 (-3.52, -0.76)**	-2.30 (-3.64, -0.95)***
BMI, per 1-kg/m^2 increase	-0.04 (-0.30, 0.22)	-0.07 (-0.32, 0.19)	0.00 (-0.26, 0.26)	-0.06 (-0.32, 0.20)
Smoking status, current	0.23 (-0.88, 1.33)	0.23 (-0.85, 1.30)	0.16 (-0.96, 1.28)	0.19 (-0.90, 1.28)

Data are presented as the estimate (95% confidence interval). **$p < 0.01$; ***$p < 0.001$; ****$p < 0.0001$.
Abbreviations: ALR, airway-to-lung ratio; BMI, body mass index; CLE, centrilobular emphysema; FEV_1, forced expiratory volume in 1 second; FVC, forced vital capacity; PSE, paraseptal emphysema; WT, wall thickness.

Table S10. Multivariable regression analysis for FEV_1 % predicted in subjects without a history of asthma

	Model 1	Model 2	Model 3	Model 4
Visual emphysema +	-2.10 (-3.99, -0.22)*			
CLE +		-3.05 (-5.24, -0.86)**		-2.82 (-5.15, -0.49)*
PSE +			-1.47 (-3.49, 0.54)	-0.63 (-2.73, 1.47)
WT subsegment per 1 mm increase	-4.46 (-30.0, 21.1)	-3.43 (-28.8, 22.0)	-5.70 (-31.5, 20.1)	-3.32 (-28.8, 22.1)
ALR per 0.01 increase	10.4 (4.83, 16.1)***	10.5 (4.92, 16.1)***	9.98 (4.33, 15.6)***	10.4 (4.82, 16.0)***
Age, per 1-year increase	-0.28 (-0.95, 0.38)	-0.21 (-0.87, 0.46)	-0.33 (-1.00, 0.34)	-0.22 (-0.89, 0.45)
Male	-1.66 (-4.65, 1.33)	-1.98 (-4.94, 0.99)	-1.62 (-4.65, 1.41)	-1.87 (-4.86, 1.12)
BMI, per 1-kg/m^2 increase	-0.32 (-0.90, 0.26)	-0.33 (-0.90, 0.24)	-0.26 (-0.84, 0.32)	-0.36 (-0.93, 0.22)
Smoking status, current	-0.41 (-2.85, 2.02)	-0.51 (-2.91, 1.89)	-0.47 (-2.93, 1.99)	-0.42 (-2.85, 2.00)

Data are presented as the estimate (95% confidence interval). *p <0.05; **p < 0.01; ***p < 0.001.
Abbreviations: ALR, airway-to-lung ratio; BMI, body mass index; CLE, centrilobular emphysema; FEV_1, forced expiratory volume in 1 second; PSE, paraseptal emphysema; WT, wall thickness.