MedTech CoRE Conference 2015 – "Meeting the Challenge"

Healthtech Award - Best Translational Research Project

Abstract Submission Form

Corresponding author:

Title:	Mr	**Occupation:**	PhD Student
First Name:	Shun	**Surname:**	Kamoi
Email address:	Shun.kamoi@pg.canterbury.ac.nz	**Phone:**	+64278915576
Organisation affiliation(s):	University of Canterbury		

Abstract Title:	Novel Stroke Volume Estimation Method from Aortic Pressure Measurements and Aortic Diameter
Author(s):	S.Kamoi, C.G.Pretty, S.Davidson, Y.S.Chiew, J.Balmer and J.G.Chase

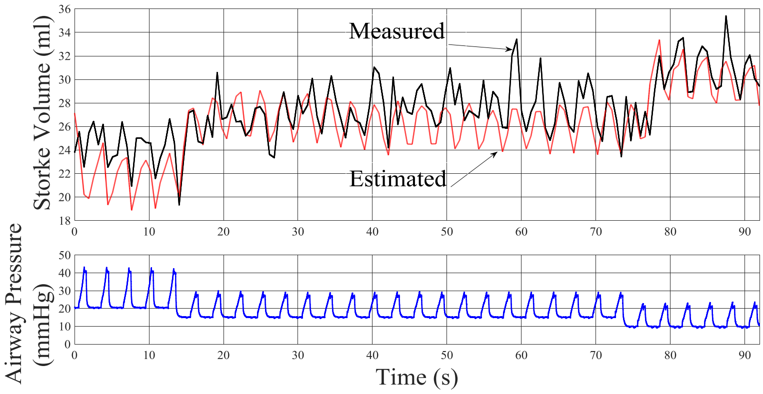
Abstract:
(250 words max + up to 1 figure)

Stroke Volume (SV) is an essential cardiac parameter in assessing and treating patients with cardiovascular dysfunction. However, direct SV measurement are not clinically feasible, requiring highly invasive procedures. Currently, devices for indirect monitoring of SV can be inaccurate during sudden hemodynamic changes, leading to sub-optimal clinical treatment. Thus, there is a need for an accurate, practical monitoring system to estimate SV from available clinical measurements.

This work presents a novel SV estimation method using two spatially separated aortic pressure measurements and aortic diameter. Pressure contours from the spatially separated sensors are used to calculate the Pulse Wave Velocity (PWV) in the aorta. PWV combined with a patient-specific estimate of the aortic diameter allow the aortic characteristic impedance to be determined. A three-element Windkessel model uses the characteristic impedance to identify the resistance and compliance of the aorta from pressure contours. Flow rates can then be calculated and integrated to deliver a beat-to-beat estimate of SV.

Currently, the method has been validated using data from five porcine experiments where rapid SV changes were made by changing positive end-expiratory pressure on the mechanical ventilator. The result showed high agreement and correlation between model-based estimates of SV and measured SV using an admittance catheter (For example Figure 1).

This novel SV estimation method accurately captures dynamics during sudden changes made in the hemodynamic conditions, as well as changes due to breathing, providing crucial information for optimizing treatment. The method has great potential for improving cardiac and circulatory treatment in the critical care environment.

	 Figure 1 – Example of model-based estimate and measured SV during positive end-expiratory pressure change from a porcine experiment. Top panel: model based estimate of SV (red dotted line) and measured SV from admittance catheter inserting into the left ventricle (black line). Bottom Panel: measured airway pressure from mechanical ventilator (blue line).