via their N-terminus or side chain amino group with a 6-amino- or a 6-azido-hexanoic acid spacer to provide a convenient attachment site for either 1,4,7,10-tetraazacyclododecane-1,4,7,10-tetraacetic acid (DOTA) or an 2-ethynyl-6-[¹⁸F]-fluoropyridine prosthetic group for radiolabelling with ⁶⁸Ga or ¹⁸F, respectively. The $\alpha_v\beta_6$ -binding capability of these peptide derivatives was assessed by competitive binding enzyme-linked immunosorbent assay (ELISA) and flow cytometry. Peptide derivatives that displayed strong affinity for $\alpha_v\beta_6$ were taken forward to “hot” cell surface binding experiments to evaluate their selectivity for the target. Stability of radiolabelled peptides was measured in human serum.

Competitive binding ELISA experiments (Figure 1) and flow cytometry experiments, showed that cRGD1 and cRGD4 were able to inhibit the binding of $\alpha_v\beta_6$ -specific 10D5 mAb to $\alpha_v\beta_6$ with IC₅₀ values of 6.6 nM and 1.6 nM, respectively. Labelling cRGD1 and cRGD4 with fluorine and gallium resulted in IC₅₀ values of 12.2 nM and 1.2 nM for ¹⁹F-Pyr-cRGD1 and ⁶⁸Ga-DOTA-cRGD4, respectively. Serum stability studies of ⁶⁸Ga-DOTA-cRGD4 have shown that this tracer is >90% stable after 2 half-lives of ⁶⁸Ga (136 min).

Radiolabelled cyclic RGD peptides have showed favourable binding and stability characteristics to warrant their investigation by PET imaging *in vivo*. A xenograft murine model using $\alpha_v\beta_6^+$ and $\alpha_v\beta_6^-$ tumours is currently under development to validate tracer uptake and biodistribution *in vivo*.

Abstract P40 Figure 1 $\alpha_v\beta_6$ competitive binding ELISA between labelled/non-labelled cyclic peptides and the $\alpha_v\beta_6$ -specific mAb (clone10D5)

P41 A PROSPECTIVE COHORT STUDY TO MEASURE IN-VIVO CHANGES IN LUNG GLUCOSE METABOLISM IN PATIENTS WITH SSCL-ILD USING FDG-PET

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Background Systemic sclerosis (SSc) is a chronic inflammatory autoimmune rheumatic disease with a UK prevalence of 2–10 per 100,000. It is a heterogenous disease characterised by varying degrees of dermal and organ fibrosis. Interstitial lung disease (ILD) occurs in 60–80% of patients and ranges from mild, clinically trivial disease to extensive fibrosis that results in respiratory failure and premature death. Therapeutic options include cyclophosphamide, mycophenylate mofetil and rituximab. Clinical decisions are complex and decisions to treat or not have historically been based on radiology and lung function tests, neither of which (at a single time point) give a dynamic view of disease

progression. Novel biomarkers are urgently needed to predict disease activity, progression and response to treatment in patients with SScl-ILD.

Aims To investigate the potential of 18Fluoro-deoxyglucose Positron Emission Tomography (FDG-PET)/CT to act as a prognostic and response biomarker in patients with SScl-ILD.

Methods 35 SScl-ILD patients were prospectively recruited for 18F-FDG-PET/CT. Patients were screened for lung involvement using clinical assessment, chest X-ray and pulmonary function testing (PFT). Those with confirmed SScl-ILD underwent combined high resolution CT scan (HRCT)/PET scanning. The imaging signal and clinical findings were correlated with the need for, and response to, therapy. Follow up was with clinical assessment, PFT and when a change in treatment was indicated, repeat imaging.

Results The overall maximum pulmonary uptake of 18F-FDG (SUVmax), the minimum pulmonary uptake or background-lung-activity (SUVmin) and target-to-background (SUVmax/SUVmin) ratio (TBR) were quantified using routine region-of-interest analysis. Kaplan-Meier analysis was used to identify associations with disease progression and response to treatment

Conclusions We have shown that high pulmonary uptake of 18F-FDG is associated with disease activity and progression in patients with SScl-ILD. These PET findings can be used to give additional information, supplemental to PFTs, which may then aid clinical treatment decisions.

P42 INCREASED FDG UPTAKE IN AREAS OF ‘NORMAL’ LUNG IN IDIOPATHIC PULMONARY FIBROSIS

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Background Idiopathic pulmonary fibrosis (IPF) has a variable disease course and we lack biomarkers that accurately predict prognosis or treatment response. Positron Emission Tomography-Computed Tomography (PET-CT) provides structural and functional information about the lung. A study of 25 IPF patients reported increased 18[F]-FDG uptake in areas of normal lung compared to controls.¹ If confirmed, this raises the possibility that PET-CT can identify ‘microscopic fibrosis’ with prognostic implications. We assess 18[F]-FDG uptake in areas of lung with normal CT appearance in a second IPF cohort.

Methods PET-CT scans undertaken for cancer staging at an interstitial lung disease tertiary referral centre were reviewed. IPF patients and controls without lung disease were identified. 18[F]-FDG uptake was assessed using manual region of interest (ROI) placement in areas of lung with normal CT appearance in IPF patients and controls. ROI were placed away from the mediastinum and concomitant tumours. 18[F]-FDG uptake within ROI was expressed as maximum and mean standardised uptake values (SUV) normalised using body weight. Mean Hounsfield Units (HU) were evaluated to assess for subtle differences in radiodensity within ROI. Data are presented as mean $\pm$ SD. Unpaired, 2-tailed T-tests were used to compare between group differences with a P value < 0.05 considered significant.

Results Forty-five subjects were included in this study (15 IPF and 30 controls). Lung cancer was the most common concomitant malignancy in both groups.

There was no difference in mean HU within ROI between IPF and controls (-719 ± 79 HU in IPF and -723 ± 147 HU in

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

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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