

2016/2017 Summer Studentship Project Application Form

Send to: Research Office, University of Otago Christchurch, PO Box 4345, Christchurch, by 5pm on **4 July 2016**

Supervisor Information (First named supervisor will be the contact):

Supervisor's Name and Title(s): Prof GM Shaw, Dr CG Pretty, Dr JL Dickson, Dist Prof J Geoffrey Chase

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Research Category (Choose one category only – to be used for judging the students' presentations):

Clinical X

Project Title (20 words MAXIMUM):

Monitoring the Transient Hemodynamic Impact of Mechanical Ventilation

Project Description:

AIM: This study aims to analyse the hemodynamic impact of model-based care of mechanically ventilated (MV) patients in the intensive care unit (ICU) during the ongoing CURE (Clinical Utilisation of Respiratory Elastance) randomised trial. The primary objective of this observational study is to assess the impact of MV and changes in positive end expiratory pressure (PEEP) over time on hemodynamics, by analysing its effect on beat-to-beat stroke volume (SV). Specifically, is their potential for higher PEEP, particularly in the acute phase, to significantly reduce SV?

Methods: The CURE study records the pressure and flow of every breath, and the ventilator settings in both the intervention and "standard care" arms of the study. (*ANZ Clinical Trials Registry No. ACTRN12614001069640; Ethics Approval: 14/STH/132*). This study will investigate those patients whose arterial pressure is monitored using a femoral arterial catheter, and will obtain all pressure data for up to 24 hours from the BedMaster™ Data Management archive where all such data is automatically stored. There will thus be no intervention or direct real-time data recording from the patient bedside, as it will only use archived data.

In particular, a novel, calibrated and validated model-based measure of beat-to-beat SV developed by the proposal authors will be obtained from the pressure sensor data and ECG data. This measure will allow us to record the level and evolution of SV with changes in MV parameters. The study will thus assess the impact of changes in PEEP on SV and other related cardiovascular parameters obtained from the patient bedside chart (inotrope doses, fluid resuscitation volumes). The overall outcome will determine if the CURE model-based best ventilator settings specific to each patient at a particular time have a negative impact on patient-specific hemodynamics.

Clinical trial: (Student participation 3 weeks): Student will gather data from archives after having identified CURE patients who met the criteria of being in the CURE study, and having a femoral arterial catheter for blood pressure monitoring.

Analysis: (Student participation 6 weeks): Student will work with UC researchers and correlate SV with hemodynamic interventions and ventilator settings, specifically addressing:

1. Association of SV and SV/kg body weight with PEEP and driving pressure, ΔP
2. Association of SV and its changes with inotrope dosing (and PEEP)
3. Association of SV and its changes with fluid resuscitation (and PEEP)

These are the primary study goals, and others may also be considered as developed by the student and supervisors.

Significance: Mechanical ventilation (MV) is applied to over 50% of patients in ICUs and is associated with reduced SV and cardiac output (CO) as PEEP increases. However, this response is patient-specific and transient, but may lead to adverse outcomes. While CO changes, as an average SV over a long time period have been measured, the transient changes have not. This study utilises a unique, new measure of SV to assess these transient changes. This project will also extend our understanding and capability to provide world class care in an area of clinical importance, while also providing a leading research and clinical experience for the student scholar.

Expectations: The student will be exposed to methods and practice of basic research and clinical practice pilot study design. He/she will be involved in the collection of data, provision of care, and decision making and will thus have experience of a wide range of clinical data. They will also assist with statistical methods to verify the results.

Their work will form part of a larger research programme carried out by senior academic staff (Prof JG Chase), Masters and PhD students from the University of Canterbury, and Prof GM Shaw from ICU. Results from this work will be published in appropriate medical and biomedical engineering journals.

Timeframe: Ideally the student will be involved in all clinical work and training, as well as in data analysis. The student will be exposed to supervised, hands-on, experience of an interventional study in critically ill patients. This will be followed by analysis to determine the association of PEEP, ΔP , inotrope dose and fluid resuscitation with changes in SV, which may have significant implications for patient safety and outcomes. Data analysis and documentation of results will take another 1-2 weeks at the end.