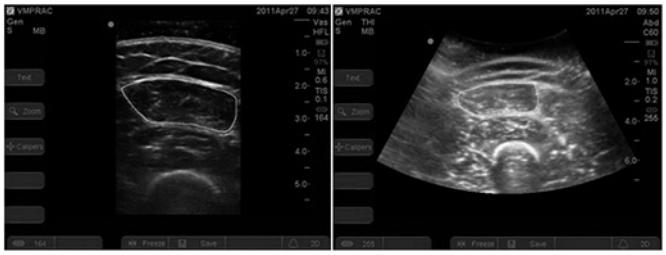

Abstract P132 Figure 1 RFcsa taken with a linear probe (image on left) and curvilinear probe (image on right) in the same individual at 2/3.

Conclusion These data demonstrate that both linear and curvilinear probes can be used to acquire accurate RFcsa measurements. Furthermore, "splicing" the images from the LUP, when a CUP is not available is a justified method to assess RFcsa. This method should be considered for RFcsa image acquisition in obese patients.

P133 LUNG CLEARANCE INDEX IS A REPRODUCIBLE AND SENSITIVE MEASURE OF AIRWAYS DISEASE IN BRONCHIECTASIS

doi:10.1136/thoraxjnl-2011-201054c.133

[1]S Rowan, [1]J Bradley, [1]M Ennis, [2]A Horsley, [3]N Bell, [4]P Gustafsson, [1]J S Elborn. *[1]Queens University Belfast, Belfast, N Ireland; [2]University of Manchester, Manchester, UK; [3]Bristol Royal Infirmary, Bristol, UK; [4]Central Hospital, Skovde, Sweden*

Introduction Lung clearance index (LCI) is a measure of ventilation in homogeneity derived from multiple breath washout (MBW). Although FEV_1 is commonly used to assess severity of airway disease and response to therapy, it is insensitive to small airways disease and is often within normal range in bronchiectasis (BE) not caused by Cystic Fibrosis (CF) until disease is well established. In CF, LCI is more sensitive than FEV_1 in detecting airways abnormalities and is currently used as an outcome measure in clinical trials. In BE, there is a need to find a sensitive outcome measure that is responsive to interventions, particularly in those with mild disease.

Objective To assess within and between visit repeatability of LCI and determine the relationship between FEV_1 and LCI in stable BE.

Methods Inclusion criteria: HRCT diagnosis of BE within the last 5 years; clinically stable (no infective symptoms for >4 weeks); no genetic or clinical features of CF. Participants attended for two visits, 2 weeks apart. At each visit they performed MBW in triplicate, using 0.2% sulphur hexafluoride and a modified Innocor device. LCI was derived from the mean of at least 2 acceptable washouts. Spirometry was performed to ATS/ERS standards.

Results 14 patients (8M/6F) attended for two visits. The mean (SD) age was 60.5 (15.4) yrs. Mean (SD) FEV_1 % predicted was 87.1 (18.6), range (44–117). Mean (SD) LCI was 9.4 (2.0) on visit 1 and 9.4 (1.9) on visit 2 (normal <7.5). The intra-visit coefficient of variation (CV) was 4.7 % (3 measures). Between visit repeatability of LCI was 0.54 (SD of variance between visits). LCI negatively correlated with FEV_1 ($r=-0.69$, $p<0.001$). Sensitivity of LCI and FEV_1 for the diagnosis of bronchiectasis by CT was 71% and 29% respectively.

Conclusions This is the first report of LCI in non-CF BE. LCI is a more sensitive test of lung function than FEV_1 and is abnormal in the majority of people with BE who have a normal FEV_1. LCI has good intra-visit and between visit repeatability. Across a range of FEV_1 there is a strong relationship between LCI and FEV_1.

P134 VALIDATING STRUCTURED LIGHT PLETHYSMOGRAPHY (SLP) AS A NON-INVASIVE METHOD OF MEASURING LUNG FUNCTION WHEN COMPARED TO SPIROMETRY

doi:10.1136/thoraxjnl-2011-201054c.134

[1]S Alimohamed, [1]K Prosser, [1]C Weerasuriya, [2]R Iles, [3]J Cameron, [3]J Lasenby, [4]C Fogarty. *[1]School of Clinical Medicine, University of Cambridge, Addenbrookes Hospital, Cambridge, UK; [2]Department of Respiratory Paediatrics, Cambridge University Hospitals, Addenbrookes Hospital, Cambridge, UK; [3]Signal Processing and Communications Laboratory, Department of Engineering, University of Cambridge, Cambridge, UK; [4]Department of Statistics, Harvard University, Cambridge, Massachusetts, USA*

Background Structured Light Plethysmography (SLP) is a recently developed technology for non-invasive and entirely non-contact monitoring of lung (respiratory) function. The system projects a structured light grid onto the thoraco-abdominal surface of the subject, which is imaged by two cameras giving a dynamic 3D reconstruction of the surface as the subject breathes. From this data we can infer changes in chest/abdomen volume over time, allowing us to extract parameters and generate curves (eg, Volume-Time, Flow-Time, Flow-Volume curves) directly comparable to conventional spirometry. SLP therefore hopes to provide an inexpensive replacement for conventional spirometry, which is an invasive methodology unusable in a number of patient classes (eg, neonates, young children, intensive care patients etc). This study tests the validity of SLP in terms of reproducibility, repeatability and position dependence, as compared to conventional spirometry (Pneumatach); by comparison of ventilation parameters extracted from both technologies.

Methods SLP and Pneumatach spirometry were used simultaneously to capture 120 datasets from 10 randomly chosen adult subjects. Each complete dataset contained tidal breathing and forced expiratory manoeuvres, in both sitting and standing positions. Operator-dependence (reproducibility) was tested by collecting data sets from each subject using three different operators. Repeatability was tested by collecting the data from each subject once, and then again after a 40 min break. Tidal Inspiratory Time (TI) parameters were extracted from the results and the data analysed using the paired Student t test.

Results There was no significant difference between TI values obtained from SLP compared to conventional spirometry throughout the study ($n=120$; $p=0.8556$). SLP comparisons of pooled mean TI before, and after a 40 min break were not significant (1.5589 vs 1.5595; $p=0.9938$); similarly, readings in different positions (sitting or standing) were not significantly different. SLP comparison of all three operator pairs (1vs2, 1vs3 and 2vs3), were not significant ($p=0.7361$, $p=0.9765$, $p=0.7343$, respectively).

Conclusions SLP measurements are not operator, time or position dependant. Therefore SLP shows a high degree of reproducibility and repeatability; and represents a promising, viable and non-invasive alternative to conventional spirometry.

P135 MAXIMUM INSPIRATORY FLOW MEASURED DIRECTLY WITH AN INSPIRATORY FLOW METRE COMPARED WITH MEASUREMENTS FROM FLOW VOLUME LOOP TRACES

doi:10.1136/thoraxjnl-2011-201054c.135

M C P Apps, M Skipper, J Skipper, S Basford, V Bryant, J Saines, T Andrews. *Queen's Hospital, Romford, UK*

Introduction Low Maximum Inspiratory Flow is characteristic of patients with muscle weakness, Laryngeal dysfunction, or Extra-thoracic airway obstruction. We have been exploring the use of an Inspiratory Flow Metre (In Check Dial- Clement Clarke International) to help in the identification of those patients who need more detailed investigation.

Methods We have compared the Inspiratory Flow rate (I) with the flow metre against Maximum Inspiratory flows taken from a flow volume loop (FVI) taken as part of routine lung function testing in 100 sequential subjects attending the Cardio Respiratory department for lung function testing.

Results We have found major variability in the FVI on flow volume traces despite attempts to obtain traces with maximum volume and effort. Only 36% of subjects had variability between attempts of <1 l/s, with 64% showing variability between attempts of >1 l/s, 24% of >2 l/s, and 3% >3 l/s. For measurements using the Inspiratory Flow metre If I>2 l/s all of the 38% of subjects showed FVI of 2 l/s or more. With I of <2 l/s there was agreement between the two methods ±0.3 l/s in 26%, and a further 14% with FVI of <2 l/s. 40% of subjects with Inspiratory Flow (I) of <2 l/s had FVI of <2 l/s. But in 22% of subjects I <2 l/s but FVI >2 l/s. FVI-I showed mean difference for these subjects of 2.4 l/s (range 0.9–4 l/s). In total 78% of subjects showed concordance of Maximum Inspiratory Flow to >2 l/s or >2 l/s between the two measurements and for 22% the inspiratory flow metre reading of <2 l/s did not reflect maximum Inspiratory Flow.

Conclusion There are major variations in the Maximum Inspiratory Flow measured with a flow volume loop but for a simpler measurement with an Inspiratory Flow metre if Maximum flow is >2 l/min then it is unlikely that Inspiratory flow is compromised. A simple clinic based measurement can be useful to exclude limitation of Inspiratory Flow but if abnormal further investigation is needed.

P136 COMPARISON BETWEEN PRIMARY CARE AND SECONDARY CARE SPIROMETRY

doi:10.1136/thoraxjnl-2011-201054c.136

K E Backler, L Leech, R C Buttery. *Hinchingbrooke Hospital NHS Trust, Huntingdon, UK*

Introduction Spirometric testing in primary care is promoted by the QoF for GPs. The validity of such tests is questionable, due to numerous factors, including poor technique, machine maintenance and interpretive skills. The COPD Strategy supports the use of quality-assured spirometry in primary care. This study assesses the accuracy of primary care-based spirometry in referrals to our chest clinic and new Direct Access Pulmonary Function service.

Aims

1. To validate GP spirometry values with Secondary care values.
2. To identify differences in diagnosis based on physiological measurements.
3. To identify changes in severity status on COPD patients.

Method An audit was conducted, comparing Spirometry performed in Primary care (various machines and various technicians) with Spirometry performed on the Masterscreen PFT (CareFusion) in Lung Function laboratory. Where appropriate, obstructive spirometry was classified using GOLD/NICE COPD guidelines.

Results 37 patients identified.

No Spirometry results from GP = 4 (11%)

No change = 17 (46%)

Changed = 16 (43%)

Of the 16 that had their diagnosis changed:

- 5 (31%) classified as restrictive on referral, but were normal
- 4 (25%) classified obstructive on referral, but were normal
- 7 (44%) classified as normal on referral, but were obstructive

Of all referrals which were classified as obstructive (22 patients), 64% had their GOLD severity changed:

- 8 maintained their severity as classified by GP spirometry (36%)
- 8 changed by 1 GOLD stage (36%)
- 6 changed 2 GOLD stages (27%)

Conclusion For patients with COPD, the cost in treating patients varies with their disease severity. A change in severity staging would significantly alter the cost of treatment for Primary Care, by influencing the appropriate choice of treatment interventions. Correct diagnosis in primary care is fundamental to appropriate treatment and referral pathways for patients with respiratory disease. This study identifies a significant difference in physiological diagnosis achieved in secondary care and supports the need for more quality-assured pulmonary function testing.

P137 INTERPRETATION OF PLETHYSMOGRAPHY IN HEALTHY YOUNG CHILDREN

doi:10.1136/thoraxjnl-2011-201054c.137

[1]J C Kirkby, [1]R Bonner, [1]S Lum, [2]P Bates, [2]V Morgan, [2]R Strunk, [1]F Kirkham, [1]S Sonnappa, [1]J Stocks. *[1]UCL, Institute of Child Health, London, UK; [2]Washington University, Missouri, USA*

Introduction Plethysmographic lung volumes are the gold standard for identifying restrictive lung defects (reduced TLC), and are useful for delineating obstructive defects (increased RV/TLC).[1] Interpretation of these measurements may, however, be limited without appropriate reference equations. The BTS recommend equations by Rosenthal[2] (based on white subjects) for children. However, to our knowledge, no ethnic-specific plethysmographic equations have been published for black children, in whom lower spirometric values are known to exist.

Aim To evaluate the appropriateness of plethysmographic reference equations in healthy young children according to ethnic origin.

Methods Healthy children (68 black and 115 white) aged 6–12 yrs underwent plethysmography measurements according to standardised guidelines.[1] Results were adjusted for sex and height and expressed as %predicted and z-scores using recommended equations.[2] Unpaired t-tests were used to establish ethnic differences.

Results Ethnic differences in lung volumes were dependent on the outcome: Black children had significantly lower FRC (~6% or 0.3z) and TLC (~8% or 0.6z), but no significant differences in RV such that their RV/TLC ratio was significantly higher (Abstract P137 table 1). In addition, relatively poor agreement between observed vs predicted FRC was seen in healthy white children. To avoid misdiagnosis, the limits of normality (mean±2 SD) need to be adjusted to cater for these discrepancies. These preliminary data suggest that, based on the Rosenthal equations, the lower limit of normal for TLC, (to detect restriction), would be ~75% predicted (−2.1z) for black children and ~80% predicted (−1.7z) for white children. For detecting hyperinflation using RV/TLC the upper limit of normal would be ~148% predicted (2.3z) for black children and ~135% predicted (1.7z) in white children, whereas for FRC they would be ~111%predicted (0.4z) and 122% predicted(1.2z) in black and white children respectively.

Abstract P137 Table 1 Comparison of plethysmographic outcomes between 68 healthy black and 115 healthy white children

	Black mean (SD)	White mean (SD)	Mean diff (95% CI) (black−white)
N (% male)	68 (46%)	115 (45%)	
Age (yr)	10.0 (1.5)	8.9 (1.7)	1.1 (0.6 to 1.5)**
FRC % pred	86.2 (12.6)	91.2 (15.4)	−5.8 (−10.1 to −1.4)*
FRC z-score	−0.7 (0.6)	−0.4 (0.8)	−0.3 (−0.5 to −0.1)*
RV % pred	103.7 (20.0)	99.0 (23.4)	4.7 (−2.0 to 11.4)
RV z-score	0.1 (0.7)	0 (0.8)	0.2 (−0.1 to 0.4)
TLC % pred	94.2 (9.8)	101.7 (11.0)	−7.5 (−10.6 to −4.3)**
TLC z-score	−0.5 (0.8)	0.1 (0.9)	−0.6 (−0.9 to −0.4)**
RV/TLC % pred	110.2 (19.0)	96.9 (19.0)	13.2 (7.5 to 19.0)**
RV/TLC z-score	0.5 (0.9)	−0.1 (0.9)	0.6 (0.3 to 0.9)**

*p<0.05, **p<0.0005.