

ESTIMATING VENTRICULAR STROKE WORK FROM AORTIC PRESSURE WAVEFORM

S.Kamoi¹, C.G.Pretty¹, Y.S.Chiew¹, A.Pironet², T.Desai², G.M.Shaw³, J.G.Chase¹

¹Department of Mechanical Engineering, University of Canterbury, New Zealand

²University of Liège (ULg), GIGA-Cardiovascular Sciences, Liège, Belgium

³Intensive Care Unit, Christchurch Hospital, New Zealand



Introduction

- Ventricular Stroke Work (VSW) is an important physiological parameter when assessing patient cardiovascular performance.
- Quantifying VSW requires ventricular pressure-volume measurements, which are highly invasive and clinically not feasible.
- This research presents a model-based analysis of aortic pressure contours to estimate VSW changes.

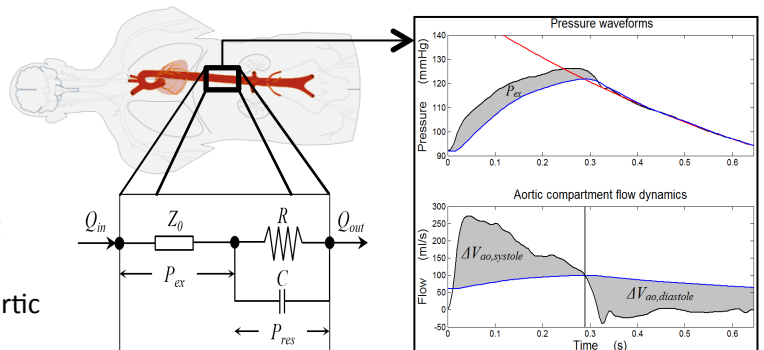
Methods

Data from porcine experiments were used to validate accuracy of the model where both aortic pressure and ventricular pressure-volume were measured.

VSW index estimation procedure

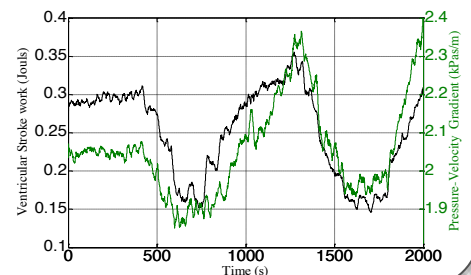
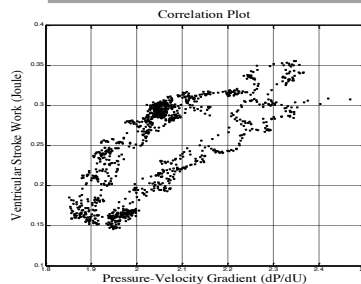
- Identify physiological parameters RC and Z_0C from measured aortic pressure (P_{ao}) contour
- Separate P_{ao} into excess and reservoir pressure using identified parameters
- Identify Pulse Wave Velocity (PWV) using Bramwell & Hill Equation
- Calculate pressure-velocity gradient in aortic compartment using Joukowski Equation

Model-Based analysis of aortic pressure



Results

The correlation coefficient between measured VSW and model-based estimation of pressure-velocity gradient in aorta (VSW index) showed good agreements with $R=0.71$.



Conclusion

- The model only requires aortic pressure waveform, and thus clinically feasible for patients in ICU.
- The method presented in this study show the potential for continuous, accurate monitoring of VSW trends

Contact

Shun.kamoi@pg.canterbury.ac.nz