investigators assigned patients to the MRC dyspnoea scale, grading dyspnoea on strenuous exertion only (normal, Grade 1); on incline/stairs (2); and on the level (3–5 according to severity). Individuals undertaking regular/intense sport were reclassified as Grade '0'. Four separate SpO_2 measurements, after standing for 7, 8, 9 and 10 min, were used for statistical calculations using GraphPad software. Interim analyses were performed on the first 88 patients.

Results In the absence of severe pulmonary hypertension or emphysema, only 18% of patients were dyspnoeic (Abstract P38 Table 1). To determine which factors might influence dyspnoea, single variables were examined. There was considerable overlap in the SpO_2 values between the three groups of Grade '0', 1 and 2, and no relationship between dyspnoea grade and SpO_2 demonstrated by Spearman's rank correlation coefficient (r=0.09; p=0.39). The patients however, ranged in age from 17 to 87 years, and older patients were more dyspnoeic (Spearman r=0.33; p=0.0016). Multiple regression analyses were therefore performed to determine whether there was a relationship between SpO_2 and dyspnoea that was masked by differences in age. These suggested SpO_2 may make an independent contribution to dyspnoea (p=0.064), although age was still more strongly associated (p=0.0044). However, these factors alone did not account for most of the population variation in dyspnoea grade (overall model: r^2=11.37%, p=0.0073).

Abstract P38 Table 1 Population stratification by dyspnoea grade: *Quartile distribution (Q1, Q2, Q3) where Q2 represents the median value

MRC grade	Number of cases	SpO2 (%) range	SpO2 (%) quartiles*	Corrected* number (%)
"0"	19	78.5–99	90.7, 94.5, 96.2	19 (22)
1	51	83.5–98	93.6, 95.5, 96.5	51 (60)
2	15	80.8–98	85.6, 90.5, 93.1	15 (18)
3	2	89–92.5	89.1, 89.2, 90.8	0
4	1	95–95	95.0, 95.0, 95.0	0
5	0	–	–	0

*Excludes patients with severe pulmonary hypertension (n =2), or severe emphysema (n = 1).

Summary These data imply that it is unusual for PAVMs alone to account for moderate to severe dyspnoea, and that there is less of an influence of SpO_2 than expected. Further study is warranted.

REFERENCES

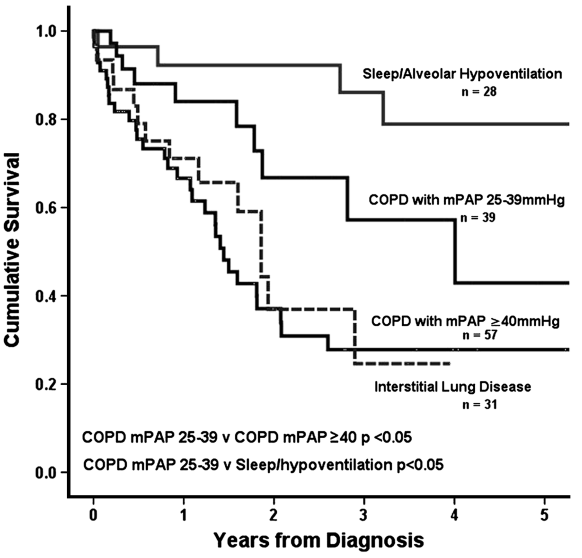
1. **Shovlin CL,** Jackson JE, eds. *Murray and Nadel's textbook of respiratory medicine*. 5th edn, 2010, pp. 1261–82.
2. **Shovlin,** *et al*. *Thorax* 2008;**63**:259–66.

P39 PULMONARY HYPERTENSION (PH) ASSOCIATED WITH LUNG DISEASE/ HYPOXIA

doi:10.1136/thx.2010.150961.39

J Hurdman, R A Condliffe, C A Elliot, I Sabroe, D G Kiely. *Sheffield Pulmonary Vascular Disease Unit, Royal Hallamshire Hospital, Sheffield, UK*

Background Mild elevation in pulmonary artery pressure (PAP) is common in patients with lung disease. In COPD, 2 groups are defined; PH proportionate to degree of underlying lung disease and PH out of proportion (mPAP ≥ 40 mm Hg) occurring in a minority.
Aim To characterise survival and prognostic factors in patients with PH associated with lung disease.
Methods Single centre retrospective review of cardiac catheters performed 2001–2010 identified incident cases of PH associated with lung disease.
Results 155 patients had a primary diagnosis of PH associated with lung disease, 96 with COPD (57 PH out of proportion to COPD, 39 PH proportionate to COPD), 31 PH in interstitial lung disease (PH-ILD) and 28 PH with sleep disordered breathing / alveolar hypoventilation. Survival is shown in Abstract P39 Figure 1. Right heart pressures were most raised in patients with PH out of proportion to COPD compared to PH-ILD and PH in proportion to COPD with mRAP 12.3, 8.5 and 8.2 mm Hg (p<0.05) and mPAP 49.4, 38.6 and 32.3 mm Hg (p<0.01) respectively. In patients with PH associated with sleep disordered breathing/alveolar hypoventilation mRAP was 11.6 and mPAP 37.8 mm Hg. Cardiac index and PVR were similar in PH out of proportion to COPD and PH-ILD but markedly reduced in both groups when compared to PH in proportion to COPD (p<0.01). Baseline shuttle walking distance was most reduced in PH out of proportion to COPD with mean 67 m compared to 133 m in PH-ILD and 156 m in PH in proportion to COPD (p<0.05). In COPD, airflow obstruction was less severe in patients with out of proportion PH than COPD with proportionate PH (FEV_1 63% vs 51% respectively) but TLCO was more severely affected (26% vs 38%).



Abstract P39 Figure 1 Cumulative survival from diagnosis in patients with pulmonary hypertension associated with respiratory disease.

Conclusions The survival of patients with PH in association with lung disease is dependent on the underlying aetiology. Whereas patients with PH associated with sleep disordered breathing/alveolar hypoventilation have a good prognosis, patients with PH in the setting of ILD and PH out of proportion to COPD have a poor prognosis.

P40 A COMPARISON OF THE VALUE OF OXYGEN SHUNT STUDIES AND CARDIAC BUBBLE ECHO AS SCREENING TOOLS FOR PULMONARY ARTERIOVENOUS MALFORMATIONS IN PATIENTS WITH SUSPECTED HEREDITARY HAEMORRHAGIC TELANGIECTASIA

doi:10.1136/thx.2010.150961.40

JW Donaldson, K Pointon, T Mathew, AW Fogarty. *Nottingham City Hospital, Nottingham, UK*

Hereditary haemorrhagic telangiectasia (HHT) is an autosomal dominant genetic disorder associated with recurrent spontaneous epistaxis, mucocutaneous telangiectasia and visceral arteriovenous malformations (AVMs). Up to 30% of patients with HHT have pulmonary AVMs (PAVMs) which are associated with an increased

risk of embolic stroke. Currently, with a sensitivity in excess of 98%, thoracic CT is the 'gold standard' for detecting PAVMs but involves a significant radiation exposure.[1] Hence screening tools without a radiation burden such as oxygen shunt studies or cardiac bubble echo (CBE) are often considered as first line investigations for right-to-left shunts. With the recent introduction of CBEs to our hospital we collected data on patients who underwent both CBE and oxygen shunt studies. We looked retrospectively at 11 patients with suspected HHT (as defined by the Curacao criteria[2]) investigated over the last 5 years and aimed to determine the sensitivity and specificity of each screening test compared to thoracic CT (Abstract P40 Table 1). The oxygen shunt study had a sensitivity of 57% and specificity of 75%. CBE had 100% sensitivity (in five patients) but two studies were positive in the absence of detectable PAVMs on CT. Our data suggest that oxygen shunt studies are not sufficiently sensitive to be used as a screening tool for PAVMs. CBE is a useful initial screening test. A negative CBE combined with a negative chest x-ray has been shown to have a negative predictive value of 100% for PAVMs.[3] This screening strategy is especially useful when the risk of CT irradiation is considered unacceptably high, for example in younger women. All patients with a positive CBE should undergo further imaging with thoracic CT to confirm the presence of PAVMs and to determine their size prior to consideration for embolisation therapy.

Abstract P40 Table 1 Patients with suspected HHT arranged by CT thorax result with outcomes of other screening studies

Patient	HHT clinical diagnosis	CT thorax	Cardiac bubble echo	Oxygen shunt study
1	Definite	+	+	–
2	Definite	+	NR	+
3	Definite	+	+	–
4	Definite	+	+	+
5	Definite	+	+	+
6	Definite	+	NR	+
7	Possible	+	+	–
8	Possible	–	NR	+
9	Probable	–	+	–
10	Possible	–	+	+
11	Probable	–	NR	+

"+" = positive study, "–" = negative study, "NR" = Study not requested.

REFERENCES

1. **Remy J,** *et al*. Pulmonary arteriovenous malformations: evaluation with CT of the chest before and after treatment. *Radiology* 1992;**182**:809–16.
2. **Shovlin C,** *et al*. Diagnostic criteria for hereditary hemorrhagic telangiectasia (Rendu-Osler-Weber syndrome). *Am J Med Genet* 2000;**91**:66–7.
3. **Cottin V,** *et al*. Pulmonary arteriovenous malformations in patients with hereditary hemorrhagic telangiectasia. *Am J Resp Crit Care Med* 2004;**169**:994–1000.

Pulmonary rehabilitation

P41 THE COPD ASSESSMENT TEST (CAT) USED TO EVALUATE OUTCOME IN PULMONARY REHABILITATION

doi:10.1136/thx.2010.150961.41

QC Jones, DW Eyre, J Young, E Tucker, J Riley, M Hardinge. *Churchill Hospital Oxford, Oxford, Oxfordshire*

Introduction Outcomes in pulmonary rehabilitation (PR) can be evaluated using exercise performance tests and health status measures such as the St George's Respiratory Questionnaire (SGRQ) and Hospital Anxiety and Depression Score (HADS). The SGRQ and HADS are timing consuming and difficult to analyse and may dissuade patients from attending. The COPD Assessment Test (CAT) is a shorter, simpler questionnaire for assessment and monitoring of health status in COPD. Scores range from 0 to 40. A high score indicates poor health status. CAT score correlates with SGRQ ($r>0.8$)[1].

Objective To determine if the CAT score could replace existing measures of health status in the evaluation of pulmonary rehabilitation.

Method 70 patients underwent standard PR in community and hospital based programs. 45 were men and 25 were women. The mean age was 69. The vast majority of patients attending had COPD, confirmed by spirometry and clinical assessment. They had MRC score of 3 or more. All patients completed CAT, SGRQ questionnaires and did a modified shuttle walk test (MSWT) at the beginning and end of the program.

Results After PR mean SGRQ score reduced by 5.54 (CI: 2.6 to 8.4, $p<0.001$). CAT score reduced by 2.08 (CI: 0.8 to 3.3, $p=0.001$). MSWT distance increased by 75.7 metres (CI: 55.7 to 95.8, $p<0.001$). Anxiety and depression scores reduced by 1.64 (CI: 0.6 to 2.6, $p= 0.002$) and 1.02 (CI: 0.17 to 1.88, $p= 0.02$) respectively. At baseline, the CAT score correlated moderately with SGRQ ($r=0.48$), shuttle walk ($r=0.47$), and HADS ($r=0.43$). The change in CAT before and after PR correlated weakly ($r=0.38$ $p=0.001$) with the change in SGRQ, and MSWT ($r=0.45$ $p<0.001$), and not significantly with change in HADS ($r=0.28$ $p=0.059$).

Conclusion Jones et al. have evaluated the CAT in pulmonary rehabilitation.[2] Their study reported an improvement in CAT of 2.2. At baseline, CAT correlated well with CRQ (Chronic Respiratory Questionnaire) domain scores. Change in CAT correlated with change in CRQ domain scores. Our study confirms CAT score can detect improvement in health status after PR. However, the lack of stong correlation with SGRQ & HADS suggests CAT should not be assumed to be equivalent in the evaluation of PR.

REFERENCES

1. **Jones,** *et al*. *Eur Resp J* 2009;**34**:648.
2. **Jones,** *et al*. *Am J Respir Crit Care Med* 2010;**181**:A6841.

P42 COMPARISON OF A 1- AND 2-WALK PROTOCOL FOR THE ENDURANCE SHUTTLE WALK TEST WHEN MEASURING CHANGE DUE TO THERAPEUTIC INTERVENTION IN COPD PATIENTS

doi:10.1136/thx.2010.150961.42

[1]SE Roberts, [1]M Stern, [2]FM Schreuder, [2]T Watson. *[1]The Whittington Hospital NHS Trust, London, UK; [2]University of Hertfordshire, Hatfield, UK*

Introduction The endurance shuttle walk test (ESWT) is an externally paced field endurance walking test. To perform the ESWT requires two incremental shuttle walk tests (ISWTs) to determine the walk speed for the ESWT, a practise ESWT (pESWT) and a repeat ESWT. The minimum important clinical difference (MCID) has been reported as 68%.[1] Limits of agreement between ESWT carried out with and without a practise walk on the same day have

Abstract P42 Table 1 Results of comparison between two ESWT protocols

	2-walk protocol	1-walk protocol
Baseline completion	71%	88%
Baseline and discharge completion	54%	71%
Ceiling effect	7.3%	12.2%
Floor effect	4.9%	4.9%
Baseline limits of agreement	± 88 s (95% CI±32)	
Limits of agreement for change	± 80% (95% CI±25.6)	