

**P227** **CROSS-SECTIONAL ASSESSMENT OF SMALL AIRWAYS TESTS IN IDENTIFYING EARLY DISEASE IN ALPHA-1 ANTITRYPSIN DEFICIENCY**

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**Rationale** Alpha-1 Antitrypsin Deficiency (AATD) is a rare genetic disease that can lead to the COPD, particularly in severe deficiency (PiZZ). COPD is currently defined by an FEV<sub>1</sub>/FVC ratio below 70%, at which point significant disease can already be well established. We have previously shown that a baseline Maximal Mid-Expiratory Flow (MMEF) less than 80% predicted in patients with a normal FEV<sub>1</sub>/FVC ratio can identify AATD patients with worse health status and a faster subsequent FEV<sub>1</sub> decline (Stockley et al. *ERJ* 2017;49(3).pii:1602055). We sought to determine if other small airways tests could identify a similar at risk population.

**Methods** 88 never- or ex-smoking PiZZ subjects were studied (57 without COPD and 31 with GOLD Stage I mild COPD) with routine lung function tests (spirometry, lung volumes and gas transfer) and tests of small airway function (lung clearance index (LCI), impulse oscillometry (R5 and R5-R20), and specific resistance (sRaw) and specific conductance (sGaw) by plethysmography). Additional spirometric parameters were also investigated (MMEF and the area under the expiratory flow-volume curve standardised for FVC (AEx/FVC)). Scatter plots of each 'small airways' parameter versus FEV<sub>1</sub>/FVC were visually analysed and, where appropriate, analysed by Spearman's rank correlation. The data were also grouped into non-COPD and mild COPD and compared using a Mann-Whitney U test.

**Results** Oscillometry and sGaw did not correlate with FEV<sub>1</sub>/FVC and were not different between the non-COPD and COPD cohorts. There were weak but significant correlations between FEV<sub>1</sub>/FVC and LCI ( $r^2=0.163$ ,  $p<0.01$ ), sRaw ( $r^2=0.156$ ,  $p<0.01$ ), and Kco ( $r^2=0.199$ ,  $p<0.01$ ) and stronger correlations between FEV<sub>1</sub>/FVC and MMEF ( $r^2=0.731$ ,  $p<0.0001$ ), and AEx/FVC ( $r^2=0.698$ ,  $p<0.0001$ ). These parameters were significantly different between the non-COPD and COPD cohorts (table 1). As with our previous study, MMEF identified a proportion of patients (n=24) with small airways dysfunction without established COPD. This number was less (n=8) when using AEx/FVC.

**Abstract P227 Table 1** Median (IQR) data from each test in AATD patients without COPD (n=57) and those with Gold Stage I (mild) COPD (n=31)

Parameter	Non-COPD	COPD	p
MMEF (% Pred)	79.3 (67.2–101.5)	32.0 (27.9–46.4)	<0.0001
Aex/FVC% (Pred)	94.8 (82.8–100.4)	54.3 (54.3–72.3)	<0.0001
LCI	8.7 (7.4–9.4)	9.9 (7.7–11.9)	0.02
sRaw (% Pred)	82.5 (71.8–100.1)	115.2 (90.5–126.9)	<0.0001
sGaw (% Pred)	121.9 (105.5–144.1)	95.6 (84.5–134.8)	ns
R5 (% Pred)	82.9 (70.2–103.6)	83.8 (72.5–96.0)	ns
R5-R20	0.025 (0.01–0.05)	0.035 (0.02–0.05)	ns
Kco	82.0 (73.0–96.0)	69.0 (61.0–80.0)	<0.01

**Conclusions** Cross-sectionally, LCI, impulse oscillometry and plethysmography do not appear to be useful markers of early disease in AATD. MMEF and AEx may be more useful but will need to be assessed longitudinally for their ability to detect change in lung physiology that reflects long term progression.

**P228** **RECORDING OF SPIROMETRY AMONGST PATIENTS WITH IDIOPATHIC PULMONARY FIBROSIS IN PRIMARY CARE: A UK GENERAL POPULATION BASED STUDY**

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**Background** We have previously shown that the incidence of idiopathic pulmonary fibrosis (IPF) in the UK is on the rise and that some individuals with IPF may be symptomatic up to five years prior to diagnosis. The aim of our study was to investigate recording of spirometry, in particular Forced Vital Capacity (FVC) amongst incident cases of IPF in primary care. **Methods** Using data from The Health Improvement Network (THIN), an electronic longitudinal UK primary care database, we ascertained what proportion of incident cases of IPF had at least one recorded FVC prior to diagnosis. We used previously published Read Codes to identify incident cases of IPF and extracted information on FVC recorded prior to date of diagnosis. Logistic regression was used to generate odds ratios for the probability of having at least one recorded FVC amongst incident cases of IPF stratified by age, sex and calendar period of diagnosis.

**Results** Our cohort consisted of 2070 incident cases of IPF, of which 1305 (63.0%) were male and the mean age at diagnosis was 74.6 years (Standard Deviation [SD] 9.6). 488 cases (23.6%) had at least one FVC recorded prior to date of diagnosis. There was no association between gender and a record of FVC, after adjusting for age and calendar period of diagnosis. (Odds Ratio [OR] 0.97, 95% Confidence Interval [CI] 0.76 to 1.23). We also found that people with IPF over the age of 85 years were 63% less likely to have a recorded FVC compared to individuals with IPF under the age of 65 (OR 0.37, 95% CI 0.24 to 0.58) and individuals diagnosed from 2010 onwards were almost 19 times more likely to have a recorded FVC compared to individuals diagnosed prior to 2005 (OR 18.99, 95% CI 13.07 to 27.58).

**Conclusion** At present, spirometry amongst patients with IPF in primary care is poorly recorded, especially in the elderly.

**P229** **FEASIBILITY OF CARDIOPULMONARY EXERCISE TESTING IN IDIOPATHIC PULMONARY FIBROSIS**

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**Introduction** Idiopathic pulmonary fibrosis (IPF) is a chronic, progressive interstitial lung disease of irreversible declining

lung function. Reductions in forced vital capacity (FVC) and diffusion capacity for carbon monoxide ( $DL_{CO}$ ) are the common clinical endpoints for prognostic monitoring and assessing treatment outcomes. The use of cardiopulmonary exercise testing (CPET) in IPF remains largely unexplored.

**Objectives** To explore the feasibility of CPET as a clinical measure in IPF and identify associations with established clinical variables.

**Methods** Seventeen patients with IPF were approached, and fifteen (88%) were recruited (13 male,  $68.1 \pm 7.5$  years). Incremental exercise testing to exhaustion was undertaken via electronically braked cycle ergometer. Variables included: peak oxygen consumption ( $VO_{2peak}$ ), peak work rate ( $WR_{peak}$ ), nadir  $SpO_2$ , ventilatory drive ( $V_E/VCO_2$ ), alongside standard clinical pulmonary function tests of FVC and  $DL_{CO}$ . Pearson's correlation coefficients established relationships between variables.

**Results** One participant was excluded (high baseline systolic blood pressure). Eight out of fourteen (57%) participants reached volitional exhaustion. Five CPETs were terminated early due to desaturation ( $SpO_2 < 88\%$ ) and one to an exercise-induced right bundle branch block (recovery within minutes of ceasing exercise). Mean ( $\pm$ SD) pulmonary and exercise results were: FVC,  $84.9\% \pm 17.0\%$ ;  $DL_{CO}$ ,  $56.5\% \pm 11.4\%$ ;  $VO_{2peak}$ ,  $1.4 \pm 0.4$  L.min<sup>-1</sup>,  $16.5 \pm 5.5$  mL.kg<sup>-1</sup>.min<sup>-1</sup>;  $WR_{peak}$ ,  $104 \pm 42$  W;  $SpO_2$ ,  $90 \pm 3\%$ ;  $V_E/VCO_2$ ,  $27.1 \pm 6.4$ . Significant correlations were identified between: FVC and  $SpO_2$  ( $r=0.58$ ,  $p=0.032$ ),  $DL_{CO}$  and  $V_E/VCO_2$  ( $r=0.81$ ,  $p<0.001$ ) and  $WR_{peak}$  ( $r=0.58$ ,  $p=0.03$ ). Body-mass relative  $VO_{2peak}$  held moderate, but not significant relationships with FVC ( $r=0.44$ ,  $p=0.11$ ) and  $DL_{CO}$  ( $r=0.53$ ,  $p=0.51$ ).

**Conclusions** Initial findings from this study have found CPET to be acceptable to patients with IPF and potentially feasible as a testing measure. Preliminary results identified common exercise desaturation, suggesting less conservative  $SpO_2$  termination criteria (e.g. 80% cut-off) could be considered. Although exercise parameters held limited relationships with FVC and  $DL_{CO}$ , results from  $VO_{2peak}$  identifies potential additional and dynamic prognostic information and warrants further investigation.

### P230 THE LUNG CLEARANCE INDEX IN ADULTS WITH CONNECTIVE TISSUE DISEASE – A PILOT STUDY IN RHEUMATOID ARTHRITIS

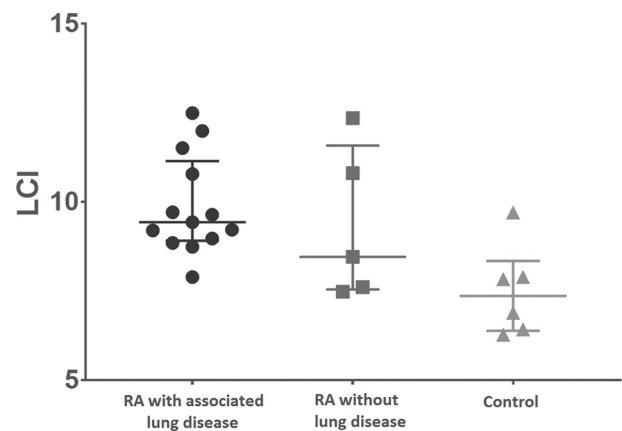
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**Introduction and objectives** Initial manifestations of lung disease in rheumatoid arthritis often occur in the small airways which can be challenging to measure using traditional lung function tests. The lung clearance index (LCI), measured by the nitrogen multiple breath washout (MBW) is a non-invasive measure of ventilation inhomogeneity and has been shown to be elevated in patients with primary lung disease.

This study aimed to assess whether LCI,  $S_{cond}$  (convection-dependent ventilation inhomogeneity) and  $S_{acin}$  (diffusion-convection dependent inhomogeneity) were elevated in patients with rheumatoid arthritis related lung disease and to assess whether MBW is feasible in this patient population.

**Methods** 19 patients with rheumatoid arthritis (5 without lung disease and 14 with associated lung disease) were recruited



**Abstract P230 Figure 1** Lung clearance index in each group. Median and inter-quartile range (IQR) for each group indicated by solid lines

from the respiratory and rheumatology clinics at North Bristol NHS Trust. Each patient participant completed spirometry, MBW and health-related quality of life (HRQoL) questionnaires at a single study visit. A separate group of 8 healthy controls also completed spirometry and MBW at a single visit. MBW was completed using the EasyOne proLAB™ (nidd Medizintechnik AG, Zurich, Switzerland).

**Results** The mean time to perform a single test was 214 s and the mean number of tests required to achieve 3 acceptable efforts was 3.5 tests. All MBW parameters were repeatable (intra-class correlation coefficient  $> 0.8$ ).

LCI and  $S_{acin}$  were significantly increased in patients with associated lung disease compared to healthy controls ( $p=0.008$ ,  $p=0.004$ ). No significant difference was seen in LCI and  $S_{acin}$  between patients without lung disease and healthy controls ( $p=0.171$ ,  $p=0.083$ ). There was no significant difference in spirometry z-scores.

There was a significant correlation between LCI and HRQoL as measured by K-BILD and SGRQ.

**Conclusion** MBW is a repeatable and feasible technique in patients with rheumatoid arthritis. The data from this pilot study suggests that N<sub>2</sub> MBW may be a promising technique in the assessment of lung disease in patients with rheumatoid arthritis, with LCI and  $S_{acin}$  appearing to be the most useful parameters.

The findings support the further investigation of MBW in patients with rheumatoid arthritis in a longitudinal cohort study to assess the variability over time and the relationship with HRQoL.

### P231 THE FEASIBILITY AND REPEATABILITY OF THE LUNG CLEARANCE INDEX VIA MULTIPLE BREATH WASHOUT MEASUREMENTS IN STABLE CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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**Introduction and objectives** Chronic Obstructive Pulmonary Disease (COPD) is a small airway disease associated with ventilation heterogeneity. The Lung Clearance Index (LCI)