

P38 THE IMPACT OF ETHNICITY ON SPECIFIC AIRWAYS RESISTANCE (sRAW) IN CHILDREN

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J Kirkby, R Bonner, S Lum, S Sonnappa, J Stocks. UCL, Institute of Child Health, London, UK

Introduction Plethysmographic Specific Airways Resistance (sRaw), which can be measured during tidal breathing without need for airway occlusion.^[1] has been shown to discriminate between young healthy children and those with lung disease. Recent recommendations and reference data were, however, based on data from White children.^[2] This could potentially bias interpretation if applied to children of other ethnicities. Nevertheless, since ethnic differences in lung and airway function have been shown to be proportional,^[3] and since sRaw is internally adjusted for differences in resting lung volume, we hypothesised that there would be no ethnic differences in sRaw.

Aim To compare sRaw between healthy Black and healthy White children of similar age.

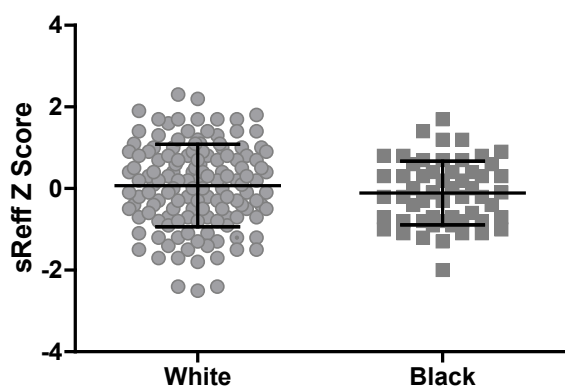
Methods Fifty-six healthy Black children (64% male, mean (SD) age: 8.3(1.1) years) and 148 healthy White children (50% male, mean (SD) age: 7.3(1.4) years) underwent sRaw measurements in accordance with recent recommendations.^[2] Results were expressed as Z-Scores to adjust for height, sex and age.^[2] Paired t-tests were used to determine the impact of ethnicity on sRaw.

Results There were no significant differences in sRaw between healthy Black children and healthy White children ($p=0.22$). The mean (95% CI) difference (Black-White) for specific effective airways resistance (sReff)^[2] was -0.2 Z-Scores (0.5; 0.1) (figure 1).

Conclusion Since ethnic differences in sRaw do not occur, published sRaw reference equations derived from White children should be equally applicable when assessing Black children with lung disease.

References

1. Dab & Alexander, *Pediatr Res*, 1976.
2. Kirkby, *ERJ*, 2010.
3. Quanjer *ERJ* 2012.



Abstract P38 Figure 1 Comparison of sReff Z-Scores in healthy White and Black children (Black lines denotes mean \pm SD)

P39 VENTILATORY RESPONSE AMONGST SCUBA DIVERS AND NON-DIVERS

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¹CMN Earing, ²DJ McKeon, ¹H-P Kubis. ¹School of Sport, Health and Exercise Science, Bangor; ²University, Bangor, Wales, Respiratory Department, Ysbyty Gwynedd, BCUHB, Bangor, Wales

Purpose To investigate the ventilatory response to CO₂ in hyperoxia, hypoxia, and during exercise amongst experienced scuba divers and matched controls.

Methods Three studies were performed comparing the ventilatory response to CO₂ of experienced scuba divers with non-diving matched controls. The first study measured the ventilatory recruitment threshold (VRT) during CO₂ rebreathing in hyperoxia of experienced divers ($n=10$) and controls ($n=10$); the second study investigated the CO₂ sensitivity in rest and exercise using CO₂ rebreathing in hyperoxia at a workload designed to mimic the load of diving with scuba divers ($n=11$) and controls ($n=11$). The third study examined the respiratory drive of scuba divers ($n=10$) and controls ($n=10$) whilst breathing four different gas mixtures balanced with N₂ (ambient air; 25% O₂/6% CO₂; 13% O₂; 13% O₂/6% CO₂) aimed to assess the combined response to hypercapnia and moderate hypoxia.

Results Experienced divers possessed a higher VRT ($P<0.05$) coinciding with the accumulation of 7%^{ins}CO₂ ($pCO_{2cap}=53.20\pm2.20$ mm Hg) during CO₂ rebreathing compared to controls with VRT occurring at 6%^{ins}CO₂ ($pCO_{2cap}=44.72\pm1.74$ mm Hg). Exercise at a load typical for diving was found to have no effect on the ventilatory sensitivity to CO₂ in divers (rest: 1.49 ± 0.33 ; exercise: 1.22 ± 0.55 [l/min x mmHg⁻¹]) and controls (rest: 2.08 ± 0.71 ; exercise: 2.05 ± 0.98 [l/min x mmHg⁻¹]) while differences in sensitivity remained between the groups ($P<0.05$). Inspiration of the four test gas mixtures revealed there was no contribution of the tested oxygen pressures to the difference in ventilatory sensitivity to CO₂ between divers and controls.

Conclusion Divers possess a lower ventilatory response to CO₂ which was not affected by exercise or the tested oxygen pressures suggesting an adaptation of central CO₂ sensitivity.

Key Words: Diving, hypercapnia, hypoxia, chemo sensitivity, exercise

P40 CHANGE IN RECTUS FEMORIS CROSS SECTIONAL AREA (RFCSA) FOLLOWING AN ACUTE EXACERBATION OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE (AECOPD)

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¹S Mandal, ¹E Suh, ²B Connolly, ¹M Ramsay, ²Z Puthucherry, ²J Moxham, ¹N Hart. ¹Lane-Fox Respiratory Unit, London, UK; ²King's College London, London, UK

Introduction Ultrasound (US) is a useful tool in measuring RFcsa. We have previously shown that a curvilinear ultrasound probe (CUP) is equally effective as a linear ultrasound probe in measuring RFcsa (Mandal et al 2011). We therefore used a CUP-US to characterise the trajectory of muscle loss in a cohort of patients with AECOPD.

Methods Subjects had RFcsa measured at 3/5 of the distance from the anterior superior iliac spine to the superior border of the patella during a hospital admission with AECOPD and at 4 weeks post hospital discharge. Image acquisition was made using real time B-mode ultrasonography using a 2–5MHz curvilinear probe (SonoSite Inc, Japan). RFcsa measurements were calculated offline using the Image J® programme. Subjects also wore an Actiwatch Spectrum device (Phillips Respironics, Murrysville, Pennsylvania) to monitor physical activity levels during exacerbation and recovery.

Results 10 patients were recruited. 40% were male with an age of 71 ± 11 years and FEV₁ 0.6 ± 0.12 L (on admission). RFcsa at admission was 519 ± 359 mm². Mean change in RFcsa between admission and follow up was -90 ± 295 mm² (19.5%). Subjects were divided in to 2 groups based on a 10% reduction in RFcsa (see table 1). Small numbers of patients prevented statistical analysis of the data. However, patients with $\geq 10\%$ RFcsa loss tended to be older, had a lower BMI and longer length of hospital stay. At discharge this group of patients had lower daily physical activity count and

greater time spent immobile. Both groups increased their daily activity count and decreased their immobile time between discharge and follow-up. However, those with preserved RFcsa tended to increase their activity count more than those with RFcsa wasting (table 1).

Discussion These data suggest RFcsa muscle wasting as a consequence of an AECOPD was more common in older patients with a lower BMI. These patients tended to have a longer hospital stay with lower activity levels both during and immediately after an AECOPD. However, more patients are required to confirm these initial observations.

Abstract P40 Table 1 Differences in physical activity levels between group 1 and group 2

	Group 1 RFcsa \geq 10% loss Mean \pm SD	Group 2 RFcsa<10% loss Mean \pm SD
DEMOGRAPHICS		
Age (years)	75.8 \pm 13.1	66.2 \pm 7.5
BMI (kg/m ²)	21.8 \pm 7.6	30.2 \pm 8.7
Length of stay (days)	10.8 \pm 10.3	4.0 \pm 4.5
Admission Numerical Rating Scale for dyspnoea (0–10)	8.3 \pm 0.5	4.6 \pm 2.7
Admission COPD Assessment Tool (0–40)	32 \pm 4	26 \pm 8
FEV ₁ (L)	0.7 \pm 0.14	0.6 \pm 0.09
Discharge Numerical Rating Scale (0–10)	5.4 \pm 3.2	2.2 \pm 1.8
Discharge COPD Assessment Tool (0–40)	25 \pm 6	19 \pm 12
ACTIVITY		
Activity count at discharge (AU)	87,699 \pm 52,786	169,548 \pm 92,657
Activity count/minute at discharge (AU/min)	93 \pm 52	185 \pm 88
Immobile time at discharge (minutes)	254 \pm 111	169 \pm 153
Percentage immobile time (%)	28 \pm 13	18 \pm 14
Activity count at 4 week follow up (AU)	148,073 \pm 87,759	213,810 \pm 65,438
Activity count/minute at 4 week follow up (AU/min)	159 \pm 85	238 \pm 68
Immobile time at 4 week follow up (minutes)	216 \pm 124	123 \pm 59
Percentage immobile time at 4 week follow up (%)	23 \pm 12	14 \pm 7

BMI=Body Mass Index, RFcsa=Rectus Femoris cross-sectional area, AU= Arbitrary units.

P41 THE ROLE OF OBESITY IN UNEXPLAINED BREATHLESSNESS AND EXERCISE INTOLERANCE EVALUATED BY CARDIO-PULMONARY EXERCISE TESTS (CPET)

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P James, Z Mangera, S Isse, B Ibrahim, R Gupta, K Wadsworth, D Mukherjee, B Yung, JT Samuel. *Basildon and Thurrock University Hospital, Basildon, United Kingdom*

Introduction Resting cardio-respiratory investigations may not indicate a cause for unexplained breathlessness and exercise intolerance (UB&EI). CPET is an objective, non-invasive tool to measure cardio-respiratory function during exercise. Increased BMI can contribute to exercise intolerance. We present a review of CPET in evaluating patients referred to our centre with UB&EI.

Methods We did retrospective analysis of CPET results in patients referred to our centre over a two year period (2010 to 2012). All patients had resting cardio-respiratory function tests including coronary angiogram and stress echo cardiogram in some cases. CPET was performed by maximum symptom limited incremental protocol on a cycle ergometer starting with 3 minutes of rest followed by 3 minutes of unloaded cycling and subsequent increase in workload as per ATS recommendations. We defined obesity as BMI of \geq 30 kg/m². Tests were supervised by two qualified physiologists and reported by a consultant chest physician.

Results Of 243 CPET tests performed during this period, 68 (28%) were done to evaluate UB&EI. 38 patients(56%) were obese. Overall, obesity was the sole cause of UB&EI in 22 patients (32%) and was a contributory factor in a further 15 patients (22%). In the obese subgroup, it was the sole cause in 21 patients (55%) and contributory in a further 16 patients (43%). Being overweight (BMI 29) was the sole cause of unexplained breathlessness in 1 non-obese patient. Obesity appeared to be the major contributing factor for UB&EI even when present with other factors. In 23 patients (34%) more than one contributory factor was present (Cardiovascular/Respiratory/VQ mismatch/physical de-conditioning/functional). Physical de-conditioning was the sole cause in 5 patients (7%) and Hyperventilation in 2 patients (3%).

Conclusion While the causes of UB&EI are multi factorial, in our study obesity was a contributory and often key factor in over half the patients. In the obese subgroup, being overweight was the sole factor in over half and played a contributory role in almost all patients. CPET is a useful test to determine specific causes of UB&EI when resting cardio-respiratory tests are non-contributory and can help with reassurance, dietary advice and exercise prescription.

P42 COMPARISON OF VENTILATION HETEROGENEITY INDICES DERIVED FROM MULTIPLE BREATH INERT GAS WASHOUT

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¹S Gönem, ¹S Natarajan, ¹S Corkill, ¹A Singapur, ¹D Desai, ²P Gustafsson, ¹CE Brightling, ¹S Siddiqui. ¹Glenfield Hospital, Leicester, United Kingdom; ²Central Hospital, Skövde, Sweden

Introduction and objectives Multiple breath inert gas washout (MBW) is a technique for quantifying ventilation heterogeneity (VH). Commonly-used indices of VH such as lung clearance index (LCI) may be biased by alterations in functional residual capacity, tidal volume and anatomical dead space. We hypothesised that a novel marker of VH, exponential decay index (EDI) would exhibit more favourable measurement properties than established indices.

Methods Seventy-four patients with asthma and eighteen healthy control subjects were recruited. MBW was performed in triplicate in each subject using a modified Innocor gas analyser (Innovision A/S, Odense, Denmark). Analysis of the washout curve yielded a number of VH parameters including LCI, mixing ratio (MiR), moment ratio (MoR) and the novel parameter EDI. EDI was calculated by fitting the washout data to both one-phase and two-phase exponential decay models and deriving the difference in goodness of fit (R²) between the two models. Phase III slope analysis yielded values for S_{cond}, S_{acin} and first breath SnIII (FB SnIII). Repeatability was assessed using intraclass correlation coefficient (ICC), and ability to discriminate between health and disease was determined using receiver operating characteristic (ROC) curves. Robustness to variations in FRC, Vt and Vd was determined by calculating the ratio of signal (absolute difference between healthy and asthma groups) to noise (standard deviation of calculated 'ideal' values for each subject, assuming perfect gas mixing).

Results The most repeatable parameters were LCI (ICC = 0.905), MoR (ICC = 0.869), FB SnIII (ICC = 0.867) and S_{acin} (ICC = 0.846). The most discriminatory parameters were FB SnIII, S_{acin} and EDI, with areas under the ROC curve of 0.728, 0.707 and 0.691 respectively. Signal-to-noise ratios for LCI, MiR and MoR were 1.726, 3.911 and 0.679 respectively, thus accounting for the poor discriminatory ability of these markers.

Conclusion FB SnIII and S_{acin} appear to be the most favourable markers of VH. EDI is the most discriminatory parameter that does not rely on phase III slope analysis. Since FB SnIII may be derived from a single-breath manoeuvre, this parameter warrants further investigation in other disease groups, and normative values should be derived in large healthy populations.