

DPhil Research Proposal

Deploying the Inspired Sinewave Technique in the ICU setting to reduce Ventilator-Induced Lung Injury in Acute Respiratory Distress Syndrome patients

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Globally, 5M patients need mechanical ventilation each year. Although a life-saving therapy, mechanical ventilation can itself damage the lung if inappropriately delivered - a condition known as ventilator-induced lung injury (or VILI). VILI increases mortality, morbidity, length of ICU and hospital stay and decreases patients' quality of life after discharge. Currently, without a bed-side monitor of lung function, clinicians have to determine ventilator settings based on judgement, and protocols derived at the population level. The combination of VILI with acute respiratory distress syndrome (ARDS) still carries a mortality >40%, affecting > 0.8m patients with a further 1.7m at risk a year globally.

The IST is a novel non-invasive method to measure cardiopulmonary function being developed in the Nuffield Division of Anaesthesia, the University of Oxford.

The IST works by delivering small amounts of tracer gas into a patient's inhaled breath and measuring the responding concentrations in the exhaled breaths. The collected data is then processed by a computer program to provide the measurements. The IST has been tested in animal models, surgical patients, and patients with chronic obstructive pulmonary disease. A feasibility study in ICU has also been conducted.

The IST can address the VILI problem by providing real-time measurement of a patient's effective lung volume – essentially the most compliant regions, the so called 'baby lung', and lung inhomogeneity (a marker of unevenly ventilation is distributed). It is feasible that the tidal volume and pressure applied to the lung can be optimised based on this information¹.

Following the positive pilot work in an animal model of ARDS, ventilated surgical and ICU patients, the Respiratory Bioengineering research group plans to take this research to into the ICU setting. This would provide an opportunity for a suitable candidate to undertake DPhil study in its development, and to validate its effectiveness in the treatment of VILI/ARDS patients. The project does not automatically come with funding, but applicants enter a funding competition with all other DPhil applicants. Prospective students with their own funding are also welcome to apply.

REFERENCE

¹: Cressoni et al., 'Lung inhomogeneity in patients with acute respiratory distress syndrome', Am. J. Respir. Crit. Care Med., vol. 189, no. 2, pp. 149–158, Jan. 2014.