TRACKING STRESSED BLOOD VOLUME DURING VASCULAR FILLING EXPERIMENTS

A. Pironet[1], P. C. Dauby[1], J. G. Chase[2], S. Kamoi[2], N. Janssen[1], P. Morimont[1], T. Desaive[1]

[1]University of Liège (ULg), GIGA-Cardiovascular Sciences, Liège, Belgium
[2]Department of Mechanical Engineering, University of Canterbury, New Zealand

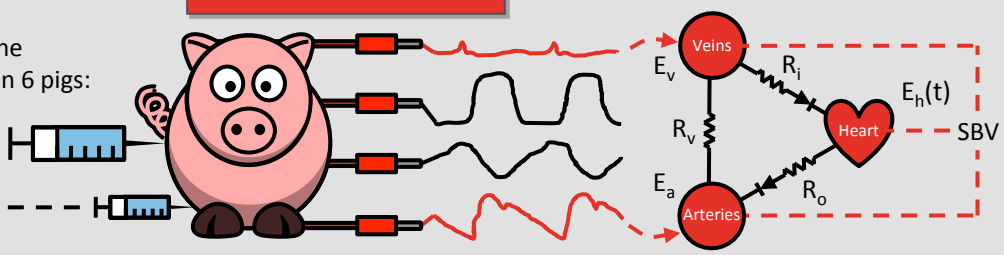
Introduction

- Vascular filling is a common procedure to restore cardiac output (CO) in critically ill patients*.
- Total stressed blood volume (SBV) is defined as the total pressure-generating blood volume.
- SBV has been associated with success or failure of vascular filling therapy*.
- Current methods to determine SBV involve repeated phases of circulatory arrests followed by fluid infusion, which is time-consuming and can be harmful*.
- In this work, a model-based method is developed to track SBV during vascular filling experiments.

Methods

Vascular filling experiments (successive infusions of saline solution) were performed on 6 pigs:

- pigs 1 and 2 received 500 ml infusions
- pigs 3 to 6 received 225 ml infusions.

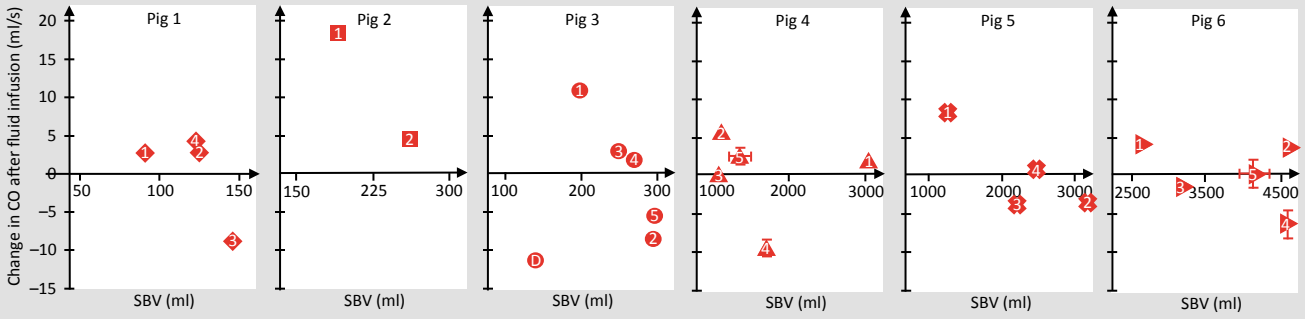


Left ventricular, aortic, and vena cava pressures and left ventricular volume were recorded before and after each infusion.

The parameters of a 3-chamber cardiovascular system model were adjusted to fit the data.

Results

The SBV value is associated with the change in CO after each 500/225 ml fluid infusion, as previously noticed*.



Conclusions

- SBV is associated with the change in CO following fluid infusion.
- The response curves are subject-specific.

Reference

*Maas, J. *et al*. Bedside Assessment of Total Systemic Vascular Compliance, Stressed Volume and Cardiac Functions Curves in Intensive Care Unit Patients. *Anesthesia & Analgesia,* 115(4), 880-887, 2012.

Acknowledgments

FÉDÉRATION WALLONIE-BRUXELLES
fnrs LA LIBERTÉ DE CHERCHER
SEVENTH FRAMEWORK PROGRAMME

Contact

A.Pironet@ulg.ac.be