Xe-MRI and QCT from a subject with COPD

Abstract S19 Figure 1

diffusion-weighted images ($b=20.855 \text{ sec/cm}^2$). Percentage predicted PFT results were established for each participant.

Whole lung and lobar QCT-derived metrics for emphysema and bronchial wall thickness were calculated from percentage of lung tissue with density of $<950 \text{ HU}$ and $\text{Pi}10$ (the square root of wall area for an airway with lumen perimeter of 10 mm), respectively.

Pearson's correlation coefficients were used to evaluate the relationship between whole lung and lobar imaging measures and PFTs.

Results Xe-MRI whole lung average ADC showed significant correlation with: whole lung QCT percentage emphysema ($r = 0.79$, $p = 0.001$), whole lung $\text{Pi}10$ ($r = 0.68$, $p < 0.05$), percentage predicted functional residual capacity (FRC) ($r = 0.635$, $p < 0.05$) and demonstrated significant negative correlation with percentage predicted TLCO ($r = -0.81$, $p < 0.001$). Whole lung QCT percentage emphysema showed a similar significant negative correlation with percentage predicted TLCO ($r = -0.80$, $p < 0.001$). Xe-MRI lobar percentage ventilated volume showed significant correlation with lobar QCT percentage emphysema ($r = -0.51$, $p < 0.001$). The QCT-derived metrics, percentage emphysema and $\text{Pi}10$ demonstrated significant correlation on a whole lung ($r = 0.75$, $p < 0.015$) and lobar basis ($r = 0.29$, $p < 0.015$).

Conclusion This study demonstrates excellent correlation between Xe-MRI, QCT-derived metrics and PFTs in COPD. New quantitative whole lung and lobar functional imaging parameters have been derived that may be of value when assessing patients with COPD for regional treatment and in trialling new therapies. Although further investigation is required, this may represent the first integrated regional lung imaging technique linked to pulmonary functional outcomes.

S20 18F-FLUORODEOXYGLUCOSE (18FDG) PET PULMONARY IMAGING: COMPARATIVE METHODOLOGY IN COPD PATIENTS

¹G Choudhury, ¹A Fletcher, ¹M Connell, ²B Whitcher, ¹S Fergusson, ¹T Clark, ²B Vennart, ²I Kilty, ¹E VanBeek, ¹W MacNee. ¹Queens Medical Research Institute, Edinburgh, UK; ²Pfizer Inc, USA

10.1136/thoraxjnl-2014-206260.26

Abstract S20 Figure 1 Shows an example of time activity curves from arterial, venous and image derived techniques (on left) and (on right) a Patlak image from venous plasma slope (1st row), intercept (2nd row) and CT (3rd row)

Introduction ^{18}F FDG PET/CT imaging may be a useful tool to study COPD and lung inflammation; however the optimal protocol for this imaging biomarker has yet to be established.

Method We aimed to develop a combined ^{18}F FDG-PET/CT imaging protocol optimised to quantify lung inflammation. Six patients with moderate-to-severe COPD underwent dynamic ^{18}F FDG-PET imaging combined with blood sampling (both arterial and venous over 60 min) to determine the localised plasma activity time curve. High resolution CT (HRCT) was utilised to segmentate the lung and determine areas of emphysema. 3 sets of comparative input functions were analysed (arterial, venous and image derived arterial input functions). ^{18}F FDG kinetics was fitted using the Patlak method.

Results Similar results were obtained using time activity curves from all three input functions. The arterial input was always found to be slightly higher than the others (Figure 1). Patlak analysis of the time-activity curves for each of the CT derived lung lobes allowed generation of images of slope (influx constant K_i) and intercept (initial volume of distribution) (Figure 1). The acquisition of HRCT co-registered to FDG-PET allows more accurate demarcation and quantification of FDG in emphysematous areas of the lung. Attempt to improve the signal by excluding voxels without COPD tissue (-935 to -300 HU) has been undertaken as well. The reproducibility of this technique is currently being studied where 20 patients are being scanned twice 4 weeks apart and compared to a baseline scan from 5 healthy controls.

Conclusion ^{18}F FDG PET/CT imaging has the potential to be a non-invasive biomarker of lung inflammation in COPD.

S21 CULTURE INDEPENDENT IDENTIFICATION OF BACTERIAL COMMUNITIES IN THE RESPIRATORY TRACT OF PATIENTS WITH COPD, HEALTHY NON-SMOKERS AND HEALTHY SMOKERS

¹GG Einarsson, ²A Walker, ³MM Tunney, ⁴JS Elborn. ¹CF and Airways Microbiology Research Group, Queen's University Belfast, Belfast, UK; ³School of Pharmacy, Queen's University Belfast, Belfast, UK; ⁴School of Medicine, Dentistry and Biomedical Sciences, Queen's University Belfast, Belfast, UK; ²Wellcome Trust Sanger Institute, Wellcome Trust Genome Campus, Hinxton, Cambridge, UK

10.1136/thoraxjnl-2014-206260.27

Introduction and aims The role bacteria play in the development and progression of Chronic Obstructive Pulmonary Disease (COPD) is unclear. We used culture-independent methods to describe differences and/or similarities in microbial communities

Spoken sessions

Abstract S21 Table 1 Characteristics

	COPD	HV	HS
Age (yrs) [Mean ± SD]	58 ± 1	50 ± 11	55 ± 1
Sex (% Female)	22	46	63
Richness [Mean ± SD]	71 ± 16	69 ± 13	69 ± 16
SW [Mean ± SD]	1.90 ± 0.63	2.66 ± 0.51	2.51 ± 0.34
FEV ₁ [Mean ± SD]	1.46 ± 0.45	3.12 ± 0.55	3.20 ± 0.71
FEV ₁ % Predicted [Mean ± SD]	58 ± 17	98 ± 6	95 ± 13
FEV ₁ /FVC Ratio [Mean ± SD]	0.51 ± 0.08	0.82 ± 0.06	0.79 ± 0.06

in the lower airways of patients with COPD, healthy non-smokers and smokers.

Methods Bronchial wash samples were collected from patients with COPD (GOLD 1–3; n = 18), healthy non-smokers (HV; n = 11) and healthy smokers (HS; n = 8). Samples were processed using the Illumina MiSeq platform. The Shannon-Wiener Index (SW) of diversity, lung obstruction (FEV₁/FVC ratio) and ordination by Non-Metric Multidimensional Scaling (NMDS) on Bray-Curtis dissimilarity indices were analysed to evaluate how samples were related. Principal component analysis (PCA) was performed to assess the effect specific taxa had within each cohort. Characteristics of each cohort are shown in Table 1.

Results There was no difference in taxa richness between cohorts (range: 69–71; p = 0.954). Diversity (SW Index) was significantly lower in COPD samples compared to samples from HV and HS (p = 0.009 and p = 0.033, respectively). There was no significant difference between HV and HS (p = 0.186). The FEV₁/FVC ratio was significantly lower for COPD compared to HV (p = 9*10⁻⁸) and HS (p = 2*10⁻⁶), respectively. NMDS analysis showed that communities belonging to either of the healthy groups were more similar to each other than they were to samples belonging to the COPD group. PCA analysis showed that members of *Streptococcus* sp. and *Haemophilus* sp. had the largest effect on the variance explained in COPD. In HS, *Haemophilus* sp., *Fusobacterium* sp., *Actinomyces* sp., *Prevotella* sp. and *Veillonella* sp. had the largest effect on the variance explained, while in HV *Neisseria* sp., *Porphyromonas* sp., *Actinomyces* sp., *Atopobium* sp., *Prevotella* and *Veillonella* sp. had the largest effect on the variance explained.

Conclusions The study demonstrates that microbial communities in the lower airways of patients with COPD are significantly different from that seen in healthy comparison groups. Patients with COPD had lower microbial diversity than either of the healthy comparison groups, higher relative abundance of members of *Streptococcus* sp. and lower relative abundance of a number of key anaerobes.

S22 THE EFFECT OF CIGARETTE SMOKE ON IMPORTANT PATHOGENS IN COPD LUNG INFECTION

K McGown, MM Tunney, SJ McGrath, JS Elborn, DF Gilpin. *Queens University Belfast, Belfast, UK*

10.1136/thoraxjnl-2014-206260.28

Introduction The leading cause of COPD in developed nations is exposure to tobacco smoke. COPD is characterised by acute periods of exacerbation, which are often bacterial in aetiology. The direct effect of cigarette smoke on bacteria present in the COPD lung, and how this may drive disease progression, has not been determined. This preliminary study aimed to determine the effect of cigarette smoke extract (CSE) on the growth and antibiotic susceptibility of COPD bacterial lung pathogens.

Methods CSE was prepared as described previously. Briefly, smoke from one, two, three or four cigarettes was bubbled through 100 mls growth medium. Bacterial type strains (*Pseudomonas aeruginosa*, *Moraxella catarrhalis*, *Streptococcus pneumoniae*, *Prevotella* spp and *Haemophilus influenzae*) were inoculated into growth medium +/- CSE and incubated either aerobically or anaerobically (*Prevotella* spp). Total viable counts (TVC cfu/ml) were estimated from 0–48 hrs (aerobes) and 0–72 hrs (*Prevotella* spp). Changes in minimum inhibitory concentration (MIC) of antibiotics used in the treatment of respiratory infections were determined by E-Test®, in bacterial cultures exposed daily to CSE over 12 days.

Results The growth of *Paeruginosa*, *S. pneumoniae* and *H. influenzae* were not completely inhibited by any concentration of CSE; however a reduction in growth rate at higher concentrations was observed. *M. catarrhalis* growth was completely inhibited by two cigarettes/100 ml growth medium. No difference in growth was observed between *Prevotella* spp +/- CSE. A marked increase in *Paeruginosa* resistance to tetracycline and doxycycline was observed after repeated CSE exposure: resistance to tetracycline and doxycycline increased from 24 to >256 µg/ml, and 48- >256 µg/ml, respectively.

Conclusions The growth of principal bacteria isolated from COPD patients were not affected by concentrations of CSE utilised in this study, but changes in the susceptibility of *P. aeruginosa* to tetracyclines was observed. This increase in resistance may be mediated by efflux pump up-regulation, and may lead to cross-resistance with other antibiotics. Work currently underway aims to determine whether CSE induces other key phenotypic changes (virulence factor expression and/or biofilm production) which might enhance the pathogenicity of these bacteria in the presence of CSE and result in poorer outcomes for patients with COPD.

Sleep disordered breathing – assessment and treatment

S23 RESULTS OF A NATIONAL SURVEY OF PRE-OPERATIVE SCREENING FOR OBSTRUCTIVE SLEEP APNOEA

¹R Sharrock, ²S Baudouin, ¹S West. ¹Freeman Hospital, Newcastle Upon Tyne, UK; ²Royal Victoria Infirmary, Newcastle Upon Tyne, UK

10.1136/thoraxjnl-2014-206260.29

Introduction and objectives There is currently no UK guidance (from BTS, BSS or RCA) regarding screening for obstructive sleep apnoea in the pre-operative setting. Evidence suggests that undiagnosed OSA is associated with increased post-operative complications but no trials have examined whether screening the UK's general surgical population is justifiable. We sought to examine current UK practice and opinion in this regard.

Methods A postal survey was sent to all 180 UK sleep service providers asking whether they had a hospital policy for pre-operative screening for OSA and what this consisted of. If there was no policy they were asked how pre-operative patients with suspected OSA were identified. Further details regarding diagnostic confirmation and opinion regarding practice were sought.

Results We received 84 replies. There is a spectrum of current practice amongst respondents. There were 31 centres (37%) with a policy for screening for OSA. Of these, 42% screened all patients with a questionnaire e.g. STOP BANG, 23% screened only patients undergoing certain operations, 13% screened patients with high BMI only. Of those with a policy who