# Lung Biology Research & Trainee Day
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Title: Transpulmonary Water Loss: Exhaled Breath Condensate Volume and its Utility as a Non-invasive Biomarker in Asthma
Abstract: Introduction: Airway epithelial barrier dysfunction is thought to contribute to mucosal inflammation in asthma, but this is difficult to measure in individual subjects. In atopic dermatitis, a condition with similar immune pathology to asthma, transepidermal water loss (TEWL) is used as a non-invasive measure of integument integrity. We sought to determine whether transpulmonary water loss (TPWL) could be a useful non-invasive biomarker in asthma. Methods: In a previous study of 144 healthy and asthmatic subjects conducted between 2009-11, we collected exhaled breath condensate (EBC) by having subjects breathe tidally into a one-way valve mouthpiece connected to an ECoScreen II collecting device (Erich Jaeger GmbH, Höchberg, Germany). EBC was collected for 12.3 ± 3 minutes. The volume of exhaled breath condensate was measured (µl) and divided by total ventilation (L) to generate the TPWL (µl/L). The cohort of subjects was diverse with respect to age, sex and severity of asthma. TPWL was compared in healthy subjects to mild, moderate and severe asthmatics, and we studied its relationship with asthma symptoms (ACT, AQLQ), inhaled corticosteroid (ICS) use, lung function (FEV1), FeNO, and concentration of different plasma biomarkers. Reproducibility of TPWL was also compared in 55 subjects who returned for a second visit (typically within 90 days). Results: Data from 144 subjects were analyzed (29 healthy and 115 asthmatics, including 42 with severe asthma). TPWL averaged 16.5±1.8 µl/L in healthy subjects compared with 16.4±2.8 µl/L in asthmatics (mean±SD, $p>0.05$). No significant differences were observed between the mild/moderate compared to severe asthmatic group (16.5±2.9 vs. 16.2±2.6, $p>0.05$). TPWL was similar in asthmatics with inhaled corticosteroid (ICS) use and those without ICS use (16.4±2.5 vs. 17.3±2.3, $p=0.06$) and in subjects with FeNO <25ppb compared to those with FeNO >25pbb (16.1±2.4 vs. 16.9±2.5, $p=0.07$). There were no significant differences in FEV1, ACT, AQLQ, and FeNO when comparing subjects with TPWL less than vs. greater than the median value (not shown). Correlation analysis revealed that TPWL was reasonably reproducible between visits (R-squared=0.103, $p=0.01$), although less than FeNO (R-squared=0.168, $P=0.0009$). Finally, a correlation matrix found a weak but positive association between TPWL and serum leptin (pg/ml) levels (R-squared 0.103, $p=0.05$). Conclusion: TPWL can be estimated by measuring the volume of EBC normalized to ventilation. There were no significant differences in TPWL when comparing healthy subjects with asthmatics, and no clear correlation between TPWL and asthma severity, FEV1, FeNO, ACT, AQLQ scores and ICS use.