Correlation between esCCO and transthoracic echocardiography in critically ill patients

Editor—We read with interest the article published by Bataille and colleagues in a recent issue of the BJA. The study tried to evaluate the correlation and agreement of esCCO compared with transthoracic echocardiography (TTE) for non-invasive cardiac output (CO) monitoring in critically ill patients. Several concerns could be highlighted from the methodology and we would like to address some comments through this letter. The authors did not standardize the timing for CO measurement. Indeed, they wrote that cardiac output was repeated each time a patient required a CO reading during a period when an investigator was available. They also describe that a variable number of CO readings were obtained per patient, but no data are given to understand the timing, the clinical condition, and the reason why the operator chose to measure CO. This design is particularly unusual. We thought that a well-designed study needs a standardized protocol and should not be based on a random decision to evaluate CO. Moreover, no information was given about the physician who performed TTE. We would like to know if the same operator systematically performed CO measurement by TTE. Indeed, it is well established that echography is an operator-dependent technique and changing operators could be a major source of bias. We agree that esCCO is a new device and further studies are needed to assess the correlation between this device and ‘gold standard’ monitoring. We also agree that echocardiography appears the ‘gold standard’ for CO evaluation by a non-invasive method. If the authors wanted to evaluate the efficacy of esCCO to monitor non-invasive CO, they need to perform a well-designed study, with standardized timing measures, by taking into account patient characteristics, and possible source of bias. Unfortunately, the authors did not give any information about patient characteristics. Without such details, we could imagine that they put into the same group: patients with severe sepsis, trauma, acute respiratory distress syndrome, postoperative patients, and others. We could not agree with this design because none of the, invasive or non-invasive, monitoring should be used without careful attention to the patient. Moreover, different possible sources of bias were not yet evaluated with esCCO. Does local skin temperature influence the result? Does the amount of vasoactive agents administered to the patient also influence? Does the vasomotor tone in a septic patient permit adequate measurement? Finally, we agree that correlation tests and the Bland–Altman method appear adequate for this study. The authors observed a significant correlation between COesCCO and COTTE; similarly, the concordance between Delta CO(esCCO) and Delta CO(esTTE) was acceptable with $R=0.63$. However, the Bland–Altman analysis has led to poor results. This could easily be explained by the small number of patients included in the analysis and the heterogeneity between the different measures (timing, patient status, co-morbidities, temperature). The esCCO was initially compared with continuous thermodilution CO in 36 postoperative cardiac surgery patients. The results in this standardized population appear really positive with a bias of $-0.06$ (mean difference) and a precision (1 sd) of $0.82$ litre min$^{-1}$. In a recent study, esCCO was used in 213 patients, 139 intensive care unit patients, and 74 in operating theatres. The analysis shows a correlation coefficient of $0.79$ ($95\%$ confidence interval: $0.76–0.82$), a bias of $0.13$ litre min$^{-1}$, and a precision (1 sd) of $1.15$ litre min$^{-1}$. These results are different from the results in the BJA study. In comparison, studies that evaluated the degree of agreement for LiDCO technology compared with pulmonary artery catheters show that general agreement is good but in some specific populations, agreement is poor. That does not mean the device is of weak interest, but it is crucial to know the potential limitations of the technique. In conclusion, we thought that even this study could be of some interest, the design does not permit an adequate evaluation of the utility of esCCO to monitor non-invasive CO in a critically ill patient. In order to evaluate the quality of this device, a well-designed study is

B. Bataille*
Narbonne, France
E-mail: b_bataille2@yahoo.fr

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required. The protocol might be systematized, must take into account patient characteristics but also identify potential sources of bias by adequate statistical analysis.

**Declaration of interest**

None declared.

D. FaranoNi*
L. Barvais
Brussels, Belgium
E-mail: davidfaraoni@me.com

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**Emergency laparotomy: time to assess risk, but not according to time**

Editor—Saunders and colleagues 1 are to be commended for their important national multicentre prospective study on emergency laparotomy.

As clinicians we have long recognized the potent value of physiological parameters in predicting mortality in acute illness; a greater number and extent of physiological abnormalities conferring greater mortality. However, of particular interest in this study is the apparent relationship of simple measures of age and ASA grade within these time subgroups when interpreting the results relating to the time of day (Table 2) that laparotomy was performed. The work of NCEPOD has rightly led to firm guidance towards solely life, limb, and organ-saving surgery being performed during the night. 2–5 This is mentioned only in passing and with relation to consultant presence rather than case mix in this paper. We can assume, as the authors have, that these time of day groups are heterogeneous, with a greater proportion of unwell patients among the cohort of 152 patients operated overnight than in the cohort of 1044 operated during the day. Therefore, we cannot effectively interpret the results in Table 2. With this important confounding variable in mind, it would be interesting to see the breakdown of the aforementioned simple measures of age and ASA grade within these time subgroups.

**Declaration of interest**

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A. J. Beamish*
D. S. Y. Chan
Wales Deanery, UK
E-mail: drbeamish@doctors.org.uk

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**Challenges with improving outcomes after emergency surgery**

Editor—Confirmation of significant mortality after emergency laparotomy in the first report from the UK Emergency Laparotomy Network 1 highlights some important issues with research into, or clinical audit of, the care of emergency surgical patients and our efforts to improve perioperative outcomes in this population. Observational studies can be