Methods We retrospectively reviewed referrals with respiratory symptoms and dysphonia to the upper airway service at the Royal Brompton, over a 12 month period to 2015. PVD was identified according to accepted criteria:[1] no structural or neurological laryngeal disease, discrepancy between laryngeal status and voice quality, temporary loss of volitional control over phonation, (e.g. frequently reported as secondary to dyspnoea), normal voicing on vegetative manoeuvres (e.g. coughing) and positive psychological factors associated with onset of symptoms. Perceptual voice quality was rated using the GRBAS scale.

Results Ten female patients were identified as having PVD (70% type 2, 20% type 3, 10% type 1). All patients had preserved spirometric indices but daily symptoms of dyspnoea and dysphonia. Respiratory diagnoses at referral included chronic cough (20%), difficult asthma (50%) and unexplained dyspnoea (30%), with symptoms of between 2 months and 15 years' duration. The majority of patients (70%) were receiving treatment with either oral +/- inhaled corticosteroid prior to referral. Perceptual voice quality varied among patients, but in all cases normal voice was restored by the end of the first treatment session, leading to subjective reduction in breathlessness. Relevant psychological factors were identified as an underlying cause of the voice disorder.

Conclusion PVD is an under-recognised cause of treatment-refractory respiratory symptoms in patients with altered voice quality. Prior to referral, these symptoms are often attributed to the use of inhaled corticosteroid, yet accurate diagnosis and targeted therapy permits rapid restoration of normal voice and symptomatic improvement. This case series underpins the importance of collaborative working between SLT and respiratory medicine to ensure patients receive timely and appropriate specialist treatment.

REFERENCE

1 Butcher P, Elias A, Cavalli L. Understanding and treating psychogenic voice disorder: A CBT framework, 2007

P77 HYPOXIC CHALLENGE TESTING FOR FITNESS TO FLY IN SEVERE ASTHMA

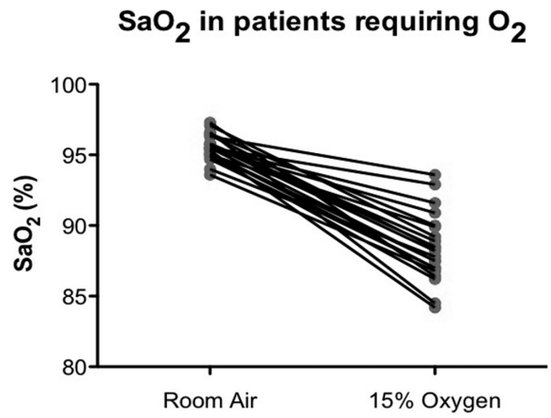
CM Orton, PM George, S Ward, A Menzies-Gow, JH Hull. *The Royal Brompton, London, UK*

10.1136/thoraxjnl-2015-207770.214

Introduction and objectives Commercial airline travel poses a recognised risk to patients with respiratory disease, including in those with asthma. Hypoxic challenge testing (HCT) is typically employed to mitigate this risk by dictating in-flight oxygen requirement. The objective of this work was to evaluate the role of HCT in patients with severe asthma.

Methods A retrospective analysis was performed of all BTS/SIGN Asthma Step 5 adult individuals under the Royal Brompton Hospital severe asthma service, who completed HCT between 2007 and 2014. In line with British Thoracic Society recommendations, under hypoxic conditions a reduction in PaO_2 to <6.6 kPa was reported as a positive result. A PaO_2 level of 6.6–7.5 kPa was considered borderline and supplemental oxygen was advised if co-existent evidence of hyperventilation. Electrocardiograph monitoring was performed in all patients during the HCT.

Results Of the 37 patients studied, 21 (57%) had a positive HCT. Individuals with a positive HCT had a lower PaO_2 under normoxic conditions (10.1 kPa v 11.4 kPa, $p < 0.01$), but similar $PaCO_2$ level (4.80 kPa v 4.91 kPa, $p > 0.05$). Baseline oxygen saturation was poorly predictive of the need for supplementary oxygen and two-thirds of patients, for whom supplementary oxygen was recommended, had a baseline SpO_2 level of greater than 95%; approximately half of these individuals desaturated to less that 90% on HCT (Figure 1). Lung function was more obstructed in the positive HCT group (predicted FEV1 (52% v 78%, $p < 0.01$). Across the entire cohort, HCT was associated with a mean rise in heart rate (HR) of 5 bpm and there was no evidence of dysrhythmia or change in QTc. A combination of any two of: baseline $PaO_2 \leq 10.5$ kPa, FEV1 ≤ 60% predicted and PEF ≤ 350 L/min predicted the need for in-flight oxygen with a sensitivity of 90% and a specificity of 69%.



Abstract P77 Figure 1

Conclusions In patients with severe asthma, baseline oxygen saturation level is poorly predictive of the need for in-flight oxygen. Our findings indicate that a HTC should be considered for all BTS/SIGN Step 5 asthmatics in whom air travel is being considered and should certainly be recommended in those with impaired lung function.

P78 STUDY OF MORTALITY IN SEVERE AND DIFFICULT TO TREAT ASTHMA

J Sullivan, K O'Shea, A Mansur. *Heartlands Hospital, Birmingham, UK*

10.1136/thoraxjnl-2015-207770.215

Introduction The National Report on Asthma Death (NRAD 2014) highlighted important shortcomings related to asthma management and an important number of patients still die from asthma. However, the mortality rate and causes of mortality in the severe asthma services has not been previously reported.

Aim To study what patients with severe asthma die from and what is their risk of mortality

Methods All patients attending our severe asthma service who had died between March 2009 and December 2014 were identified. We retrieved data from case notes, GPs, local hospitals and local database using a pre designed proforma which included cause of death, place of death, age at time of death, clinical details on asthma duration, lung function, biomarkers, medication, exacerbations including hospitalisation and co-morbidities. Causes of death was obtained from death certificates and when available coroner's post-mortem reports.

Results Of the 520 patients attended our service between January 2009 and December 2014, there were 24 deaths (4.6% over 72 months, 0.7% annually). The mean age of death was 51 yrs (range 21–69), 17/24 (71%) were females. 50% had poorly

controlled asthma with a mean predicted FEV1 of 54%. 13/24 (61%) were on a maintenance dose of oral corticosteroids (mean dose 19 mg/day). The mean inhaled corticosteroids was 1006 µg. The cause of death was not known in 6 cases, with majority of cases died from non-asthma causes (78%) with cardiovascular disease being the most common. Asthma was the cause of death in 4/18 (22%) cases. Co-morbid diseases were prevalent particularly those that form the metabolic syndrome. Non-concordance with asthma medications and smoking history (current and ex-smokers) were also common (50% and 60% respectively).

Conclusion Although death is a rare event in our severe asthma service (0.7%), patients did die prematurely (mean age 51 yrs) usually from non-asthma causes, but asthma still accounted for death in the fifth of this group. Larger multicentre study with control data will be needed to confirm these finding and look for drivers and predictors of mortality in severe asthma.

New markers of lung physiology

P79 COMPARISON OF CF AND NON CF LCI RESULTS USING THE EXHALYZER D AND INNOCORTM DEVICES

KJ Bayfield, C Saunders, EWFW Alton, JC Davies. *Imperial College London, London, UK*

10.1136/thoraxjnl-2015-207770.216

Background Multiple breath washout (MBW) is a pulmonary function test that allows measurement of lung clearance index (LCI), a marker of ventilation heterogeneity. LCI is increasingly being considered as a clinical trial outcome measure. The Exhalyzer D N_2 washout (N_2/ExD, Ecomedics AG, Switzerland) is the recommended technique by the ECFS CTN. Mostly our group's experience with LCI uses the Innocor^{TM} gas analyser (Innovision, Denmark), SF_6 as a tracer gas (SF_6/Inn). To understand the N_2/ExD technique, the aims of this study were to compare a) intra-test variability; b) LCI values c) LCI and FEV_1 for the two techniques.

Methods 21 CF (14F, mean 20 ± 12 yrs) and 10 non-CF (8F, mean 28 ± 10 yrs) have completed MBW trials with the 2 techniques in random order on the same visit; methods previously described (Horsley *et al*. 2009, Jensen *et al*. 2013).

Results Intra-test CoV (2–3 repeats) was similar for SF_6/Inn and N_2/ExD (3.57 vs 3.78 CF, ns). LCI was significantly higher with N_2/ExD than with SF_6/Inn in both CF (14.05 vs 9.33; p = <0.0001) and non-CF (7.08 vs 6.64, p = 0.04). Both techniques show a significant correlation for LCI and FEV_1%, although the regression slopes were significantly different (p = 0.005); much steeper for N_2/ExD.

Conclusions LCI values cannot be used interchangeably between the Innocor^{TM} and Exhalyzer D. In non CF, there was a statistically significant difference, with higher values in the N_2/ExD. The difference was much greater in CF and increased as LCI did. In the context of similar intra-test variability, the hypothesis that this may translate into improved power in future clinical trials needs to be tested. Sponsored by a non-restricted grant from Novartis.

REFERENCES

1 Horsley AR, Gustafsson PM, Macleod KA. *et al.* Lung clearance index is a sensitive, repeatable and practical measure of airways disease in adults with cystic fibrosis. *Thorax*. 2008;**63**:135–40
2 Jensen R, Stanojevic S, Gibney K, *et al.* Multiple breath nitrogen washout: a feasible alternative to mass spectrometry. *PLoS One*. 2013;**8**:e56868

P80 EXTRAPOLATING LUNG CLEARANCE INDEX (LCI) FROM SHORTENED MEASUREMENTS

[1]K Tanou, [2]S Irving, [3]F Ahmad, [2]L Fleming, [2]M Rosenthal, [3]A Bush. [1]*Aghia Sofia Childrens' Hospital, Athens, Greece*; [2]*Royal Brompton and Harefield NHS Foundation, London, UK*; [3]*Imperial College, London, UK*

10.1136/thoraxjnl-2015-207770.217

Introduction and objectives Shortened multiple breath washouts (MBW) are attractive in young children, where a long test time may not be tolerable (Thorax 2013;68:586–7). Lung clearance index (LCI) is usually calculated at 1/40th of the starting concentration (LCI_{std}), but in shorter MBWs the LCI is calculated at 1/20th of the starting concentration ($LCI_{0.5}$). $LCI_{0.5}$ and LCI_{std} are closely correlated but not interchangeable, and so we calculated an extrapolated full LCI (LCI_{ex}) from $LCI_{0.5}$. Our hypothesis was that extrapolated LCI (LCI_{ex}) will better reflect LCI_{std} than $LCI_{0.5}$ and be more sensitive to intervention.

Methods Condition-specific equations for cystic fibrosis (CF), primary ciliary dyskinesia (PCD) and asthma, and an overall equation for all 3 groups, were developed to convert $LCI_{0.5}$ to LCI_{ex} from data previously analysed (n = 90, Thorax 2014;69 [Suppl^2]A166). LCI_{std}, $LCI_{0.5}$ and LCI_{ex} were then calculated for new cohorts (n = 70, 20 asthma, 30 CF, 20 PCD), and LCI_{ex} was compared to LCI_{std}. CF patients receiving IV antibiotics (n = 17) and asthma patients receiving triamcinolone (n = 32)) also had LCI_{std}, LCI0.5 and LCI_{ex} calculated and compared. The upper limit of normal for LCI_{std} was calculated from healthy controls. LCI_{ex} was compared to LCI_{std} with a Bland-Altman plot.

Results In CF, at higher LCIs, the spread between LCI_{ex} and LCI_{std} grew but there was no bias. For PCD and asthma agreement remained very good. There was no significant difference between LCI_{std} and LCI_{ex}. Results for positive and negative prediction of LCI_{std} for $LCI_{0.5}$ and LCI_{ex} are shown in the Table 1. LCI_{ex} and $LCI_{0.5}$ were also sensitive to interventions in asthmatic and CF patients, although in general LCI_{std} had better p values.

Conclusions LCI_{ex} performed better than $LCI_{0.5}$ in predicting results of LCI_{std}. However, LCI_{ex} did not always reflect LCI_{std}, particularly in CF, so the two cannot be used interchangeably in lung disease.

Abstract P80 Table 1 LCI_{ex} had an improved false negative rate compared with $LCI_{0.5}$

LCI	Correctly categorised (%)				Sensitivity to intervention	
	True positive	True negative	False positive	False negative	Asthma	CF
LCI_{std}	-	-	-	-	p = 0.001	p = 0.03
LCI_{ex}	37	26	5	2	p = 0.02	p = 0.02
$LCI_{0.5}$	38	26	0	6	p = 0.02	p = 0.04