Conclusions PR as currently delivered gives initial benefits to participants with ILD, however these are not sustained. More tailored approaches to this group are needed to improve the sustainability of response to PR.


S100   IS IT FEASIBLE TO ASSESS DYNAMIC HYPERINFLATION DURING AN INCREMENTAL TREADMILL TEST IN PATIENTS WITH SEVERE ASTHMA?

[1]S Majd, [2]TE Dolmage, [3]RH Green, [1]P Bradding, [4]SJ Singh, [3]RA Evans. [1]Leicester Respiratory Biomedical Research Unit, University of Leicester, Leicester, UK; [2]Respiratory Department, West Park Healthcare Centre, Toronto, Canada; [3]Respiratory Department, Glenfield Hospital, Leicester, UK; [4]Centre for Exercise Rehabilitation Science, GlenfieldHospital, Leicester, UK

Introduction We wish to investigate whether dynamic hyperinflation contributes to exercise intolerance in patients with severe asthma. It is unclear whether there is an influence by the exercise platform. To begin with, we explored whether performing serial inspiratory capacity (IC) manoeuvres is feasible during a maximal incremental treadmill test in patients with severe asthma.

Method Patients with severe asthma (step 4–5 of the British Thoracic Society guidelines), MRC dyspnoea grade ≥2, were recruited from physicians specialising in the care of patients with difficult-to-treat asthma at Glenfield Hospital, Leicester. Patients were excluded if they had both fixed airflow obstruction (FEV_1/FVC <70%) and a smoking history of ≥10 pack years. All participants performed an incremental treadmill test to intolerance, with expiratory gas analysis, designed to produce a linear increase in peak oxygen uptake (VO_2).[1] Patients performed a practice resting inspiratory capacity manoeuvre and then subsequently at rest, during the warm up phase and every two minutes during exercise.
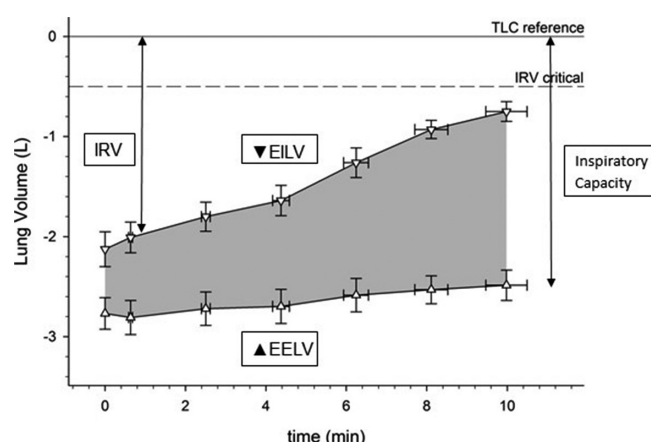
EELV: End Expiratory Lung Volume, EILV: End Inspiratory Lung Volume, IRV: Inspiratory Reserve Volume, TLC: Total Lung Capacity.

Abstract S100 Figure 1 Inspiratory capacity during a maximal incremental treatmill test in patients with severe asthma

Results 18 participants (8 female, mean [SD] 49 [14] yrs, BMI 31 [7] kg/m^2, FEV_1/FVC 70 [13]%, 17% were ex-smokers) completed the treadmill test in a duration of 482 [120] s.

Observations at peak exercise were: VO_2 2.0 [0.4] L/min (100 [25]% predicted); ventilation 67 [18] L/min (87 [20]% maximum voluntary ventilation); heart rate 145 [17] beats/min (85 [9]% predicted); Borg Score for breathlessness 7 [2], perceived exertion 17 [3], 16 were predominantly limited by breathlessness. 115 IC manoeuvres were performed with only one datapoint missed due to an incomplete manoeuvre. Figure 1 shows the mean end expiratory and inspiratory lung volumes during exercise. Six patients had an inspiratory reserve volume of <500 mls.

Conclusion Assessment for dynamic hyperinflation with serial inspiratory capacity manoeuvres during a maximal incremental treadmill test is feasible in patients with severe asthma. The relationship among lung volumes, time and ventilation can be established from rest to peak exercise with minimal practice of the IC manoeuvre or interruption to the test in this patient population.

REFERENCE
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S101   DO THOSE PATIENTS WITH A CHRONIC RESPIRATORY DISEASE THAT WALK AT A FASTER WALKING SPEED IMPROVE MORE POST PULMONARY REHABILITATION?

[1]EJL Chaplin, [1]S Lohar, [1]SJ Singh, [2]SJ Singh. [1]Centre for Exercise and Rehabilitation Science, Pulmonary Rehabilitation Department, Glenfield Hospital, University Hospitals of Leicester, Leicester, UK; [2]School of Sport, Exercise and Health Sciences, Loughborough University, Loughborough, UK

Introduction Several baseline factors influence the response to Pulmonary Rehabilitation (PR). The Incremental and Endurance shuttle walk test is used to prescribe an exercise walking speed for patients with a chronic respiratory disease as part of a PR programme. We wished to explore the speed and duration of baseline endurance performance and observe how this impacted upon changes post rehabilitation particularly around the higher speeds of the endurance shuttle walk test (ESWT).

Methods Patients completed a 7 week outpatient PR programme comprising of both endurance and strength training. The endurance training is based on the ESWT speed which is 85% of the individual maximal capacity derived from the incremental shuttle walk test (ISWT). The ISWT and subsequent ESWT were performed at baseline and discharge. Patients were categorised into low (<3.6 km/hr) or high (>3.6 km/hr) speed walkers based on their baseline ESWT performance.

Results 990 patients completed the SWT: 567 low speed walkers (mean age 70.9 ± 9.7 years; FEV_1 1.5 L ± 4.9; BMI 27.6 ± 9.0 kg/m^2; MRC 4 (IQR 3–4); ISWT pre 128.4 ± 61.6 m; ESWT pre 166.3 ± 161.5 secs) and 423 high speed walkers (mean age 67.8 ± 9.2 years; FEV_1 1.62 L ± 3.8; BMI 27.1 ± 14.0 kg/m^2; MRC 3(IQR 2–3); ISWT pre 373.4 ± 103.3 m; ESWT pre 262.4 ± 147.6 secs). Those walking at a higher speed had a significantly higher pre ESWT (p ≤ 0.001). A statistically significant improvement was observed in the ESWT within each group (low: mean change 344.2 ± 401.5 p ≤ 0.001; high: mean change 369.3 secs p ≤ 0.001). However the change in ESWT was not significantly different between the groups (p = 0.3).

Abstract S101 Table 1

	Low speed walkers (n = 567)	High speed walkers (n = 423)	Between group differences (p value)
Age (years)	70.9 ± 9.7	67.8 ± 9.2	p ≤ 0.001
FEV$_1$ (L)	1.5 ± 4.9	1.62L ± 3.8	P = 0.7
MRC (IQR)	4 (IQR 3–4)	3(IQR 2–3)	p ≤ 0.001
BMI (kg/m^2)	27.6 ± 9.0	27.1 ± 14.0	P = 0.5
Pre ISWT (m)	128.4 ± 61.6	373.4 ± 103.3	p ≤ 0.001
Post ISWT	191.8 ± 91.1	415.9 ± 115.0	p ≤ 0.001
Change in ISWT	63.4 ± 66.1	42.6 ± 67.7	p ≤ 0.001
Pre ESWT (secs)	166.3 ± 161.5	262.4 ± 147.6	p ≤ 0.001
Post ESWT	510.5 ± 428.4	631.7 ± 388.5	p ≤ 0.001
Change in ESWT	344.2 ± 401.5	369.3 ± 363.9	P = 0.3

All values are mean (±SD) unless otherwise stated. FEV$_1$, forced expiratory volume in 1 s; MRC, Medical Research Council; IQR, interquartile range; BMI, body mass index; ISWT, Incremental shuttle walk test; m, metres; ESWT, endurance shuttle walk test; sec, seconds.

Conclusion Interestingly, those patients who walk at a faster speed have a greater baseline ESWT performance compared to those patients who walk at a slower endurance speed. However both groups made comparable changes in the ESWT following PR.

Lung cancer biology and biomarkers

S102   **SOX2 INITIATES CARCINOGENESIS IN A NOVEL ORGANOTYPIC MODEL OF BRONCHIAL DYSPLASIA**

[1]LD Correia, [2]H Farah, [3]DM Rassl, [3]RC Rintoul, [2]T Sethi, [1]TD Littlewood, [1]GI Evan, [2]F McCaughan. [1]University of Cambridge, Cambridge, UK; [2]King's College London, London, UK; [3]Papworth Hospital Foundation NHS Trust, Cambridge, UK

Introduction and objectives Improving the early detection and chemoprevention of lung cancer are key to improving outcomes. The pathobiology of early squamous lung cancer is poorly understood. We have shown in a previous publication that amplification of SOX2 is an early and consistent event in the pathogenesis of this disease but its functional oncogenic potential remains uncertain. We aimed to test the impact of deregulated SOX2 expression in a novel organotypic system that recreates both the molecular and microenvironmental context in which squamous carcinogenesis occurs.

Our objectives are:

1. To develop a 3D *in vitro* model of bronchial dysplasia that recapitulates key molecular and phenotypic characteristics of the human disease.
2. To test the hypothesis that SOX2 deregulation is a key initiating event in the pathogenesis of bronchial dysplasia.

Methods We use lentiviral transduction to facilitate the inducible activation of SOX2 in immortalised bronchial epithelial cells iBECs. We use lentiviral shRNA and cutting edge CRISPR genome editing technology to introduce specific defects in key tumour suppressor pathways in order to recapitulate the molecular context seen *in vivo*. We incorporate the genetically manipulated iBECs at the air-liquid interface in a 3-dimensional tissue culture system that also comprises a stromal equivalent with embedded pulmonary fibroblasts and carefully defined media to build an organotypic model of bronchial dysplasia.

Results We develop a model that recapitulates human bronchial dysplasia. SOX2 deregulation does not cause an obvious phenotype in standard tissue culture conditions, but can initiate the dysplastic phenotype in 3D culture systems. Loss of TP53 and PTEN are co-operating genetic events that potentiate the dysplastic phenotype. The alterations in cell signalling pathways recapitulate signatures seen in invasive squamous cell lung cancer.

Conclusions In the appropriate molecular and microenvironmental context acute deregulation of SOX2 expression initiates and drives bronchial dysplasia. This confirms it's oncogenic potential in human cells. This model can be used to test the impact of therapeutic agents aimed at chemoprevention and the potential for co-operating genetic lesions to drive disease progression.

S103   **SYNTHESIS OF GOLD-BASED NANOMEDICINES TO TREAT NON-SMALL CELL LUNG CANCER**

AM Cryer, P Ruenraroengsak, TD Tetley, AJ Thorley. *NHLI, Imperial College London, London, UK*

Introduction Lung cancer is the leading cause of cancer death worldwide, with an average 5 yr survival rate of just 9.5% in the UK. The success of current chemotherapy regimens for non-small cell lung cancer (NSCLC), the predominant subtype of lung cancer, is hindered by poor tumour penetration and accumulation, and systemic side effects which significantly affect patient quality of life. The field of cancer nanomedicine seeks to overcome these problems by utilising the unique physicochemical properties of nanoparticles; gold-based nanomedicines (AuNPs) show particular promise as they may be able to offer multimodal therapeutics and diagnostics in a single formulation.

Objectives This study aimed to conjugate cisplatin and pemetrexed, a first line therapy for NSCLC, to AuNPs, and investigate their efficacy on tumour cell proliferation compared to free drug. Furthermore, we investigated whether conjugation to AuNPs abrogated the inflammatory and toxic effects of these drugs on non-cancer human pulmonary epithelial cells.

Methods Cisplatin and pemetrexed were conjugated to AuNPs using heterobifunctional polyethylene glycol (PEG) linkers and were characterised by electron microscopy, ICP-OES, dynamic light scattering and thermogravimetric analysis. The effect of conjugates in *in vitro* cancer (H226 and A549 cells) and non-cancer (human alveolar type I epithelial cells) cell models were measured by electric cell-substrate impedance sensing (ECIS), MTT assay, ELISA and confocal microscopy.

Results Nanoparticle characterisation confirmed successful conjugation of cisplatin and pemetrexed to AuNPs. Confocal microscopy demonstrated that nanoparticles were internalised by cancer cells and distributed throughout the cytoplasm. Further studies showed that conjugates inhibited cancer cell proliferation significantly more than the respective free drug (Figure 1) and abrogated free drug cytotoxicity in non-cancer alveolar type I epithelial cells (0% cell death vs 30% respectively; 10 μM cisplatin; $P < 0.001$). Conjugates also attenuated chemotherapy-induced IL-6 release in both cancer and non-cancer cells; 10 μM cisplatin induced 6.6-fold and 7-fold greater IL-6 release compared to equimolar conjugates in H226 and alveolar type I epithelial cells respectively ($P < 0.001$).