controls, $P = 0.92$). Areas of normal lung in IPF patients exhibited increased ^{18}F -FDG uptake compared to controls measured by maximum SUV (0.98 ± 0.32 in IPF and 0.70 ± 0.20 in controls, $P < 0.01$) and mean SUV (0.80 ± 0.29 in IPF and 0.57 ± 0.18 in controls, $P < 0.01$).

Conclusions We confirm that in IPF, areas of normal appearing lung exhibit increased ^{18}F -FDG uptake compared with corresponding areas in controls. A longitudinal study is required to establish the relationship between ^{18}F -FDG uptake, disease progression and treatment response.

REFERENCE

- 1 Win T, Thomas BA, Lambrou T, *et al.* Areas of normal pulmonary parenchyma on HRCT exhibit increased FDG PET signal in IPF patients. *Eur J Nucl Med Mol Imaging* 2013;**41**(2):337–42.

P43 HYPERPOLARISED XENON-129 MRI OF LUNGS IN HEALTHY VOLUNTEERS: A SAFETY & FEASIBILITY STUDY

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Introduction Conventional proton MRI, although non-invasive and non-ionising, is of little value in imaging the lungs due to poor signal intensity. Hyperpolarised xenon-129 MRI (^{129}Xe -MRI) is a novel technique developed to enhance the applicability of MRI in lung imaging. It has the potential to provide not only anatomical data but also regional lung function data, particularly as xenon is highly lipophilic, and can be used as a gas exchange probe.

Aim We aimed to assess the feasibility and tolerability of ^{129}Xe -MRI in healthy adult volunteers.

Method This was a single centre prospective observational study. Ethical approval had been obtained. The volunteers had provided written informed consent. A GE 2000 polariser was used for production of hyperpolarised ^{129}Xe , with a 1.5T GE MRI scanner for imaging.

The volunteers underwent a conventional MRI thorax, followed by ^{129}Xe -MRI of lungs. The inhaled volume of hyperpolarised ^{129}Xe ranged 0.6–1.0L. There was 30 minutes of observation with recording of vital signs, i.e., oxygen saturations (O_2 sats), heart rate (HR), and blood pressure (BP) at 5, 10, 15, and 30 minutes post-inhalation of xenon, after each scan. Each visit comprised of a maximum of four scans.

Results Nine volunteers (male: female 8:1, aged 20–34) underwent 28 scan visits, comprising of 102 scans. ^{129}Xe -MRI was well-tolerated, with no serious adverse events. The polarisation achieved ranged 4.10–10.57%.

To assess the impact of inhaling xenon on vital signs as a safety measure, the recorded vital signs were analysed using student's t-test. There was no significant change in O_2 sats or BP. The most notable change was noted in HR, which was persistently reduced following inhaling xenon ($p < 0.001$). These changes were not deemed clinically significant.

We achieved good image quality (Figure 1). Spectroscopy distinguished lung tissue-dissolved xenon from blood-dissolved. Dissolved phase imaging (DPI) was obtained. The technique was reproducible.

Discussion The data demonstrates satisfactory feasibility and tolerability of ^{129}Xe -MRI. DPI can image regional gas exchange. ^{129}Xe -MRI may be used to develop biomarkers of disease progression, and assess drug efficacy, to personalise medicine, reduce healthcare costs, and lower cost and duration of drug development.

P44 COMPARISON OF STRUCTURAL BRAIN ABNORMALITIES AND COGNITIVE FUNCTION IN COPD PATIENTS AFTER HOSPITALISATION, STABLE COPD PATIENTS AND HEALTHY AGE-MATCHED CONTROLS

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Introduction and objectives Cognitive impairment is a common co-morbidity in chronic obstructive pulmonary disease (COPD) and is associated with poor disease management, greater disability and mortality [Chang *et al.*, *J Am Geriatr Soc*, 2012;60:1839–46]. We have previously shown that cognitive impairment is worse in COPD patients during and after hospitalisation for exacerbations, than in those with stable disease [Dodd *et al.* *Chest*, 2013;144:119–27]. Our aim was to use multimodal brain magnetic resonance imaging (MRI) to compare structural brain abnormalities between hospitalised and stable COPD patients and healthy controls.

Methods 23 COPD patients hospitalised for exacerbations within the last year (hospitalised), 17 COPD patients not hospitalised

Abstract P43 Figure 1 25 mm coronal plane (top row) and axial plane ^{129}Xe -MRI of a healthy volunteer

Abstract P44 Table 1 Clinical, demographic and MRI indicators in hospitalised and stable COPD patients and controls

	Hospitalised COPD	Stable COPD	Controls	P value	Post hoc tests
Number (n)	23	17	23	—	—
Age (years) ¹	69 ± 11	67 ± 7	66 ± 7	0.477	—
Gender (% male) ²	61%	60%	46%	0.540	—
FEV ₁ (% predicted) ³	51 ± 18	54 ± 24	—	0.604	—
Smoking (pack years) ⁴	43 (35)	60 (25)	0 (3)	<0.0001	H>C** S>C**
Cognitive function (/30) ⁴	23.0 (5)	27.0 (2)	28.5 (3)	<0.0001	H>C**
White matter lesion volume (ml) ⁵	8.9 (17.0)	7.4 (16.5)	3.0 (7.2)	0.026	—
Normalised whole brain volume (ml) ⁵	1399 (113)	1424 (121)	1381 (111)	0.736	—
Normalised brain ventricular volume (ml) ⁶	71.1 ± 27.6	52.8 ± 22.8	53.1 ± 19.1	0.016	H>S* H>C*

Values are given as mean±standard deviation or median (interquartile range). Statistical tests: 1. One-way analysis of variance; 2. Pearson Chi-square test; 3. Independent t test; 4. Kruskal-Wallis test with post hoc Dunn-Bonferroni; 5. Kruskal-Wallis test; 6. One-way analysis of variance with post hoc Bonferroni; * $p<0.05$; ** $p<0.0001$.

within the last year (stable) and 23 healthy age-matched controls, were recruited. Exclusion criteria included neurological or psychiatric disorders, cerebrovascular disease or hypertension. Cognition was measured using the Montreal Cognitive Assessment. T1-weighted (T1W), diffusion tensor (DTI) and Fluid Attenuated Inversion Recovery (FLAIR) were acquired using a Philips 3T scanner. The following brain indicators were calculated: normalised whole brain and ventricular volumes (scan: T1W, software: SIENAX), white matter microstructural fractional anisotropy and mean diffusivity – compared voxelwise using tract-based spatial statistics (DTI, FSL), and white matter lesion volume (FLAIR, *dis-punc*). Ethical approval was obtained (15/LO/0425).

Results Cognition was clinically impaired in hospitalised COPD (median (IQR); 23.0 (5)) but not in stable patients (27.0 (2)) or controls (28.5 (3)), with a significant difference only between hospitalised patients and controls ($p < 0.0001$). No significant differences were found in normalised whole brain volume, however, normalised brain ventricular volume was significantly greater in hospitalised COPD, compared to stable COPD ($p = 0.046$) and controls ($p = 0.028$). Hospitalised and stable COPD patients had widespread significant reductions in fractional anisotropy and increased mean diffusivity throughout the white matter skeleton, compared to controls ($p < 0.001$). Hospitalised patients had the highest white matter lesion volume, however this was not significantly different between groups.

Conclusions Hospitalised COPD patients have greater cognitive impairment compared to stable COPD and controls with evidence of greater ventricular and white matter lesion volumes and damaged white matter microstructure. Mechanisms behind these neuropathological processes and possible links to observed cognitive dysfunction remain unclear, but may involve ischaemic small-vessel disease.

Background Pulmonary hypertension (PH) is important in COPD as it predicts death and hospitalisation. The diagnosis is made by right heart catheter (RHC). Several predictive cardiac MRI (CMR) models have been proposed to estimate mean pulmonary artery pressure (mPAP):

1. VMI/IVS: $-4.6 + (\text{interventricular septal angle (IVS)} \times 0.23) + (\text{ventricular mass index (VMI)} \times 16.3)^1$
2. PA/RV: $\times 21.806 + (\text{IVS} \times 0.31) + (\text{VMI} \times 11.5) + (\text{Diastolic pulmonary artery (PA) area} \times 0.01) - (\text{PA relative area change} \times 0.22)$
3. Alpha-index: minimum PA area/right ventricular ejection fraction²

The predictive value of these models in a COPD population with suspected PH remains unknown, so we aimed to assess their diagnostic accuracy.

Methods All consecutive patients referred to a PH centre from April 2012 to October 2015 with suspected PH were assessed. Any patient with a formal diagnosis of COPD was included. Sensitivity and specificity were calculated using diagnostic cut-offs published in the literature (VMI/IVS = 32, PA/RV model = 25, alpha index = 7.2). Ethical approval was granted.

Results 1864 patients were referred to the PH centre, 145 had a documented diagnosis of COPD, 102 had MRI and RHC within 90 days. All CMR models showed good correlation with RHC measured mPAP (Pearson's R for (i) VMI/IVS = 0.689, (ii) PA/RV model = 0.732 and (iii) Alpha-index = 0.527). Sensitivity and specificity for (i) VMI/IVS were 92% and 79%, (ii) PA/RV model 80% and 93% and (iii) for Alpha index 100% and 13% respectively. An ROC curve for the diagnosis of PH for each of the models is provided.

Conclusion VMI/IVS and PA/RV models both have good accuracy in the detection of PH in COPD patients. Alpha-index had a low specificity, largely due to a low diagnostic threshold. As such these models are useful in the assessment of PH, and likely prognosis in patients with COPD.

P45 NON-INVASIVE METHODS FOR THE ESTIMATION OF MPAP IN COPD PATIENTS USING CARDIAC MRI

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