P125 NON-INVASIVE ASSESSMENT OF VENTILATION DISTRIBUTION IN INFANTS USING ELECTRICAL IMPEDANCE TOMOGRAPHY (EIT)

doi:10.1136/thx.2010.150987.26

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Background Early detection of lung disease in conditions such as cystic fibrosis (CF) is vital to maximise lung health but lung function tests (LFT) during the 1st year of life are limited to a few specialised centres. Electrical Impedance Tomography (EIT) provides a novel non-invasive technique for measuring breathing patterns and regional ventilation but its use has generally been restricted to anaesthetised or ventilated subjects in intensive care.[1 2]

Aim To assess the feasibility and potential usefulness of EIT for monitoring changes in breathing pattern and ventilation distribution in spontaneously breathing sleeping infants.

Methods Simultaneous recordings of EIT (Goe-MF II EIT system) and changes in tidal volume using a pneumotachograph (PNT) were made in the supine position in infants undergoing standard LFT under chloral sedation, before and after application of face mask and PNT, and during tidal breathing (TB) vs passive lung inflations (PLI) to 30cmH_2O.

Results To date, paired data have been obtained from 9/10 infants in whom measurements were attempted (aged 3–12 months: five=CF and four=healthy controls, one technical failure of EIT). Application of the face mask resulted in a mean (range) 27 (12–39)% increase in impedance. Compared with TB, PNT volume increased by mean (SD) 127 (20)% during PLI, which was accompanied by a 152 (22)% increase in impedance. During TB, ventilation was relatively evenly distributed between left (L) and right (R) lung, mean (SD) L/R:1.09 (0.22) and, as in adults, was preferentially distributed to the dependent (dorsal) lung (dorsal/ventral (D/V):1.36 (0.29)). During PLI, there was a significant shift in ventilation distribution to the left and ventral portions of the lung (mean (95% CI) L/R:1.29 (1.24; 1.35); D/V:0.89 (0.71;1.06)) (Abstract P125 Figure 1). Data collection is continuing.

Conclusions These results suggest that EIT maybe a useful non-invasive method of monitoring changes in breathing pattern and ventilation distribution in spontaneously breathing infants. Despite suggestions that distribution of ventilation differs in infants, the preferential distribution to the dependent lung during tidal breathing mimics that seen in adults. Improvements in software and equipment will be required prior to routine applications.

Funding This work was supported by the British Lung Foundation, Cystic Fibrosis Trust and GOSH Special Trustees.

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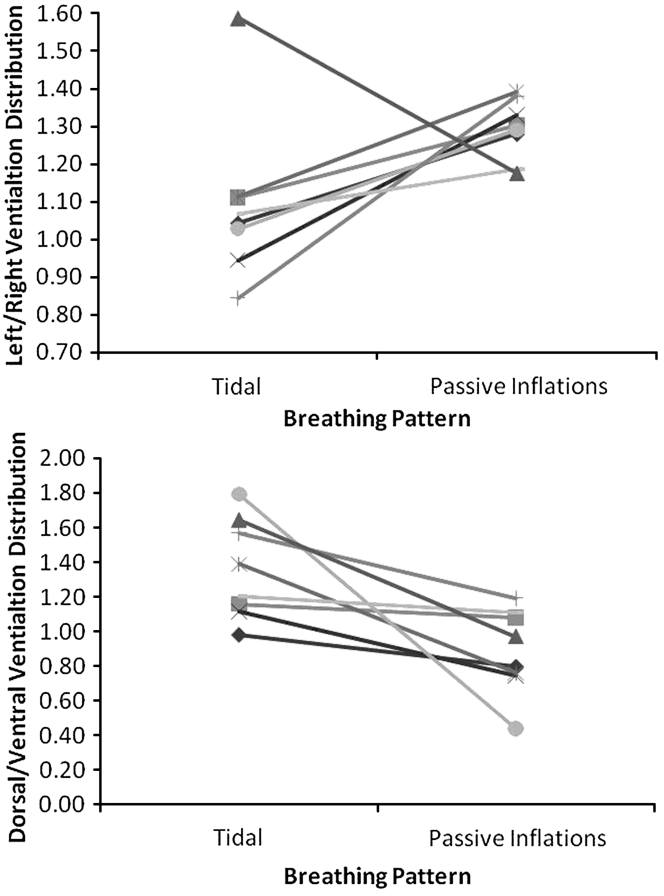

Abstract P125 Figure 1 Change in ventilation distribution in sleeping, supine during different breathing patterns.

P126 THE INFLUENCE OF BREATHING PATTERN ON SPECIFIC AIRWAYS RESISTANCE

doi:10.1136/thx.2010.150987.27

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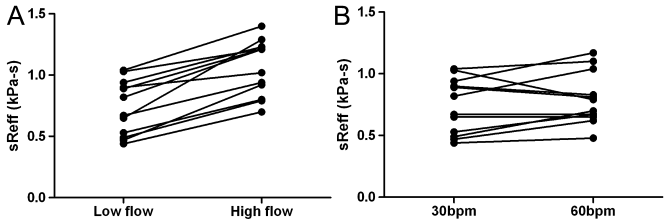
Introduction Plethysmographic Specific Airways Resistance (sRaw) is measured during tidal breathing from the relationship between simultaneous measurements of airflow and change of plethysmographic pressure without need for airway occlusion.[1] sRaw has been shown to be useful for discriminating lung disease in young children. It has previously been shown that breathing frequency (BF) can have a marked impact on measured values on sRaw,[2] and recent recommendations have suggested BF should be maintained at 30–45 bpm.[3] However, we hypothesise that the true impact of breathing pattern may relate more to pattern of breathing and flows attained than breathing frequency per se.

Aim To determine the influence of flow and breathing frequency on specific effective airways resistance (sReff) measurements.

Methods 12 healthy adults (age 17–56 year) performed repeated measures of sReff in the plethysmographic body box (V5.01, Cardinal Health) at either 30 bpm or 60 bpm at low flows (ie, quiet, natural breathing) or high flows (ie, forced breathing) in a random order. Paired t-tests were used to determine the impact of flow and BF on sReff.

Results There was a significant increase in sReff (mean difference: 0.3 kPa·s (95% CI of the difference: 0.2 to 0.4) $p<0.0001$) when flows were doubled from approximately ±1 l/s to ~±2 l/s, while maintaining a constant BF. By contrast, when BF was doubled while maintaining a constant flow there was no significant change in sReff (mean difference: 0.06 kPa·s (95%CI of difference: 0 to 0.1), $p=0.21$) (Abstract P126 Figure 1).



Abstract P126 Figure 1 Within-subject changes in sReff when (A) flows are doubled but breathing frequency remains constant at 30 bpm, and (B) when flows remain relatively constant but breathing frequency is doubled.

Conclusion The true impact of breathing pattern on sRaw relates more to flows attained than to breathing frequency. To facilitate improved repeatability and minimise inter-subject and inter-centre variability, it is essential that subjects are encouraged to breathe quietly and naturally during plethysmographic recordings of sRaw. Software adaptations that allow accurate display of flows during data collection and analysis are required before guidelines pertaining to flow can be generated.

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P127 DOES IT MATTER HOW THEY BREATHE?—PERCEPTIONS IN COPD PATIENTS WHEN ADOPTING DIFFERENT ROUTES OF BREATHING

doi:10.1136/thx.2010.150987.28

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Introduction We have reported that normal subjects prefer nasal breathing (NB) and that the adoption of mouth breathing (MB) is associated with uncomfortable sensations including breathlessness.[1] MB may predispose to the perception of breathlessness by dynamically changing chest wall mechanics (CWM), and thus proprioceptive input. This study has been extended to COPD patients in whom airways resistance and dynamic hyperinflation is likely to alter CWM.

Method 20 COPD patients, mean age 71 years (range 47–89), FEV_1 mean 0.8 l (range 0.4–2.02 l), whilst at rest (tidal breathing), undertook a 2×2 min cross over exercise during which subjects were requested to note their perceptual experiences when randomly allocated to either NB or, after a break, MB. The results have been compared to the individuals preferred route of breathing normally and 20 normal subjects (controls).[1]

Results 10/20 (50%) of COPD patients during NB found the exercise to be uncomfortable compared to only 3/20 (15%) controls (p=0.04). 9/20 (45%) witnessed discomfort with breathing/breathlessness, 0/20 dry mouth and 2/20 (5%) a desire to cough. 13/20 (65%) of COPD patients during MB found the exercise to be uncomfortable compared to 10/20 (50%) controls (p=0.52). 8/20 (40%) COPD patients witnessed discomfort with breathing/breathlessness, and dry mouth 6/20 (30%). 6/20 (30%) COPD patients preferred NB, 7/20 (35%) had no preference and 7/20 (35%) preferred MB during normal breathing in usual life. This compares to 13/20 (65%), 4/20 (20%) and 3/20 (15%) respectively for controls. 9/20 (45%) COPD patients had a positive Nijmegen score (>23) (compared to 0/20 controls) and Hospital Anxiety Depression (HAD) scores were greater in COPD (p<0.001). Depression in COPD patients was strongly associated with a preference for MB normally (r=0.6, p=0.007).

Conclusions This study has shown that COPD patients, in contrast to controls, have adopted a shift in breathing preferences to favour MB. High scores for Nijmegen and HAD in COPD suggest ventilatory dysfunction with depression closely linked to MB. We hypothesise that MB in COPD patients is intricately linked to high levels of ventilatory dysfunction and depression.

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P128 THE CHALLENGES OF HYPERTONIC SALINE IN NON-CF BRONCHIECTASIS

doi:10.1136/thx.2010.150987.29

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Background Non-Cystic Fibrosis (CF) bronchiectasis is an understudied clinical area. Many studies are extrapolated from CF despite prior evidence suggesting this is not wholly appropriate. Recent BTS guidelines have suggested a role for Hypertonic Saline (HS) after findings from Kellet et al (2008). In that study, a nebulised (7%) HS challenge test was done and subjects were to be excluded from ongoing HS therapy if they reported 'chest tightness', 'wheeze' or 'difficulty in breathing', or had a 10% reduction in spirometry following inhalation of HS. Notably none of 23 patients were excluded on these criterion. We hypothesised that a fall in FEV_1 greater than 10% would be more common in a non study population but of limited clinical significance.

Methods We reviewed our 6% hypertonic saline challenge (baseline, post 2.5 mg Salbutamol and post 6% HS) data from consecutive patients commenced on this therapy due to mucus retention despite other interventions (eg, physiotherapy and/or mucolytic) Results: 33 patients were identified (20F, 13M) mean age 61.5±13 years, mean baseline FEV_1 was 1.37L±0.7 (range 0.4–2.65) mean FEV_1% predicted 54%±25% (range 23–111%). One patient's data were excluded due to inability to reproducibly perform spirometry. The mean change in FEV_1 from baseline was +4.3%±10.8 % (range −21 to −36) and fall from post Salbutamol was −0.64±11.6% (range −14 to +14%). Seven patients have stopped HS therapy either due to chest tightness or taste (20%).

Conclusions This cohort is larger than that previously reported and includes a wider range of airflow obstruction severity. No exclusion criterion were applied to trying HS. The overall fall during an acute HS challenge in an unselected bronchiectasis population is small. Despite this many patients discontinue HS within 3 months of initiation.

P129 LUNG CLEARANCE INDEX (LCI) IS A SENSITIVE MARKER OF EARLY AIRWAY CHANGES IN SMOKERS WITH NORMAL SPIROMETRY

doi:10.1136/thx.2010.150987.30

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Introduction and objectives Abnormalities in indices of gas mixing derived from multiple breath nitrogen washouts have been demonstrated in smokers without spirometric evidence of airflow obstruction, which improved on smoking cessation. We report initial data from a study investigating the ability of a simpler