

## Correspondence

# Cardiac output measurements during off-pump coronary surgery: comparison between partial rebreathing and pulmonary artery thermodilution

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### EDITOR:

We read the article by Dr Gueret and colleagues comparing two different methods of cardiac output determination in off-pump cardiac surgery with great interest [1]. Off-pump coronary artery bypass surgery (OPCAB) is an increasingly popular method of myocardial revascularization for both routine and high-risk patients. During positioning the heart for grafting, however, there is potential for sudden and profound haemodynamic deterioration, especially for posterior placed grafts. Therefore, continuous and reliable monitoring of cardiac performance is of paramount importance and the best way to determine cardiac output during OPCAB has yet to be defined. Hence the authors should be commended for their study, having for the first time investigated if either the widely used cardiac output determination by semicontinuous pulmonary artery thermodilution or the partial CO<sub>2</sub> rebreathing technique (PRCO) is able to obtain reliable and reproducible haemodynamic data during rapid haemodynamic changes. However, some methodological limitations should be noted.

Firstly, since OPCAB causes both large and rapid global haemodynamic changes [2], assessment of cardiac output should be 'beat-to-beat' so that reductions during positioning of the heart or during grafting can be rapidly identified. In this respect, neither conventional assessment with pulmonary artery catheter nor PRCO is suitable to display haemodynamic changes rapidly but only with considerable delay. Our group has shown recently that PRCO does not reliably reflect rapid haemodynamic changes during aortic reconstruction [3]. The authors claim a faster response of PRCO to changes in cardiac output but do not present any data to justify their

conclusion. Consequently, the ability of methods to track such changes was never really challenged. Even if the time constant of PRCO may be comparable, the CO determined does not reflect instantaneous cardiac output. Therefore, cardiac output values obtained should have been compared to a true clinical gold standard, i.e. transit time ultrasound flow determination at the ascending aorta.

Secondly, it is well known that ventilation during OPCAB has to be tailored to facilitate surgical procedure. Repeatedly, low tidal volumes are applied that may be insufficient for adequate rebreathing.

Finally, it must be emphasized that PRCO as determined with the NICO device is in principle limited in its ability to display acute and pronounced changes in cardiac output. The NICO algorithm is mainly based on the assumption of a stable pulmonary capillary blood flow during the measurement cycle. The rebreathing cycle consists of either 50 s (normal mode) or 35 s (fast mode). However, a preceding baseline period (60 s) and a following stabilization period (70 s) are required for reliable measurement. Therefore, PRCO is not suitable for any situation where rapid and sudden changes are anticipated.

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### References

1. Gueret G, Kiss G, Rossignol B *et al.* Cardiac output measurements in off-pump coronary surgery: comparison between NICO and the Swan-Ganz catheter. *Eur J Anaesthesiol* 2006; 23: 848–854.
2. Mathison M, Edgerton JR, Horswell JL *et al.* Analysis of hemodynamic changes during beating heart surgical procedures. *Ann Thorac Surg* 2000; 70: 1355–1360.
3. Bein B, Hanne P, Hanss R *et al.* Effect of xenon anaesthesia on accuracy of cardiac output measurement using partial CO<sub>2</sub> rebreathing. *Anaesthesia* 2004; 59: 1104–1110.

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