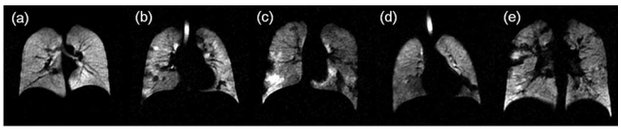
corresponding to the LCI values given), and VV% = 89.2(2.6). 2 of the 4 CF patients had normal sitting and supine LCI and 2 of 3 had no evidence of gas trapping, but ^{3}He MRI showed clear focal ventilation defects in all patients (b-d).

Conclusions High quality ^{3}He MRI images can be produced in young children. Preliminary results suggest that hyperpolarised ^{3}He ventilation MRI may be more sensitive to early ventilation changes in CF than LCI or conventional lung function tests.

Acknowledgements CF Trust funding



Abstract S8 Figure 1. Ventilation images from (a) a healthy volunteer and (b-e) patients with mild CF.

S9 SIFT-MS ANALYSIS AS A NON-INVASIVE DETERMINANT OF PSEUDOMONAS AERUGINOSA INFECTION IN PATIENTS WITH CYSTIC FIBROSIS

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Background There is evidence that *Pseudomonas aeruginosa* (Pa) produces volatile organic compounds (VOCs) such as hydrogen cyanide (HCN) and 2-aminoacetophenone (2-AA). VOCs in exhaled breath are therefore proposed as potential biomarkers of infection. We hypothesised that selective ion-flow mass spectrometry (SIFT-MS) breath analysis might allow discrimination of CF patients with (CF + Pa) and without Pa (CF-Pa).

Methods 79 adults (31 CF + Pa, 22 CF-Pa and 26 healthy controls) provided starved, single tidal exhalation breath samples into Nalophan^{TM} bags. Quantification of 15 VOCs was performed within two hours on SIFT-MS. All results are presented as (median parts-per-billion by volume [IQR]).

Results 2-AA was significantly higher in CF + Pa than CF-Pa (5.0 [3.4–7.1] vs. 1.3 [0.0–3.2], p <0.01). However, there was significant overlap and median co-efficient of variation was 35.41%; clinical utility is therefore questionable.

Dimethyl disulphide was also significantly higher in CF + Pa (95.2 [41.3–211.2 vs. 35.5 [22.1–79.8], p < 0.01). When combined with 2-AA, area under ROC curve was 0.867.

Counter to our sputum results, there was no difference in HCN between CF + Pa and CF-Pa (8.1 [5.0–11.9] vs. 6.9 [4.4–11.0], n/s) or between all CF patients and healthy controls (7.8 [4.9–11.5] vs. 7.0 [4.6–11.5], n/s).

Our early *in vitro* data showed decreased butanol above Pa cultures, suggesting consumption. This was replicated in breath with lower levels in CF + Pa vs. CF-Pa (37.4 [24.3–87.6] vs. 91.7 [46.9–143.7], p < 0.05).

Of VOCs likely to be of host origin, isoprene was increased in CF vs. controls (108.0 [83.4–195.5] vs. 69.6 [46.9–89], p < 0.01) with no difference between CF + Pa vs. CF-Pa. Acetone was reduced in CF (269.9 [161.9–356.4] vs. 324.9 [236.7–598.9], p < 0.01).

Conclusions 2-AA is a potential biomarker of Pa infection but clinical applicability is uncertain. Dimethyl disulphide and butanol also show promise. Mouth-exhaled HCN assessed by SIFT-MS does not appear to fulfil its promise as a Pa biomarker. Other VOCs assessed were either similar between Pa groups or different between healthy controls and CF, but unable to differentiate between Pa status. This study provides proof-of-concept for the development of a non-invasive tool with which to screen for lower airway bacterial infection in CF though a clinically applicable test remains some way off.

S10 LUNG CLEARANCE INDEX (LCI) AND PSEUDOMONOUS AERUGINOSA IN ADULTS AND CHILDREN WITH CYSTIC FIBROSIS (CF)

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Introduction LCI obtained from multiple breath washout (MBW) is a sensitive measure of ventilation inhomogeneity in CF. Persistent colonisation with *P. aeruginosa* is associated with a decline in LCI in children (Kraemer *et al*. 2006). Further research is required to investigate the relationship between airways infection and LCI in adults.

Objective To investigate the sensitivity of LCI to *P. aeruginosa* in adults and children compared with FEV_1%pred and $FEF_{25–75}$% pred.

Methods Stable CF patients from adult & paediatric Northern Ireland CF centres were recruited. LCI was derived from MBW, using 0.2% SF_6 and a modified Innocor^{TM}device. *P. aeruginosa* status was determined from routine diagnostic culture of a sputum sample or deep throat swab. Patients categorised as having *P. aeruginosa* infection met the criteria of chronic infection as defined by the Leeds criteria (Lee *et al*. 2003).

Analysis Receiver-operator characteristic (ROC) curves and area under the receiver operating curves (AUC_{ROC}) indicate the level of sensitivity and specificity where 1.0 = perfect discrimination considering sensitivity and specificity.

Results Sixty-seven adults were recruited (39M), median (IQR) age 27 (16) years. Mean (SD) FEV_1%pred 71.8 (20.3), median (IQR) $FEF_{25–75}$%pred 40.0 (46.7) and mean (SD) LCI 10.3 (3.0) lung volume turnovers. 49% had *P. aeruginosa* infection.

Forty-three children were recruited (24M), mean (SD) age 11.7 (3.4) years. Mean (SD) FEV_1%pred 85.2 (16.6), mean (SD) $FEF_{25–75}$%pred 66.0 (27.6) and mean (SD) LCI was 7.8 (1.8) lung volume turnovers. 16% had *P. aeruginosa* infection

Compared to FEV_1%pred and $FEF_{25–75}$%pred, LCI had the greatest sensitivity and specificity to discriminate between CF patients with and without *P. aeruginosa* in both adults and children. Adult AUC_{ROC} (SE) for LCI = 0.82 (0.05), p < 0.0001, compared with FEV_1%pred = 0.66 (0.07), p = 0.021 and $FEF_{25–75}$%pred = 0.64 (0.07), p = 0.044 (Figure 1). Child AUC_{ROC} (SE) for LCI = 0.85 (0.10), p = 0.004, compared with FEV_1%pred = 0.80 (0.12), p = 0.014 and $FEF_{25–75}$% pred = 0.67 (0.13), p = 0.152.

Conclusion LCI is more sensitive and specific to the presence of *P. aeruginosa* airways infection across the age groups in CF compared with spirometry.

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