Citation for published version (APA):
https://doi.org/10.1109/EMBC.2014.6944441

Citing this paper
Please note that where the full-text provided on King's Research Portal is the Author Accepted Manuscript or Post-Print version this may differ from the final Published version. If citing, it is advised that you check and use the publisher's definitive version for pagination, volume/issue, and date of publication details. And where the final published version is provided on the Research Portal, if citing you are again advised to check the publisher's website for any subsequent corrections.

General rights
Copyright and moral rights for the publications made accessible in the Research Portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognize and abide by the legal requirements associated with these rights.

•Users may download and print one copy of any publication from the Research Portal for the purpose of private study or research.
•You may not further distribute the material or use it for any profit-making activity or commercial gain
•You may freely distribute the URL identifying the publication in the Research Portal

Take down policy
If you believe that this document breaches copyright please contact librarypure@kcl.ac.uk providing details, and we will remove access to the work immediately and investigate your claim.
This model expresses stroke volume, $V_{in}$, as the sum of distending flow and outflow terms. Each term contains an unknown physical variable: compliance, $C(P)$, or resistance, $R$.

$$V_{in} = \int_{t_0}^{t_1} C(P) \, dP + \frac{1}{R} \int_{t_0}^{t_1} [P - P_{out}] \, dt$$

Several simplification methods have been used to eliminate one unknown variable. An independent calibration measurement is used to estimate the other variable, facilitating continuous CO monitoring.

**1. Why is this clinically important?**

Cardiac output (CO) monitoring is used to assess the haemodynamics of critically ill patients. It is used to guide fluid administration and vasoactive drug use. However, it is often inaccurate during changes in vascular tone [1], which can be caused by fluid administration and vasoactive drug use. Monitors estimate CO from the arterial blood pressure (ABP) wave using the Windkessel model of the circulation.

**Aim:** To assess the accuracy of existing methods for CO monitoring using the Windkessel model during a change in vascular tone.

**2. The Windkessel Model**

This model expresses stroke volume, $V_{in}$, as the sum of distending flow and outflow terms. Each term contains an unknown physical variable: compliance, $C(P)$, or resistance, $R$.

**Methods**

ABP signals were acquired from 15 critically ill patients, alongside reference CO measurements, $C_{ref}$ [1]. The dosage of norepinephrine infusion, a vasoactive drug, was doubled during the recording giving a step-change in vascular tone. Continuous CO, $C_{est}$, was estimated using each simplification method. $C_{est}$ values were calibrated with $C_{ref}$ prior to dosage increase. The precision of each method was assessed by comparing $C_{ref}$ during double dosage with the mean $C_{est}$ during that $C_{ref}$ measurement.

**Results**

See table. The most accurate methods maintained both compliance and outflow terms. The remaining methods, which eliminated one of the terms, tracked CO less well during changes in vascular tone.

**References**


The paper accompanying this poster is:


**3. Clinical Evaluation**

**4. Conclusion**

CO monitoring using the Windkessel model is more accurate during changes in vascular tone when distending flow and outflow terms are maintained. No methods tracked CO within the clinically-acceptable ±30%.

**Contact:** Peter.Charlton [at] gstt.nhs.uk