99. Monitoring with lung function tests in airway diseases

P915

Pulmonary function in sarcoidosis: A review of 85 cases using percentage predicted and lower limit of normal values to determine pattern of pulmonary function deficit

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Previous studies have shown airflow limitation is common in Sarcoidosis. Recent evidence (Chest 2011; 139:52-59) suggests using fixed percentage predicted (PP) values may discordantly classify patients compared to using fifth percentiles as the lower limit of normal (LLN). We studied PFT patterns, and the effect of classifying by PP and LLN.

Our study assessed the PFT results found in consecutive patients presenting with Sarcoidosis to one medical team over a 14 year period. Eighty-five patients fulfilled the entry criteria. All had PFTs available. Patients were classified into normal, obstructive, restrictive and mixed deficits using the ATS/ERS flowchart for PFT interpretation. Classification by PP and LLN values were compared.

Eleven patients (12.9%) were classified discordantly comparing PP with LLN methods. Six had normal PFTs classified by LLN, but abnormal by PP values. Normal lung function (PP 64.7%, LLN 68.2%) was the commonest pattern. Obstruction was the commonest abnormality (PP 24.7%, LLN 21.7%). Patients with obstructive deficits were more likely to have ever smoked.

The frequency of airflow obstruction in this study was 24.7% when classified by PP, equivalent to findings from a similar cohort (Resp Med 1991; 59-64 - 24.3%

using PP), but higher than cohorts studied previously in Japan (8.8%). Classified by LLN, the proportion of our patients with obstruction falls to 21.2%. Overall, the commonest PFT pattern in patients with Sarcoidosis is normality. Expiratory airflow obstruction remains the commonest abnormal pattern, with a slightly higher frequency when classified by PP compared to LLN.

P916

A negative result of airway reversibility test in obstructive airway disease does not mean no reserve of lung function

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Introduction: The airway reversibility test (ART) is performed to diagnose obstructive airway disease (OAD) such as asthma and COPD. The ART revealed negative results in some asthma patients. It can be made insufficient treatment (Tx) for those patients.

Objectives: We reviewed the patients' data to evaluate the characteristics of the patients who have marked improvement of spirometry (SPM) after regular Tx among patients with SPM below COPD stage II by GOLD guideline.

Method: We reviewed SPM records of 1072 patients who performed ART to evaluate dyspnea from 1st September 2009 to 30th August 2010. Finally we reviewed the pre and post-Tx SPM data and characteristics of 121 patients who have pre-bronchodilator (BD) FEV₁/FVC<70%, FEV₁<80%, and negative for ART.

Results: Twenty four patients (19.8%) showed improved FEV₁ > 80% after regular Tx with ICS and/or tiotropium (group 1). Four patients showed improvement of FEV₁/FVC >70% and FEV₁ > 80% (group 2). The mean increments of FEV₁ are 0.47 L and 0.61 L in group 1 and 2. The increment of FEV₁ after Tx slightly correlated with initial post-BD FEV₁ change in ART (R=0.213, p=0.019). But, the post-BD FEV₁ change (%) was not different between group 1 and non-responder group (5.29±6.35 vs. 6.71±5.41, p = 0.33).

Conclusion: The results of this study show about 20% of patients with SPM fitted in moderate COPD had FEV_1 improvement >80% after Tx. But we could not find specific characteristics in those patients. Collectively, physicians may consider active initial Tx including ICS when managing patients of OAD even though initial BD response is minimal. And further study to find the predictor of favorable Tx outcome will be needed.

P917

Comparison between presence of respiratory symptoms and peak expiratory flow (PEF) values $<\!80\%$ predicted as screening tools for obstructive airways diseases (OAD)

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When screening large populations for OADs, it is not known whether respiratory symptoms or PEF is a better predictor.

Aim: To compare predictive values of presence of respiratory symptoms vs PEF values < 80% predicted for detecting OADs.

Methods: 7154 employees from 24 bus depots and 7 cities and towns of Andhra Pradesh State in India were administered a respiratory health questionnaire and performed peak flow metry using an EU scale Peak Flow Meter (Breathometer, Cipla Ltd. India). Subjects with presence of at least one respiratory symptom and/or PEF values <80% predicted underwent Spirometry according to ATS/ERS standards. OAD was defined as FEV1/FVC <70%, small airways obstruction (SAO) as FEF25-75% <65% of predicted.

Results: Of the 3348 subjects who performed spirometry, 1433 had PEF <80% predicted (Group A), 746 had at least one respiratory symptom but PEF >80% predicted (Group B) and 1169 had both PEF <80% predicted and presence of at least one respiratory symptom (Group C). The prevalence of OAD was 8.9%, 4.1% and 10.5% in Groups A, B and C respectively while the prevalence of SAO was 49%, 27.5% and 46.6% respectively. Use of PEF <80% predicted was a significantly better predictor of OAD (Δ 4.8%; p=0.01) and SAO (Δ 21.5%; p<0.0001) than the presence of respiratory symptoms.

Conclusion: PEF values <80% predicted is a better predictor of OAD and SAO than presence of respiratory symptoms. We recommend use of PFM as a screening tool for OAD in large epidemiological studies.

P918

Lung function differences between subjects with tobacco smoke-induced COPD (TS-COPD) and biomass smoke-induced COPD (BS-COPD) in an Indian population

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Exposure to biomass fuel smoke is as an important risk factor for COPD (BS-

COPD), but it is not known whether this phenotype is different from tobacco-smoke induced COPD (TS-COPD) with reference to lung physiological changes. Aim: To compare lung function profiles between subjects with BS-COPD and TS-COPD

Methods: 17 BS-COPD (mean 43 yrs exposure) and 35 TS-COPD (mean 43 smoking pack yrs) subjects underwent pre and post bronchodilator spirometry to measure FEV1, FVC and FEF25-75%, bodyplethysmography to measure residual volume (RV) and total lung capacity (TLC), impulse oscillometry (IOS) to measure R5Hz and R20Hz and single-breath DLCO to measure lung diffusion. Two sample "t" test was used to compare mean (\pm SD) lung function parameters between the two groups.

Results: There were no significant differences in% predicted values for FEV1, FVC, R20Hz, RV and TLC between TS-COPD and BS-COPD (all p values >0.05). However, BS-COPD showed a trend towards greater small airway obstruction indicated by lower FEF25-75% predicted values [BS: 9% ($\pm 3\%$) vs TS: 12% ($\pm 5\%$), p= 0.02], higher R5H2% predicted values [BS: 272% ($\pm 65\%$) vs TS: 222% ($\pm 94\%$), p= 0.05] and higher R5-20Hz values normalised to total airway resistance [BS: 0.53 (± 0.07) vs TS: 0.46 (± 0.13) p=0.05], while TS-COPD showed lower% predicted values in Spirometric, IOS and body plethysmographic parameters as TS-COPD. However, BS-COPD was associated

with greater small airways obstruction, while TS-COPD was associated with lower DLCO values.

P919

Monitoring small airways disease (SAD) in cystic fibrosis (CF)

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Introduction: CF lung disease starts in small airways. SAD is visible on chest-CT as trapped air (TA). For routine monitoring of CF lung disease spirometry parameters are used. Forced expiratory flow after 75% of vital capacity is exhaled (FEF75) is a sensitive marker of SAD. Lung Clearance Index (LCI) obtained by Multiple Breath Washout test (MBW) has been advocated as a parameter to monitor SAD. Whether LCI is more sensitive than FEF75 to detect SAD is unknown.

Aims: To study the relation between FEF75 and LCI and trapped air on CT and between FEF75 and LCI.

Methods: Retrospective study of stable CF patients (n=50) who had their (bi)annual check-up including chest-CT and spirometry. Tidal breathing MBW (n=23) was performed using the Ecomedics Exhalyzer D. In- and expiratory (volumetric) chest CT-scans were scored using the CF-CT score and expressed as% of maximum score.

Results: CF patients (1-19 years, male N=26). 36% had chronic pseudomonas. FEF75 mean 45,5 (range 7,5-119,2)% predicted, LCI 9,4 (6,9-14,3), TA 33,0 (0-83,3)% FEF75 correlated with LCI (N=23) (r=0,573, p=0,005). FEF75 (n=49) correlated with bronchiectasis (r=0,339, p=0,016), airwall thickening (r=0,520, p<0,001), mucusplugging (r=0,505, p<0,001) parenchymal abnormalities (r=0,508, p<0,001) and total CF-CT score (r=0,535, p<0,001) but not with TA. LCI did not correlate with abnormalities on CT.

Conclusion: FEF75 correlates with LCI. Neither FEF75 nor LCI correlate with TA. The additional value of LCI over FEF75 as a sensitive monitoring tool for SAD requires further validation.

P920

The use of forced oscillation technique (FOT) in assessment and stratification of disease severity in elderly COPD patients

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Introduction: Forced oscillation technique (FOT) is a fast, convenient technique for lung function measurement. However, its use for assessing disease severity in elderly COPD patients remains unclear.

Aim: 1)To evaluate the accuracy of FOT in assessing disease severity in elderly COPD patients and 2)to determine the cut-off value of FOT for identifying severe patient group.

Methods: Spirometry confirmed COPD subjects were recruited from Kwong Wah Hospital, Hong Kong from Jan 10 to Jan 11. The "GOLD stages" of each patient were calculated. The correlation of different GOLD stages and FOT parameters including frequency resonance (FRes), frequency dependence (FDep), average resistance (RAvr), average reactance (XAvr) and resistance at 6Hz (R6Hz), were analyzed. The cut-off value of FOT to define "severe" COPD group (%FEV1 <50% predicted) was evaluated.

Results: Totally, 102 COPD patients with a mean age of 70.3±8.2 and median GOLD stage of 2 were recruited. FOT parameters correlated well with GOLD stages. Among the FOT parameters, FRes was the best to predict disease severity. Cut-off value of FRes >29 has a sensitivity of 71% and specificity 69% in identifying severe patients (%FEV1<50%), with area under curve value 0.77.



Conclusion: FOT is accurate for assessing disease severity in elderly COPD patients. FRes value >29 has a good sensitivity and specificity in identifying severe COPD patients

P921

Reproducibility data of breath analysis through a gas sensors array and

comparison to spirometry in COPD patients Simone Scarlata¹, Giorgio Pennazza², Domenica Chiurco¹, Marco Santonico², Arnaldo D'amico³, Raffaele Antonelli Incalzi¹. ¹*Geriatrics, Unit of Respiratory* Pathophysiology, University Campus Bio-Medico, Rome, Italy; ²Faculty of Engineering, University Campus Bio-Medico, Rome, Italy; ³Department of Electronic Engineering, University Tor Vergata, Rome, Italy

Background: There is insufficient information on reproducibility and intra observer variability of breath analysis, a technique proved to have classificatory and discriminative properties in respiratory diseases. Aim of this study is therefore to compare variance over time of breath analysis and global spirometry in elderly patients with COPD.

Materials and methods: Data refer to the 9 COPD patients so far recruited. Patient underwent breath analysis and respiratory function study 3 times along a period of 3 weeks. The gas sensors array (based on 6 Quartz Microbalances (QMB) covered with different metalloporphyrins) used for this study was fabricated by Tor Vergata University, Rome. The reproducibility of sensors measurements and spirometry data were then compared.

Results: Results are summarized in figure 1 with panels A, B and C respectively representing the frequency shifts registered by the six QMB sensors (A) and twelve parameters obtained by global spirometry (B and C). Variance, mean value, confidence interval and outliers of a set of data are graphically depicted.



Conclusions: Spirometric values show a smaller variance respect to the QMB frequency shifts. However, the reproducibility of selected sensor data seems fair enough to allow follow up COPD patients.

P922

Patients with fluctuant peak expiratory flow value in the absent category are insensitive to dyspnea and are at risk for severe asthma exacerbation Kumiya Sugiyama, Hirokuni Hirata, Naoya Ikeda, Taichi Shiobara,

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Exacerbation of asthma has a negative impact on quality of life and increases the risk of fatal asthma. One of the known risk factors of patients with a history of near-fatal asthma is experiencing mild asthmatic symptoms as opposed to airway obstruction. We set out to find patients carrying such a risk before they experience severe exacerbation of asthma.

To determine the character of such patients, we compared the background and asthma diaries (mean period, 274 days) of 53 asthma patients with their symptoms and peak expiratory flow value (PEF). According to the criteria of the Japanese Society of Allergology, symptoms were classified into 8 categories ranging in severity from absent to severe attack.

Average PEF was 75.2% (50.5-100) in absent, 64.5% (36.6-92.6) in wheeze, 57.3% (25.0-94.7) in mild attack and 43.6% (20.4-83.1) in moderate attack, and the personal best was 100%. Thus, differences in decreased PEF in cases with the same symptoms varied widely between patients. PEF in wheeze, mild and moderate attack did not correlate significantly with the duration of asthma, FEV1 or the proportion of personal best to standard PEF. These PEFs did not show a significant difference in the groups that were divided by regular treatment of asthma, but did show a significant negative correlation with the coefficient of variation of PEF when asthma was absent.

To reveal patients who are insensitive to dyspnea, the most important factor to consider is the coefficient of variation of PEF when asthma is absent. When we find such patients who exhibit fluctuant PEF, we have to intervene in their treatment, even when they claim to be stable.

P923

The use of forced oscillation technique (FOT) in assessment of airway obstruction and airtrapping in elderly COPD patients

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Introduction: Forced oscillation technique (FOT) is a new lung function measurement technique that may have a role in assessing elderly COPD patients. Aim: To evaluate the accuracy of FOT in assessment of airway obstruction and airtrapping in elderly COPD patients.

Methods: Stable spirometry-confirmed elderly COPD subjects were recruited from Kwong Wah Hospital, Hong Kong from Jan 10 to Jan 11.

Subjects were assessed by both conventional plethysmography and FOT machine in the same visit. Airway obstruction was measured by FEV1%, Raw, Gaw while degree of airtrapping was measured by residual volume (RV), total lung capacity (TLC), inspiratory capacity (IC) and RV/TLC ratio. FOT parameters like frequency resonance (FRes), frequency dependence (FDep), resistance at 6Hz (R6Hz), average resistance (RAvr), average reactance (XAvr) were obtained. The FOT parameters were then compared with the plethysmography.

Results: Totally, 106 patients were recruited. 93.1% were male with a mean age of 70.6±8.3 and FEV1 of 54.3±21.3. FOT correlates well with conventional plethysmography for measurement of airway resistance and airtrapping in elderly COPD patients. Among the FOT parameters, FRes showed the best correlation with FEV1 (r=0.608, p<0.001) and RV/TLC ratio (r=0.563, p<0.001).



Conclusion: FOT is an accurate and convenient technique for assessment of airway obstruction and airtrapping in elderly COPD patients.

P924

Pulmonary function and exercise tolerance in glycogenosis type II (GSDII) Giovanni Ciana¹, Ingrid Toller², Mattia Guerra², Bruno Bemb¹, Mario Canciani². ¹Regional Coordination Centre for Rare Diseases, University of

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Pompe disease is an autosomal recessive myopathy caused by deficiency of the lysosomal enzyme a-glucosidase. Enzyme replacement therapy (ERT) with human recombinant α -glucosidase (rhGAA) is effective in the treatment of infantile forms of GSDII, but experience in late-onset disease is still limited.

Aim: To determine ERT long-term effects on pulmonary function and exercise tolerance in late-onset GSDII.

Methods: 7 children (mean age at starting ERT 11 years, 4M:3F) receiving bi-weekly infusion of rhGAA for at least 36 months were evaluated performing pulmonary function tests and 6-min walking tests (6MWT), before (T0) and during treatment (T12, T24, T36).

Results: Our data describe a predominantly restrictive pattern of lung function at baseline, without a significant improvement after ERT.

	TO	Median values during ERT
FEV1	72.7 (26-110)	85.7 (24-131)
FVC	76.7 (27-113)	81.1 (23-119)
FEV1/FVC	93	104.4

The 6MWT improved during ERT; analysis of individual performances showed a progressive increase in walking capacity in all the patients. The difference in 6MWT rank distribution at baseline, T12, T24 and T36 was statistically significant (p < 0.05, according to Friedman).

Patients	Т0	T12	T24	T36
1	15*	589	565	590
2	718	782	770	739
3	104	156	156	180
4	643	742	630	649
5	572	548	513	598
6	636	580	562	640
7	680	685	719	720
Median	481	583	559	588

*Patient tracheostomized at T0.

Conclusion: Our data highlight as motor and respiratory functions respond differently to ERT: motor function seems to improve due to an increased peripheral muscular endurance, while pulmonary function remains unchanged after starting treatment. Long-term ERT is effective in improving motor function and in stabilizing respiratory function in late-onset GSDII.

P925

Expiratory flow limitation (EFL) detected non-invasively as a phenotypic characteristic of COPD

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Within-breath change in reactance at 5Hz during tidal breathing reliably detects EFL in patients with COPD. We used the method proposed by Dellaca et al to determine presence of EFL and its relationship to spirometry and demographics of 424 healthy smokers and COPD patients from the Bergen cohort of the ECLIPSE study.

Aim: Establish the prevalence of EFL by GOLD stage and its relationship to dyspnoea and BMI.

274 stable COPD patients and 150 healthy smoking controls performed spirometry and tidal impulse oscillometry.

Results: Presence of EFL in healthy smokers, COPD grade 2,3, and 4 was.7%, 13%, 28% and 40% respectively. Inspiratory resistance and reactance at 5Hz were higher in COPD than smokers but differed little across GOLD stages.

Demogra	nhice
Demogra	pines

	n	BMI	MRC	FEV1	R5insp	X5insp
Healthy smoke	rs					
non-EFL	149	26±4	0.2 ± 0.4	30.4±0.7L	$0.28 {\pm} 0.07$	-0.09 ± 0.03
EFL	1	32	1.0	3.9L	0.39	-0.08
COPD GOLD	2					
non-EFL	125	26±5	1.3 ± 1.0	1.8±0.5L	0.39 ± 0.12	-0.15 ± 0.06
EFL	19	30±7*	$1.9 \pm 1.2^*$	1.5±0.3L	$0.51 {\pm} 0.08$	-0.20 ± 0.05
COPD GOLD	3					
non-EFL	76	24±5	1.5 ± 0.9	1.2±0.3L	0.41 ± 0.10	-0.20 ± 0.07
EFL	29	30±6*	2.3±1.2*	1.1±0.3L	$0.50 {\pm} 0.12$	-0.22 ± 0.07
COPD GOLD	4					
non-EFL	15	22±5	2.6 ± 1.5	0.8±0.2L	0.42 ± 0.10	-0.22 ± 0.10
EFL	10	25 ± 6	$2.4{\pm}1.4$	0.7±0.1L	0.43 ± 0.06	-0.23 ± 0.08

MRC: Medical Research Council dyspnoea scale; R5insp: Inspiratory resistance at 5Hz; X5insp: Inspiratory reactance at 5Hz; *p<0.05.

Conclusion: EFL became more common in higher GOLD stages, but a significant number of patiens in all GOLD stages were not flow limited at rest. In GOLD stage 2 and 3 EFL patients were more breathless, despite similar spirometry, but EFL also tracked obesity, which may contribute to both EFL and dyspnea. Presence of EFL has potential to be an independent phenotypic characteristic in stable COPD.

P926

Area under the maximum expiratory flow-volume curve a sensitive parameter in the evaluation of airway obstruction

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Introduction: The most frequently used parameters for assessing bronchoconstriction and bronchodilation are forced expiratory volume in 1 s (FEV 1) and peak expiratory flow (PEF).

Objectives: To assess the sensitivity of other parameters after induced bronchoconstriction and bronchodilation.

Methods: Forced vital capacity, FEV 1, PEF, maximum expiratory flows (MEF) at 25, 50 and 75% of vital capacity and the area under the maximal expiratory flow- volumeMEFV curve (Area ex) were measured in two groups of asthmatic patients after induced bronchoconstriction and bronchodilation.

Results: In 158 asthmatics without airway obstruction, bronchoconstriction was induced by inhalation of 1% histamine aerosol. The 20% fall in Area ex compared to baseline was found in all asthmatics, while the 20 and 15% falls in FEV 1 were noted in 31 and 69% of the patients, respectively. Other parameters were less sensitive. Another 102 asthmatics with mild-moderate airway obstruction were treated with various bronchodilators. The 20% increase in Area ex was observed in all asthmatics, while the 20% increase in FEV 1 was found in only 28% of the patients and the 15% increase in FEV 1 in 56%.

Conclusion: In evaluation of correlation between dynamic functional parameters the most accurate parameter is Area_{ex} – value defining surface under the expiratory part of "flow – volume" curve. Area ex was a sensitive parameter in the evaluation of airway patency in comparison withf MEF₂₅, MEF₅₀, MEF₇₅, FEV 1 and other parameters measured from the MEFV curve in our study patients.

P927





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Increased temporal fluctuation of oscillatory mechanics parameters measured over 15 minutes has been suggested to be a specific feature of asthma, though this is still a controversial issue. We aimed to evaluate whether variability over time scales >1 day can reliably separate asthmatic from healthy subjects.

Within-breath respiratory resistance (Rrs) and reactance (Xrs) were measured by forced oscillations during 2min of tidal breathing at morning and evening for 6 months in 10 mild asthmatic and 10 healthy subjects. Short-term (within measurements) and long-term (2, 4, 8, 16 and 32 consecutive days) variability of Rrs and Xrs was characterized by their standard deviations (SD_{Rrs} and SD_{Xrs}).

Short-term variability of either Rrs or Xrs was not significantly different between asthmatic and healthy subjects (p>0.05). SD_{Rrs} was significantly larger in asthmatics than in healthy subjects with a time scale \geq 4 days using morning

(0.60 vs 0.32 cmH₂O s L⁻¹, p<0.03) and \geq 16 days using evening (0.64 vs 0.42, p<0.05) data. When Rrs was partitioned into inspiratory (Rinsp) and expiratory (Rexp) components, long-term SD_{Rinsp} but not long-term SD_{Rinsp} was greater already for time scales \geq 2 days in the morning (0.44 vs 0.24, p<0.02) and \geq 4 days in the evening (0.49 vs 0.30, p<0.05). SD_{Xrs} was significantly larger in asthmatics from 2-day time scale (0.23 vs 0.11, p<0.01 morning; 0.19 vs 0.13, p<0.03 evening). In conclusion, the assessment of FOT-based variability over a relatively long-term, i.e., few days, period provides an explanation for previous controversial findings and allows us to reliably distinguish asthmatics from normal subjects.

P929

Determination of respiratory flow by tracheal sound-frequency-analysis Volker Gross¹ Denice Basu² Michael Scholtes² Florian Schult¹

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The established methods to detect the flow are pneumotachographic measurements, which are not always ideal to use regarding long term measurements and measurements during sleep. Thus it is interesting to find an alternative non-invasive method to detect the quantitative value of the flow.

There are some further appendages that use tracheal respiratory sound intensity, but there is no method suitable for measurements during a noninvasive ventilation. The aim was to create a new method, easy to use under different long term conditions, based on tracheal sound-frequency-analysis.

Up to now, 43 subjects (male, non-smoker, normal BMI, 18-60 years old, FEV1>80%) were tested. The subjects breathed during 15 minutes without and with different masks. The measuring method included a respiratory sound sensor which was affixed paralaryngeally on jugular and a pneumotachograph. The flow-curve was calculated using the envelope of frequency spectra via fast fourier transformation.

It was possible to achieve a very good correlation between the calculated flow-curve and the real flow (R>0,8) in all conditions.

This method is very easy to use and could be established for patients who are not eligible for conventional measurements (infants, measurement during sleep and for patients with noninvasive ventilation).

P930

Peripheral airway function in COPD assessed by Sacin and Scond using SF6 and He multiple breath washout

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Background: Peripheral airways, particularly acinar airways, are involved in COPD. Sacin for SF6 reflects ventilation inhomogeneity deep inside the acinus, while Sacin for He reflects inhomogeneity proximally in the acinus, and Scond indicates inhomogeneity in the small conducting airways. We tested the hypothesis that Sacin and Scond are greater for SF6 vs. He in COPD.

Mathods: Multiple breath SF6 and He washout, using a mass spectrometer, was performed at baseline and post bronchodilator (BD, 400 mcg salbutamol and 80 mcg ipratropium pMDI) prior to spirometry and DLCO: 41 COPD subjects (17M/24F), 45-66 yrs, smoking history 10-75 pack yrs. Reference values for Sacin and Scond were obtained in 46 non-smoking healthy subjects aged 19-71 yrs. Local spirometry and DLCO reference equations were used [1,2]. Results were expressed as median (range) z-scores, and wilcoxon rank sum test used for paired comparisons.

Results: SF6 Sacin and Scond z scores were greater than He indices both at baseline and post BD in COPD subjects (p<0.001 for all).

	At Baseline	Post BD	
FEV1	-2.8 (-5.6; -0.9)	-2.2 (-4.4 ; -0.6)	
FEV1/VC	-3.1 (-7.4; -1.0)	-2.6 (-7.2; 0.2)	
DLCO	-2.0 (-5.0; -0.6)		
Scond He	1.8 (-1.1; 7.7)	2.0 (-1.5; 7.5)	
Scond SF6	3.0 (-1.5; 10.5)	4.0 (-1.0; 10.4)	
Sacin He	5.9 (1.5; 23.8)	6.0 (0.8; 23.5)	
Sacin SF6	9.5 (2.4; 25.4)	8.5 (0.8; 28.6)	

Conclusions: COPD was characterized by greater ventilation inhomogeneity in the distal vs. the proximal acinar portion. The degree of ventilation inhomogeneity found in COPD within the acinus is greater than in the conducting airway zone. **References:**

[1] Hedenström et al. Bull Eur Physiopatol Respir. 1985;21:551-7.

[2] Hedenström et al. Upsala J Med Sci. 1986;91: 299-310.

P931 Spatial betaroo

Spatial heterogeneity in regional pulmonary function in COPD patients and healthy young and elderly subjects

healtny young and enterly subjects Barbara Gawelczyk¹, Sven Pulletz¹, Hans-Peter Hauber², Peter Zabel², Norbert Weiler¹, Inéz Frerichs¹. ¹Dept. of Anesthesiology and Intensive Care Medicine, University Medical Center Schleswig-Holstein, Campus Kiel, Kiel, Germany; ²Dept. of Pneumology, Medical Clinic, Research Center Borstel, Borstel, Germany

Introduction: Electrical impedance tomography (EIT) can determine regional dynamic gas volume changes in the lungs. The aim of our study was to examine the regional differences in lung function in COPD patients and healthy adults using EIT.

Patients and methods: 33 COPD patients (GOLD II-IV) and 25 healthy young and elderly adults were studied. EIT data were collected at up to 44 images/s (Goe-MF II, CareFusion, Hoechberg, Germany) in parallel with spirometry. Regional inspiratory (IVC) and forced vital capacities (FVC), forced expired volume in 1s (FEV₁) and tidal volume (V_T) were determined in 912 EIT image pixels in the chest cross-section. Coefficient of variation (CV) was calculated from all pixel values to characterize the heterogeneity of lung function. The average value reflecting the volumetric changes in the cross-section was also determined. Statistical analysis was carried out by one-way ANOVA with Bonferroni post test.

Results: The CV values of regional IVC, FVC, FEV₁ and V_T were significantly different between healthy adults and COPD patients (p values: 0.0102, 0.0050, 0.0022 and 0.0047). No differences existed between the young and elderly subjects. The average IVC, FVC, FEV₁ and V_T in the chest cross-section were significantly different among the groups (p values: <0.001, <0.001 and 0.0054). The highest values were noted in the young subjects, significant differences between the elderly and COPD patients were found for IVC, FVC and FEV₁.

Conclusion: EIT is able to detect disease and age related differences in regional lung function. The heterogeneity of lung function is similar in the young and elderly healthy subjects but lower than in COPD patients.

P932

Evaluation of respiratory impedance in COPD by forced oscillation technique using a MostGraph

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Background: COPD is characterized by not fully reversible airflow limitation and defined with the decrease in FEV1 by spirometry. The Forced Oscillation Technique (FOT) can detect impairments of lung function by measuring lung resistance and reactance during normal tidal breathing. A MostGraph is one of the FOT, using multi-spectrum oscillation technique, and demonstrates the frequency-dependent and time-dependent respiratory impedance in 3-dimensional graphics.



We evaluated the respiratory impedance during inspiratory and expiratory phase of normal breathing in COPD patients.

Methods: We recruited 26 outpatients with stable mild (n=13) and moderate (n=13) COPD at the University of Tokyo Hospital. The impedance of respiratory system was measured by FOT using a MostGraph. Respiratory resistance (Rrs) and respiratory reactance (Xrs) during inspiration and expiration were evaluated at 5 Hz and at 20 Hz of oscillatory frequency. **Results:** All indices of respiratory resistance, such as Rrs5 and Rrs20, were slightly

Results: All indices of respiratory resistance, such as Rrs5 and Rrs20, were slightly higher in moderate COPD than mild, although there were no significant differences. There was a tendency that the ratio between the difference of Rrs5max-min and the difference of Rrs20max-min within tidal breathing was higher in mild COPD than moderate (p=0.08).

Conclusion: The larger difference in Rrs5-20 during tidal breathing might be useful property to distinguish the severity of COPD.

P933 Freeflowmetry – The new method of evaluation of the respiratory function phenotype

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Introduction: Freeflowmetry is the new method of air flow and air volume measurement during forced and free breathing through the open or partially closed mouth or through the nose. Application of tight silicone mask connected with dPp^{0p} pneumotachograph allows adaptation of the natural resistance of the oral cavity in order to reduce the airway collapse.

The aim of the study was to compare the results of examination performed with dPP[®] pneumotachograph with mouthpiece, with the results of examination performed with silicone mask

Method: The examinations were performed using PNEUMO[®] PC spirometer [abcMED, PL] in group of COPD patients: 6 female and 4 male at age of 75 ± 5 years and in control group of healthy: 6 female and 2 male at age 73 ± 6 years. The results are shown in table 1.

Table 1

Method	Spirometric				Freeflowmetric		
Parameter	FIVC [L]	FVC [L]	ΔFVC [ml]	FEV1 [L]	FEV1/FVCmax	fFVC-CM [L]	∆fFVC] [ml]
COPD Control	1,55 2,77 NS	1,04 2,38 p<0,05	510 390 NS	0,92 2,11 p<0,05	0,59 0,76 NS	1,63 2,45 NS	590 70 p<0,05

 Δ FVC = FIVC – FVC; fFVC-CM = measurement of FVC through partially closed mouth; Δ fFVC = fFVC-CM – FVC.

Conclusion: Freeflowmetric examination can contribute to the optimization and individual adaptation of treatment, the determining of the phenotype of bronchial obstruction and/or airway collapse in common diseases such as COPD and asthma. Further studies are required for the comparison of freewlowmetric test results before and after physical exercise and before and after application of bronchoilator.

P934

Audit of a new mannitol challenge testing service in a UK tertiary centre Martyn Bucknall. Lung Function Department, Guys and St Thomas' NHS Foundation Trust, London, United Kingdom

Guys and St Thomas' NHS Foundation trust (GSTT) is a tertiary hospital based in London, UK, offering specialist allergy and asthma clinics.

In July 2010, GSTT switched from using histamine to mannitol for performing bronchial challenge testing (BCT). BCT is an essential diagnostic investigation for identifying/excluding asthma and monitoring responses to treatment regimes. We performed an audit of the new service, using mannitol between July 2010 and February 2011. We looked at patient demographics, (age, sex, baseline lung function), test outcomes (i.e. positive, negative, reasons for terminating test, fall in FEV1), sources of referral and clinical rweasons for referral to our laboratory. Table 1 shows patient demographics and baseline lung function. 60 patients were referred to the service (28M, 32F). The mean age was 40.2 yrs.

Table 1. Patient demographics

	All	Male	Female
Number (n, %)	60	28 (47%)	32 (53%)
Age in yrs, mean (range))	40.2 (16–70)	40.1 (21–66)	40.2 (16–70)
Baseline FEV1, % pred (range)	95.2 (54–145)	92.0 (55–145)	98.0 (54–130)

Table 2 shows source of referral and reason for referral.

Table 2. Source of referral				
Source of Referral	Number (%)			
Allergy	36 (60%)			
Thoracic Medicine	18 (30%)			
Paediatric Allergy	1 (1.66%)			
Cardiology	1 (1.66%)			
ENT	1 (1.66%)			
Oncology	1 (1.66%)			
Accident + Emergency	1 (1.66%)			
Unknown	1 (1.66%)			