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Tracking of cardiac output from arterial pulse wave

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In a previous issue of Clinical Science, Remmen et al. [1] addressed the question whether the Modelflow* method can reliably assess cardiac output (CO) from an arterial pressure waveform without calibration. This question is not new, neither is the answer: it does not, as we have shown in a series of earlier studies [2–5]. If accurate absolute values are required, the methodology needs calibration against a 'gold standard', such as thermodilution [2] or Fick [6]. Otherwise, CO can be expressed as changes from control with the same precision in CO tracking [4]. Uncalibrated, the model cannot replace thermodilution, but after one calibration the Modelflow* method can do without further thermodilutions for a long period of time [2]. Even under the adverse circumstances of low arterial pressure, e.g. in severe shock, calibrated Modelflow* C0s from radial or femoral arterial pressure track over a wide range of C0s with a limited error (2±7%) for up to 2 days without recalibration [5]. The model equally accepts intra-arterial and non-invasively determined finger pressure as input, as we have shown during prolonged orthostatic stress [4]. Modelflow* stroke volume estimates and those from thermodilution differed neither in direction nor in magnitude (3±8 ml for prolonged head-up tilt and 3±9 ml for standing).

Rather than to take issue with the methodology of Remmen et al. [1] that may have inspired the overstated title of their paper, we want to stress the basic value of the Modelflow* method for cardiovascular research and for clinical practice. We consider it highly important that changes in CO can be tracked from an arterial pressure waveform, which can be as peripheral as the radial artery [5,7] or finger [4]. We are aware that erroneously absolute values without calibration or comment have been reported in the literature [8,9]. Therefore we want to stress once more that, without calibration, Modelflow* CO should be expressed as relative changes from its starting value.

REFERENCES


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Tracking of cardiac output from arterial pulse wave: authors’ reply

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We appreciate the comments of J. J. van Lieshout and J. M. Karemaker who underscore the conclusion of our report [1] that, without initial calibration, Modelflow* cannot be used for reliable assessment of the absolute cardiac output (CO) levels. We agree indeed that the Modelflow* method is a valuable method for cardiovascular research and clinical practice, as has been demonstrated in several reports [2–5]. However, under circumstances when absolute values for CO are needed, the prerequisite for calibration may limit the use of Modelflow*, especially in elderly subjects. Since the method gives reliable trend data [2–4], Modelflow* may be useful for continued monitoring of CO after removal of a pulmonary artery catheter in those patients in whom CO was initially assessed invasively, e.g. in patients who stayed at the intensive or coronary care unit.

Without initial calibration, changes in CO should be reported solely as relative changes and not as absolute changes, as stressed by J. J. van Lieshout and J. M. Karemaker. However, to our knowledge, no data have been reported comparing relative changes in thermodilution CO with relative changes in Modelflow* CO without invasive calibration. Furthermore, no prior studies have specifically addressed this issue in the elderly. We believe that further studies are warranted on the value of Modelflow* on assessment of relative changes in CO without invasive calibration in the elderly, including the most aged subjects.

REFERENCES


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