

Saturday 4 April
1300-1415 ANZSRS Oral Session 1A
AO 01

COGNITIVE FUNCTION DURING ACUTE ALTITUDE EXPOSURE IN PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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Introduction: Altitude induced hypoxia can impair cognitive function in healthy individuals. Patients with chronic obstructive pulmonary disease (COPD) will experience greater hypoxia at altitude than healthy individuals due to ventilation and gas impairment. The aim of this study was to assess cognitive function in patients with COPD in response to acute altitude exposure.

Methods: Eighteen subjects with COPD were tested at ground level (40m) and at the summit of the Mt Hutt ski-field (2086 m), New Zealand. Two cognitive tests were performed: (1) Reaction time (RT) using a Palm held psychomotor vigilance test (PALM-PVT); and (2) a symbol digit modalities test (SDMT) to assess cerebral dysfunction, visual processing and motor function.

Results: Data are presented as mean (SD) unless stated otherwise.

	PaO ₂ (mmHg)	Median (SD) RT (ms)	RT Lapses (>500ms)	SDMT Score
Ground Level (40m)	75 (9)	315 (32)	6 (4)	41 (11)
Altitude (2086m)	51 (6)	332 (49)	8 (7)	42 (13)

Ascent to 2086m resulted in significant hypoxaemia. There was no significant difference using paired t-tests in either RT ($p = 0.06$), RT lapses ($p = 0.06$) or SDMT ($p = 0.63$) following ascent to altitude. RT did not correlate with age or PaO₂. SDMT correlated with age ($r = 0.60$, $p = 0.01$ at ground level and $r = 0.69$, $p = 0.002$ at altitude) but not PaO₂.

Conclusions: Acute exposure to moderate altitude did not significantly alter cognitive function in this group of COPD patients. The level of hypoxaemia did not influence sustained attention (5min) or the visual processing task in our group of COPD patients.

Key Words: Cognitive function, COPD, Altitude, Hypoxaemia

Acknowledgements: Asthma and Respiratory Foundation of New Zealand; Radiometer NZ; Mt Hutt Ski-field; McLaren Medical; nnd Medizintechnik.

AO 02

RESTING AND EXERCISE RESPONSE TO ACUTE ALTITUDE EXPOSURE IN PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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Introduction: Acute altitude exposure invariably involves some physical activity. There is limited data available to help predict the exercise response at altitude in patients with chronic obstructive pulmonary disease (COPD). The aim of this study was to identify sea-level (SL) correlates that predict the resting and exercise response to acute altitude exposure in patients with COPD.

Methods: SL measures of cardio-pulmonary function were compared to the resting and exercise hypoxemic response at the summit of the Mt Hutt ski-field (2086 m), in 18 subjects with COPD. Results are expressed as (mean \pm SD).

Results: Ascent from SL to altitude caused significant hypoxemia at rest (PaO₂: 75 \pm 9 vs. 51 \pm 6 mmHg), and during a walk test (41 \pm 7 mmHg). At altitude, the walk test distance was reduced by 52%. SL PaO₂ and SaO₂ correlated with resting PaO₂ (r=0.69) and SaO₂ (r=0.79) at altitude. Diffusion capacity corrected for alveolar volume (K_{CO}) correlated with resting SaO₂ (r=0.74) and exercise PaO₂ (r=0.75) at altitude. Aerobic capacity correlated with the walk test distance at altitude (r=0.70). Spirometry values, lung volumes and ventilatory reserve did not correlate with the hypoxemic response to altitude.

Discussion: Baseline arterial oxygen levels and K_{CO} are key measures in predicting the hypoxemic response to acute altitude exposure in patients with COPD. The impairment in gas exchange associated with COPD is a significant mechanism causing altitude related hypoxemia in this group.

Keywords: Altitude, COPD, hypoxemia, respiratory function, exercise.

Acknowledgements: Asthma and Respiratory Foundation of New Zealand; Radiometer New Zealand; Mt Hutt Ski-field.

AO 03

PREVENTION OF AIRWAY NARROWING FOLLOWING MANNITOL INHALATION IN SUBJECTS WITH BRONCHIECTASIS

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Background and Objective: Mannitol is under investigation as a treatment for bronchiectasis because of its demonstrated ability to enhance mucociliary clearance. However, some bronchiectatic subjects are prone to bronchoconstriction after inhaling mannitol. This study investigated if pre-medication with either sodium cromoglycate (SCG) or eformoterol could protect such individuals from developing significant airway narrowing after inhaling mannitol.

Methods: A double-blind, placebo-controlled, randomised crossover study was conducted. Twenty one subjects had their lung function, airway sensitivity (PD₁₅) and airway reactivity (Response Dose Ratio) to mannitol assessed. Nine recorded a PD₁₅ <635 mg at screening and entered the trial. These subjects were then pre-medicated and re-assessed after placebo, SCG and eformoterol. Those not recording a PD₁₅ <635 mg after treatment were assigned a PD₁₅ of 1270 mg. A washout period of ≥ 72 hours separated each visit.

Results: At screening, subjects had a mildly reduced FEV₁ (68 ± 14% predicted), normal FVC (97 ± 15% pred.) and mildly reduced FEV₁/FVC (71 ± 8%). Airway sensitivity and reactivity were mildly increased, with a geomean PD₁₅ of 235mg mannitol (CI: 150, 368mg) and RDR of 0.057 % per mg (CI: 0.038, 0.085%/mg). After pre-medication with SCG, PD₁₅ increased significantly to 773mg (CI: 424, 1408; p < 0.05) and RDR reduced to 0.013%/mg (CI: 0.003, 0.050; p < 0.05). A small but significant (p < 0.05) fall in SpO₂ from 95 ± 2% to 93 ± 2% occurred after mannitol in the presence of SCG. Pre-medication with eformoterol also resulted in a significant increase in PD₁₅ to 1141mg (CI: 892, 1460; p < 0.05) and reduction in RDR to 0.009%/mg (CI: 0.003, 0.029; p < 0.05), but no fall in SpO₂.

Conclusion: Pre-medication with either SCG or eformoterol protects bronchiectatic patients with known airway sensitivity to mannitol from developing significant airway narrowing after inhaling mannitol.

Key words: bronchiectasis, bronchoconstriction, eformoterol, mannitol, sodium cromoglycate.

Declaration of Interest Statement: SDA is the inventor of the mannitol test; however, the intellectual property is owned by her employer, the Sydney South West Area Health Service. SDA has not received any fees personally from Pharmaxis. SDA has undertaken research studies that were funded by Pharmaxis. She is a shareholder in Pharmaxis but holds no options. She is likely to benefit from royalties in the future.

AO 04

BRONCHIAL PROVOCATION TEST(BPT) IMPROVEMENT IN DEFENCE FORCE RECRUITING(DFR) APPLICANTS AFTER LOW DOSE INHALED STEROID (LDIS)

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Background: In late 2006 DFR began to allow applicants with asthma into the defence forces if they were able to pass a BPT while on a LDIS treatment.

Aim: To review results of applicants who had BPT performed before and after a 3-month trial of LDIS and the difference in response between these 2 BPT's.

Method: BPT was performed using a standardized mannitol challenge procedure, on DFR applicants selected for testing based on baseline spirometry results or a previous diagnosis of Asthma. The patients then returned to the DFR/referring doctor and were prescribed a LDIS (either fluticasone propionate, budesinide or ciclesonide). After completion of a 3-month trial of the LDIS they returned for repeat BPT.

Results: From a total of 109 DFR applicants, 90 presented without recent LDIS use. Of these 34 had a positive response to the BPT (ie. $\geq 15\%$ drop in FEV1 from pre-challenge dose) with the average response being 18% (15% to 25%) at mannitol doses of 15mg to 635mg. Of these, 7 were placed on a 3-month trial of LDIS treatment and returned for repeat BPT.

Discussion: For the 7 applicants, the average response to initial BPT was 19% (15%-23%) at mannitol doses of 155mg to 635mg. After the 3-month trial of LDIS the number of positive responses to the BPT was 0 with the average response being 8% (1% to 12%) at 635mg mannitol. The applicants performing repeat BPT were on no respiratory medication prior to testing and are considered highly compliant with the LDIS treatment due to their desire for future employment opportunities.

Conclusion: With all 7 applicants having a negative BPT after LDIS, the LDIS is shown to be effective treatment for these otherwise undiagnosed or under-treated applicants. With 38% of DFR applicants, presenting for BPT, not on LDIS and showing a positive BPT response, there is a strong case for DFR to consider LDIS for a greater number of their applicants.

Key Words: Bronchial provocation test, mannitol, low dose inhaled steroid

AO 05

SPONTANEOUS RECOVERY FROM METHACHOLINE INDUCED BRONCHOCONSTRICTION MEASURED BY MULTIPLE BREATH NITROGEN WASHOUT (MBNW) IN ASTHMA

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Introduction: Methacholine challenge tests are commonly used for assessment of airway hyperresponsiveness (AHR) in asthma. Ventilation heterogeneity measured by MBNW yields two indices of heterogeneity: *Scond*, an index of conductive airways heterogeneity, and *Sacin*, an index of acinar heterogeneity. The aim of this study was to determine the site of spontaneous recovery after induced bronchoconstriction.

Methods: Asthmatic subjects performed three serial MBNW tests, five minutes apart, after the last dose of methacholine to induce a fall in FEV1 of 20% from baseline. *Scond*, *Sacin* and lung clearance index (LCI), a global measure of ventilation heterogeneity, were calculated for each test. ANOVA with repeated measures was used to analyse these results.

Results: Seventeen patients, 6 female, (mean(SD)) age = 38.7 (18) yrs were recruited. Baseline FEV1 %Pred = 87 (15) % and dose response ratio, a measure of AHR, was (median (range)) 18.08 (3.17 - 112.38). During spontaneous recovery there was a significant improvement in *Sacin* from (mean (SD)) 0.4013 (0.2) L⁻¹ to 0.3175 (0.16) L⁻¹ (p = 0.03) and LCI from 14.6 (3.7) to 13.2 (2.8) (p = 0.009), but not in *Scond*. FEV1 also recovered from 2.50 (0.7)L to 2.81 (0.8)L (p < 0.0001).

Conclusions: The spontaneous recovery in the first 30 minutes after methacholine induced bronchoconstriction occurs predominantly in the acinar airways. The mechanisms for this site of recovery are unknown, but could be related to mechanical, pharmacological or cellular inflammatory causes.

Key Words: Methacholine, ventilation heterogeneity, bronchoconstriction, MBNW.

Support: The Barbara Dunn Trust Fund, CRC for Asthma and NH&NMRC #457346.

Saturday 4 April
1300-1415 ANZSRS Oral Session 1B
AO 06

PRELIMINARY AUSTRALIAN LUNG AGE EQUATIONS

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Introduction: “Lung age” equations using spirometry were developed in 1985, by Morris et al¹, using data collected prior to 1971. There have been significant changes in the technology used to collect spirometry since the early 1970s.

Methods: 125 people were recruited into the Port Lincoln Lung Function Study,² subjects were age and sex stratified, between the ages of 25 and 74 years, were Caucasian non-smokers, with no history of respiratory disease. New predictive equations were produced by multiple linear regression.

Results: Preliminary lung age equations have now been produced for males and females, for the adult Australian Caucasian population, between 25 and 74 years, and are based on FEV1.

Discussion: The concept of spirometric “Lung age” was developed to provide physicians with an extra tool to motivate cigarette smokers to quit. Some modern spirometers automatically generate “lung age”, which use the original equations published by Morris et al in 1985. Participants in a recent study³ gave positive feedback of an adaptation of Lung Age, where graphical information was well-received and understood. Preliminary lung age equations suitable for the Australian Caucasian population aged between 25 and 74 years have now been developed. It is recommended that the Australian Lung Age equations be used for Australian Caucasians.

Key Words: spirometry, lung age, Australia, adults

References

- 1 Morris J, et al. Preventive Medicine. 1985;14:655-62.
- 2 Newbury W, et al. Respirology. 2008;13:1070-75.
- 3 Parker D, et al. Lung. 2008;186:313-16.

Support: PHC RED

AO 07

QUALITY ASSURANCE IN THE PERFORMANCE OF SPIROMETRY

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Background: Quality assurance of spirometric equipment is well documented and routinely performed in complex laboratories. However, quality assurance of the adherence of results to the American Thoracic Society (ATS)/European Respiratory Society (ERS) criteria for acceptability and repeatability does not appear to share the same level of scrutiny.

Aim: To look at the effect of annual auditing on adherence to the acceptability and repeatability criteria outlined by the ATS/ERS guidelines for spirometry.

Method: Each year (2004–2008), during the same time period, one hundred consecutive spirometry tests, displayed as both flow-volume and volume-time curves, were assessed for adherence to ATS criteria (2004-2005) and then ATS/ERS criteria (2006 -). The results of each audit were shown to staff, with feedback given via discussion and revision of the criteria after the first audit in 2004 and also after the 2005 audit when new criteria were implemented. In addition, a test rating scale was introduced after the 2005 audit in an attempt to improve adherence and assist with interpretation of results.

Results: The table below shows the percentage of audited results each year that met the ATS and ATS/ERS criteria for acceptability and repeatability (%ATS/ERS).

Year of audit	2004	2005	2006	2007	2008
% ATS/ERS	58	74	69	86	92

Conclusion: These results clearly demonstrate that yearly auditing, with feedback where necessary, substantially improve scientist adherence to acceptability and repeatability criteria. Therefore, it is imperative that quality assurance programs not only include regular assessment of equipment, but also regular auditing of results.

Keywords: Acceptability and repeatability criteria, quality assurance, spirometry.

AO 08

FORCED EXPIRATORY TIME MEASURED WITH SPIROMETRY AND AUSCULTATION FOR IDENTIFYING AIRWAY OBSTRUCTION

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Introduction: The recommended screening test for patients with suspected airway obstruction is post bronchodilator spirometry. Due to limited access to spirometry in rural areas and in emerging countries forced expiratory time (FET) may be a useful surrogate for identifying patients who do require a referral for spirometry.

Aim: To compare FET measured by spirometry (FETs) and auscultation (FETa) for identifying airway obstruction.

Methods: ATS/ERS standardised spirometry was performed on 117 patients (55 with airway obstruction) patients referred to the laboratory. A second scientist blinded to the spirometry result used a stethoscope to obtain duplicate measurements of FET by auscultation at the trachea.

Results: The group mean (S.D) for FETs was 11.04 (3.95) seconds and FETa 9.76 (4.55) seconds ($p < 0.001$). Pair-wise comparisons showed a difference in mean FETs and FETa between obstructed and non-obstructed patients ($p < 0.001$). The mean (S.D.) difference between FETs and FETa using Bland Altman plot was -1.46 (3.33) for non-obstructed patients, -1.09 (4.72) patients with airway obstruction and for the total group -1.28 (4.03). Receiver operator curves (ROC) for predicting FEV₁/FVC below the lower limit of normal of the predicted value show an area under the curve (95% confidence interval) for FETs of 0.855 (0.783 – 0.926) and FETa 0.826 (0.749 – 0.902) respectively. ROC curves best predictor point for FETs was 10.4 seconds, sensitivity 80%, and specificity 82.3%. For FETa the predictor point was 9.2 seconds, sensitivity 76.4% and specificity 79%.

Conclusion: The prediction of airway obstruction using FET by FETs or FETa both show good agreement when compared to FEV₁/FVC ratio. The FETs measurements performed slightly better than FETa measurements. Forced expiratory time would be a satisfactory screening value for identifying airway obstruction in the absence of spirometry.

Key words: Forced expiratory time, airway obstruction, spirometry, auscultation.

AO 09

REMOTE MONITORING IN CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD) DOES NOT REDUCE HOSPITAL ADMISSIONS OR IMPROVE QUALITY OF LIFE WHEN COMPARED TO STANDARD BEST PRACTICE CARE

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Remote in-home monitoring (RM) of physiological and symptom-related variables may allow early detection and treatment of exacerbations in patients with COPD. It is unclear whether RM improves patient outcomes or reduces healthcare resource utilisation.

Aim: To determine whether RM in moderate-severe COPD reduces hospital admissions and length of stay (LOS) or improves quality of life (QOL) (SF36, Chronic Respiratory Disease Questionnaire-CRDQ).

Methods: Forty-four patients having at least one hospital admission in the previous 12 months were randomised to standard best practice care (SBP) (n=22) or SBP+RM (n=22). SBP included clinical management according to COPD-X guidelines with availability of pulmonary rehabilitation and provision of outreach nursing. RM involved daily measurement of spirometry, inspiratory capacity, weight, temperature, blood pressure, oximetry, ECG, sputum colour and volume, symptoms and medication usage. RM data were reviewed five days weekly to determine need for intervention.

Results: There were no differences (mean±SD, SBP vs. SBP+RM) in age (68±8 vs. 70±9), gender (M/F: 10/12 both groups) or previous computer-familiarity (59% vs. 50%) between groups. The SBP group had a lower FEV1 (0.66±0.24 vs. 0.91±0.34, p<0.01). There were no differences in number of COPD-related admissions/year (1.5±1.8 vs. 1.3±1.7, p=0.76), COPD-related LOS days/year (15.6±19.4 vs. 11.4±19.6, p=0.66), total admissions/year (2.2±2.1 vs. 2.0±2.3, p=0.86), total LOS days/year (22.1±29.9 vs. 21.6±30.4, p=0.88) or QOL between the two groups.

Conclusion: The addition of RM to SBP did not reduce healthcare utilization or improve quality of life in this group of patients already receiving regular nursing outreach.

Key Words: COPD, monitoring, remote, exacerbations, admissions

Support: Department of Human Services (Vic).

AO 10

THE DEVELOPMENT OF COPD IN A COHORT STUDY OF CHILDHOOD ASTHMA

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Introduction: It has been suggested that the origin of adult lung disease stems from childhood illness. The aim of the study was to describe lung function outcomes of childhood asthma and the development of COPD in a community-based cohort at 50 years of age.

Methods: In 1964, 484 children were randomly selected out of 30,000 grade two school children living in Melbourne. Out of the participants, 374 had asthma and 105 were controls. All participants were followed prospectively at seven-year intervals up to the age of 50 years. To date, results of standard lung function, multiple-breath nitrogen washout and bronchial provocation challenge tests have been collected from 182 participants still remaining in the study.

Results: Based on lung function data, 182 subjects were grouped into the following:

	Intermittent		Asthma		Severe Asthma	
	Remission	Continuing	Remission	Continuing	Remission	Continuing
FEV1	104 (96 - 111)	97 (91 - 104)	99 (92 - 105)	94 (88 - 100)	99 (78 - 120)	85 (78 - 92)
FEV1/FVC	76 (74 - 79)	72 (70 - 75)	74 (70 - 77)	70 (67 - 73)	74 (63 - 86)	63 (60 - 67)
DLco	96 (91 - 102)	98 (92 - 105)	93 (86 - 100)	97 (90 - 104)	84 (33 - 135)	105 (99 - 111)

It was found that 14% of subjects had a significant bronchodilator response.

Conclusion: At 50 years of age, those with severe asthma showed lower lung function with majority not responding to bronchodilator.

Key Words: Asthma, COPD, DLco.

Support: National Health and Medical Research Council

Sunday 5 April
1530-1700 ANZSRS Oral Session 2
AO 11

DLCO VARIES BETWEEN RESPIRATORY FUNCTION SYSTEMS

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Introduction: The DLCO varies within an individual over time. Commercial systems measure DLCO by different techniques. Since changes in DLCO over time are used to alter treatment (eg during chemotherapy), it is important to determine the magnitude of any differences in measurement between different equipment.

Methods: Thirteen subjects, 24-57 years had measurements of DLCO made on the same day within a 3 hour period using 4 commercially available systems: Morgan (PK Morgan, UK), Vmax Autobox 6200;(SensorMedics, USA); Medisoft Body Box series 5500 (Medisoft Group, Belgium); and Medgraphics Ultima (Medtechnica, USA). All repeat measures were at least 4 minutes apart and satisfied ATS/ERS criteria for reproducibility and acceptability. Between day repeatability was measured for Medgraphics and Vmax from two repeat measurements, made within 1 week of each other.

Results: The mean &(SEM) DLCO for the Morgan, Vmax, Medisoft and Medgraphics systems were 25.4(1.3(SEM)),25.6(1.2),27.9(1.3)and 30.3(1.5) mlCO/mmHg/min, respectively. The Morgan and Vmax measurements were similar but were different from the others ($p<0.0001$, ANOVA). There were similar differences for KCO mean 4.78(0.2(SEM)), 5.21(0.2), 5.36 (0.2),5.84(0.2) ml/mmHg/min/l($p<0.0001$).Morgan measurements were lowest. The VA measurement was lowest for Vmax compared with the other three systems , VA mean 5.34 (0.32(SEM)), 4.98 (0.27), 5.31 (0.27), 5.30(0.34) litres ($p<0.0001$). The 95% limits of agreement for DLCO for Vmax and Medgraphics measurements were ± 6.26 ($\pm 24\%$) and ± 6.85 ml/mmHg/min ($\pm 27\%$), respectively.

Conclusion: There were clinically significant differences in DLCO, KCO and VA measurements between different systems with poor within subject repeatability. The repeatability of these measurements should be known for any given system. Measurements made with different equipment should be interpreted with caution.

Key Words: DLCO, KCO, VA, Repeatability.

Nomination: Young Investigator award.

AO 12

REDUCED RESPIRATORY REACTANCE IN CHILDREN BORN PRE-TERM IS NOT RELATED TO LUNG VOLUMES

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Introduction: Bronchopulmonary Dysplasia (BPD) is a chronic lung disease following premature birth. Rapid advances in neonatal care have shifted the abnormality in BPD lungs from the conducting airways to structural alterations in distal parenchyma. The long-term outlook of “new BPD” is not known.

Aims: To characterise the relationship between resistance (R_{rs}) and reactance (X_{rs}), assessed using the Forced oscillation technique (FOT) and lung volumes of pre-term children with and without BPD.

Methods: Pre-term subjects (<32 w gestation) with BPD (≥ 28 d supplemental O₂ or respiratory support at 36 w postmenstrual age) or nonBPD, and a healthy control group born at term were studied. Measurements of R_{rs} and X_{rs} using the FOT and FRC by Multiple Breath Nitrogen Washout (MBW) were obtained.

Results: 150 children (74 BPD, 44 nonBPD, 32 healthy controls), aged 4-8 y, were studied. Measurements of FOT were obtained in 148 children and MBW in 54 children. There was a significant decrease in X_{rs} ($p < 0.02$) between preterm children, irrespective of BPD category, and healthy subjects, but no difference in R_{rs} . Significant differences in X_{rs} were noted at 8 Hz between the BPD and nonBPD preterm groups (BPD mean Z-score: -1.62, nonBPD mean Z-score: -1.10, $p = 0.008$). There was no difference in FRC between the preterm and healthy children.

Conclusion: Children aged 4 to 8 y and born preterm have reduced X_{rs} , but similar FRC when compared to healthy controls. Respiratory reactance (a marker of distal lung function) differentiated between preterm children with and without BPD. The reduced X_{rs} was not explained by reduced lung volumes, suggesting that preterm children have altered lung structure resulting from pre term birth.

Key Words: Bronchopulmonary dysplasia, FRC, resistance, reactance

Nomination: Young Investigator Award

Funded by Princess Margaret Hospital Foundation Grant.

AO 13

THE EFFECT OF SHORT ACTING BRONCHODILATORS ON THE COMPLIANCE OF AIRWAY DIAMETER AND LENGTH

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Background: In patients with long-standing asthma, chronic inflammation results in airway remodelling and irreversible airflow obstruction presumably due to a loss of airway compliance within the bronchial tree. Short-acting bronchodilators (BD) have limited effect in reversing loss of lung compliance. Currently it is unknown whether the primary site of improved compliance is the large or small airways, and whether it is predominantly length or diameter dependent.

Aim: To investigate the effect of BD on the compliance of airway lumen inner diameter (DI), airway outer diameter (DO) and length (L), in large and small airways, in asthmatic patients.

Methods: 8 asthma patients underwent partial HRCT scans at FRC, TLC and a mid-volume (MID). Individual airways were identified in consecutive scans, from which DI, DO, and L were measured. The relationship between both DI and DO compliance and airway size was quantified, before and after BD, using a novel methodology that enables 3-dimensional representation of airway compliance specific to airway size.

Results: Small airways (DI<3mm) DI and DO are more compliant than large airways (DI>8mm), before and after BD. Following BD: 1) Mean L at FRC decreased by 5%. 2) In the small airways, the increase in DI and DO (from FRC to TLC) was 27% and 10%, respectively; in the large airways, the increase in DI and DO (FRC to TLC) was 9% and 16% greater, respectively.

Conclusion: Our study showed that airway compliance attributable to DI, DO and L are non-uniform between FRC and TLC. Our findings demonstrate that the small airways and DI are important for improved lung compliance in asthma.

Nomination: Young Investigator Award

Supported by: CRC for Asthma and Airways and Asthma NSW

Conflict of Interest: No

AO 14

EFFECTS OF CHANGING REFERENCE VALUES ON INTERPRETATION OF SPIROMETRY

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Background: Recent spirometry reference studies^{1,2} are arguably the most rigorous and valid ever performed, and as such the ATS/ERS now recommend NHANES¹ data be used throughout North America. It is timely to consider adopting these reference values in our region however an evaluation of the consequences of such a change is required.

Aim: To assess the effects of changing spirometry reference equations on interpretation.

Methods: We analysed data from 554 consecutive patients tested in each of 2 adult pulmonary function laboratories in public teaching hospitals. Lower limits of normal (LLN) were calculated using ECCS (1993), Knudson (1983), NHANES¹ and HSE² prediction equations and used to define restriction (FVC<LLN) and obstruction (FEV1/FVC<LLN). This interpretative strategy was also compared with the GOLD definition of obstruction as FEV1/FVC<70%.

Results: Average age for all 1,108 patients (50% female) was 60 years (range: 20-91). The mean predicted FVC from NHANES and HSE were similar and consistently higher than that from ECCS and Knudson (average of 270mls higher). This translates into a 76% increase in the incidence of 'restrictive' interpretations using NHANES data compared with ECCS and Knudson, and a smaller increase of 40% for HSE. Using FEV1/FVC <70% to diagnose obstruction in those over 65 years of age (n=463) would result in false positive rates of 28% (using NHANES) and 27% (HSE). Using the same definition in a younger group (<50 yo, n=268), approximately one in seven obstructed patients would be incorrectly classified as being within normal limits.

Conclusion: Changing to either NHANES or HSE predicted values will significantly increase the rate of 'restrictive' interpretation, and alter the rate of 'obstructive' findings. The NHANES and HSE data confirm that using FEV1/FVC <70% to define obstruction causes over-diagnosis in the elderly, and under-diagnosis in younger subjects.

¹Hankinson et al. AJRCCM, 1999, 159:179. ²Falaschetti et al. ERJ, 2004, 23:456

Key words: Reference values, Spirometry, Interpretation

AO 15

ANALYSIS OF VENTILATION HETEROGENEITY (VH) WITH HYPERPOLARIZED HELIUM MAGNETIC RESONANCE IMAGING (HPHEMRI) FOLLOWING INHALED METHACHOLINE (MCH) AND MANNITOL (MNT) CHALLENGES IN ASTHMATIC SUBJECTS

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VH is a feature of asthmatic bronchoconstriction and contributes to airway hyperresponsiveness (AHR) and disease expression. Response to direct (Mch) and indirect (Mnt) inhalational challenges help to distinguish between remodelling and inflammatory components of AHR. HPHeMRI provides topographical information about VH in asthma but has not been quantitatively analysed.

Aim: To characterise VH as measured by HPHeMRI following Mch and Mnt challenges in asthmatic subjects.

Methods: Asthmatic subjects were recruited and had HPHeMRI at baseline and following crossover Mch and Mnt challenges on separate days. Images were analysed and indices of VH performed using voxel analysis to construct a frequency histogram of ventilation. Qualitative analyses of image heterogeneity between Mch and Mnt challenges were also performed.

Results: 8 asthmatic subjects (7F, 1M) were studied with baseline lung function comparable between Mch (FEV₁ 95±13% pred) and Mnt (FEV₁ 94±12% pred) challenge days. The maximal falls from baseline in FEV₁ were 24±7% (Mch) and 17±11% (Mnt) respectively (p=0.10). All scans demonstrated visually significant VH post challenge. Quantitative voxel intensity frequency histogram analyses did not reveal significant differences between Mch and Mnt challenges.

Conclusions: There are no significant differences in HPHeMR image analysis between Mch and Mnt challenges in stable asthmatic subjects. This is a novel quantitative method of analysing topographical changes in ventilation following airway challenge, and further work is required to correlate this with physiological measures of VH.

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