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SUPPLEMENTARY MATERIAL

Comparative evaluation of impulse oscillometry and spirometry for the detection of small airway disease in patients with obstructive airway diseases

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Supplementary Table 1. Demographical and clinical characteristics of the study participants.

	COPD (n=41)	Asthma (n=61)	Bronchiectasis (n=16)	Overall (n=118)
Gender, n (%)				
Male	35 (85.36)	25(40.98)	10(62.5)	70 (59.32)
Female	6 (14.63)	36(59.01)	6(37.5)	48 (40.67)
Age (in years), mean (SD)	57.73(8.46)	43.09(16.00)	44.93(18.23)	48.43(15.66)
Place of residence, n (%)				
Urban	26 (63.41)	39 (63.94)	9 (56.25)	74(62.71)
Rural	15 (36.58)	22 (36.06)	7 (43.75)	44 (37.28)
BMI (kg/m^2), mean (SD)	23.86 (3.92)	24.47 (4.50)	23.19 (3.94)	24.08 (4.22)
Comorbid condition, n (%)	30 (73.17)	43 (70.49)	9(56.25)	82 (69.49)
DM, n (%)	6 (14.63)	6 (9.83)	1 (6.25)	13 (11.01)
HTN, n (%)	14 (34.14)	10 (16.39)	3 (18.75)	27 (22.88)
AR, n (%)	0 (0)	19 (31.14)	1 (6.25)	20 (16.94)
History of pulmonary TB, n (%)	11 (26.82)	2 (3.27)	4 (25)	17 (14.40)
Smoking history, n (%)				
Current smoker	2 (4.87)	0 (0)	0 (0)	2 (1.69)
Former smoker	31 (75.60)	8 (13.11)	2 (12.5)	41 (34.74)
Never smoker	8 (19.51)	53 (86.88)	14 (87.5)	75 (63.55)
Pack years, mean (SD)	15.80 (13.52)	0.63 (1.88)	1.56 (5.07)	6.03 (10.91)

SD, standard deviation; BMI, body mass index; TB, tuberculosis; DM, diabetes mellitus; HTN, hypertension; AR, allergic rhinitis.

Supplementary Table 2. Respiratory and treatment characteristics of the study participants.

	COPD (n=41)	Asthma (n=61)	Bronchiectasis (n=16)	Overall (n=118)
Biomass exposure index, mean (SD)	11.95 (39.59)	2.28 (5.54)	0.50 (2.00)	5.40 (23.98)
Duration of symptoms in years, mean (SD)	8.31 (6.16)	8.43 (8.18)	16.06 (13.52)	9.42 (8.82)
No. of exacerbation in last year, n (%)	35 (44.30)	34 (43.03)	10(12.6)	79 (66.94)
History of NIV use in last year, n (%)	8 (19.51)	0 (0)	0 (0)	8 (6.77)
History of mechanical ventilation in last year	0 (0)	0 (0)	0 (0)	0 (0)
Treatment, n (%)				
MDI	25 (60.97)	42(68.85)	13 (81.25)	80(67.79)
DPI	16 (39.02)	19(31.14)	3 (18.75)	38 (32.20)
Biological use	0 (0)	0 (0)	0 (0)	0 (0)
Oral steroids	0 (0)	1 (1.63)	1 (6.25)	2 (1.69)
Laboratory investigation, mean (SD)				
AEC per microlitre	216.00 (122.29)	284.21 (206.46)	180.75 (72.20)	246.48 (171.17)
S.total IgE (IU/mL)	133.12 (55.81)	281.49 (315.76)	268.81 (364.49)	228.22 (272.22)

NIV, non invasive ventilation; AEC, absolute eosiniphil count; S.total Ig E, serum total immunoglobulin E; MD, metered dose inhaler; DPI, dry powder inhaler; SD, standard deviation.

Supplementary Table 3. Spirometric and impulse oscillometry parameters among obstructive airway disease and chronic obstructive pulmonary disease patients (pre- and post-bronchodilatation responsiveness).

		Total OAD pre-BDR n=118	Total OAD post-BDR n=118	COPD pre-BDR n=41	COPD post-BDR n=41
Forced vital capacity (FVC), mean (SD)	FVC (L)	2.31 (0.71)	2.39 (0.73)	2.00 (0.53)	2.11 (0.56)
	FVC %	78.84 (20.33)	81.23 (20.06)	67.61 (16.95)	71.41 (17.95)
	FVC Z score	-1.17 (1.19)	-1.07 (1.16)	-1.71 (1.17)	-1.55 (1.12)
Forced expiratory volume , 1 second (FEV1) , mean (SD)	FEV1 (L)	1.50 (0.73)	1.56 (0.74)	1.03 (0.37)	1.09 (0.39)
	FEV1%	60.74 (25.89)	64.00 (25.87)	44.17 (16.16)	46.63 (16.75)
	FEV1 Z score	-2.04 (1.40)	-1.91 (1.41)	-2.77 (1.12)	-2.67 (1.13)
FEV1/FVC, mean (SD)	FEV1/FVC	62.66 (15.60)	63.53 (16.55)	51.44 (9.57)	51.60 (10.29)
	FEV1/FVC Z score	-2.35 (2.04)	-2.19 (2.16)	-3.61 (1.36)	-3.50 (1.47)
Maximum expiratory flow 25-75 (MEF 25-75) , mean (SD)	MEF25-75 (L/s)	1.16 (1.08)	1.25 (1.13)	0.49 (0.23)	0.52 (0.28)
	MEF 25-75 Zscore	-2.40 (0.99)	-2.30 (1.03)	-2.77 (0.62)	-2.74 (0.64)
Respiratory resistance, mean (SD)	R5 (cmH2o.s/L)	6.84 (2.15)	5.95 (2.14)	6.72 (1.98)	6.13 (1.83)
	R20 (cmH2o.s/L)	4.14 (1.43)	3.86 (1.36)	3.78 (0.91)	3.65 (0.99)
	R5-R20 (cmH2o.s/L)	2.69 (1.48)	2.13 (1.48)	2.94 (1.42)	2.48 (1.32)

R5, resistance at 5 hz; R20, resistance at 20 hz; R5-R20, difference of R5 and R20; OAD, obstructive airway disease; BDR, bronchodilatation responsiveness.

Supplementary Table 4. Spirometric and impulse oscillometry parameters among asthma and bronchiectasis (pre- and post-bronchodilatation responsiveness).

		Asthma Pre-BDR n=61	Asthma Post-BDR n=61	Bronchiectasis Pre-BDR n=16	Bronchiectasis Post-BDR n=16
Forced vital capacity (FVC), mean (SD)	FVC (L)	2.54 (0.71)	2.60 (0.75)	2.22 (0.86)	2.27 (0.81)
	FVC%	88.09(18.80)	89.77 (19.00)	72.37 (17.54)	73.87 (14.74)
	FVC zscore	-0.71 (1.08)	-0.65 (1.12)	-1.51 (1.00)	-1.43 (0.85)
Forced expiratory volume , 1 second (FEV1), mean (SD)	FEV1 (L)	1.82 (0.69)	1.90 (0.71)	1.47 (0.93)	1.46 (0.90)
	FEV%	73.18 (25.15)	78.06 (23.65)	55.81 (24.47)	54.93 (22.73)
	FEV z score	-1.47 (1.33)	-1.27 (1.33)	-2.33 (1.37)	-2.38 (1.25)
FEV1/FVC, mean (SD)	FEV1/FVC	70.39 (13.91)	72.41 (14.66)	61.94 (17.11)	60.26 (16.57)
	FEV1/FVC z score	-1.45 (1.91)	-1.14 (2.03)	-2.56 (2.28)	-2.81 (2.14)
Maximum Expiratory Flow 25-75 (MEF 25-75) , mean (SD)	MEF25-75 (L/s)	1.60 (1.15)	1.78 (1.19)	1.21 (1.30)	1.10 (1.17)
	MEF 25-75 z score	-2.10 (1.11)	-1.90 (1.12)	-2.57 (0.95)	-2.67 (0.86)
Respiratory resistance, mean (SD)	R5 (cmH2o.s/L)	6.74 (2.12)	5.62 (2.18)	7.54 (2.65)	6.76 (2.58)
	R20 (cmH2o.s/L)	4.36 (1.63)	4.00 (1.57)	4.25 (0.41)	3.89 (1.33)
	R5-R20 (cmH2o.s/L)	2.37 (1.36)	1.71 (1.41)	3.29 (1.83)	2.83 (1.71)

R5, resistance at 5 hz; R20, resistance at 20 hz; R5-R20, difference of R5 and R20; OAD, obstructive airway disease; BDR, bronchodilatation responsiveness.

Supplementary Table 5. Small airway disease (pre-bronchodilatation responsiveness) diagnosis and comparison using impulse oscillometry and spirometry across chronic obstructive pulmonary disease patients, asthma and bronchiectasis.

	COPD spirometry (MEF25-75 Z score <-1.64) SAD Absent	COPD spirometry (MEF 25-75 Z Score <-1.64) SAD Present	Asthma spirometry (MEF 25-75 Z score <-1.64) SAD Absent	Asthma spirometry (MEF 25-75 Z score <-1.64) SAD Present	Bronchiectasis spirometry (MEF 25-75 Z score<-1.64) SAD Absent	Bronchiectasis spirometry (MEF 25-75 Z score<-1.64) SAD Present
IOS (R5-R20 >150%)						
SAD absent, n (%)	0 (0)	2 (4.87)	3 (4.91)	1 (1.63)	0(0)	0 (0)
SAD present, n (%)	0 (0)	39 (95.12)	16 (26.22)	41 (67.21)	2 (12.5)	14 (87.5)
Total, n (%(	0 (0)	41 (100)	19 (31.14)	42 (68.85%	2 (12.5)	14 (87.5)
p-value	NA		0.085		NA	

SAD, small airway disease; IOS, impulse oscillometry; MEF25-75, maximum expiratory flow 25-75; BDR, bronchodilatation responsiveness.

Supplementary Table 6. Small airway disease (post BDR) diagnosis and comparison using IOS and spirometry across COPD, asthma and bronchiectasis.

	COPD spirometry (MEF25-75 Z score< -1.64) SAD absent	COPD spirometry (MEF 25-75 Z score <-1.64) SAD present	Asthma spirometry (MEF 25-75 Z score< -1.64) SAD absent	Asthma spirometry (MEF 25-75 Z score < -1.64) SAD present	Bronchiectasis spirometry (MEF 25-75 Z score< -1.64) SAD absent	Bronchiectasis spirometry (MEF 25-75 Z score< -1.64) SAD present
IOS (R5-R20 >150%)						
SAD absent, n (%)	0 (0)	5 (12.19)	8 (13.11)	1 (1.63)	0 (0)	0 (0)
SAD present, n (%)	0 (0)	36 (87.80)	18 (29.50)	34 (55.73)	1 (6.25)	15 (93.75)
Total, n (%)	0 (0)	41 (100)	26 (22.03)	35 (57.37)	1 (6.25)	15 (93.75)
p-value	NA		0.003		NA	

SAD, small airway disease; IOS, impulse oscillometry; MEF25-75, maximum expiratory flow 25-75; BDR, bronchodilatation responsiveness.