

USING CONTINUOUS AIFLOW UNDERESTIMATES THE AIRWAY EPITHELIAL CHANGES CAUSED BY REDUCED ABSOLUTE HUMIDITY IN VITRO.

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Continuous airflow has been used in many laboratories when studying airway epithelial function in vitro because the temperature and humidity of the gas flowing over the epithelium can be more rigorously controlled than with reciprocal flow.

However this method does not reflect normal tidal breathing. We aim to assess epithelial function in a model involving reciprocal airflow in comparison with continuous airflow. **METHODS:** The in vitro preparation has been described previously (Kilgour et al. Intensive Care Med. 30:1491-4,2004). Mucus velocity was measured directly; ciliary beat frequency from reflected light. The epithelium was ventilated with humidified air ($V_T = 0.4\text{l}$, $f = 15.\text{min}^{-1}$); returning gas coming from an artificial 'moist lung'. Absolute humidity was reduced by reducing gas temperature. Preparations kept at 34°C or 30°C for five hours were compared with controls at 37°C (100%RH throughout; $n = 10/\text{situation}$). Time effects were assessed using ANOVA, and survival curves created including using the logrank test for trend and χ^2 used to compare reciprocal versus continuous airflow.

RESULTS: Ciliary activity continued for the entire experimental period at 37°C. Mucus movement was more labile with only 1 preparation having movement at 270 minutes. Lower air temperature caused a more rapid cessation of function - mucus movement ceased within 2 hours at 34°C and within 1 hour at 30°C. At 34°C, some ciliary beating was maintained throughout however it stopped within 2.5 hours at 30°C. The median survival time for mucus transport was 30 min and 90 min for ciliary activity at 30°C - significantly more rapid than the 84.5 min and 120 min previously seen with continuous airflow (ref). The effects of lowered temperature and hence absolute humidity were graded ($p = 0.022$) and even 34°C, 100% RH had a significant effect on epithelial survival in vitro. **CONCLUSION:** Studies performed with continuous flow significantly underestimate the epithelial damage caused by low absolute humidity.

Key Words: Mucus, ciliary function, epithelium, trachea.