

FloTrac for monitoring arterial pressure and cardiac output during phaeochromocytoma surgery

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EDITOR:

The recently introduced FloTrac device (FloTrac/Vigileo; Edwards Lifescience, Irvine, CA, USA) has been proposed as a reliable semi-invasive device for cardiac output (CO) measurements. Its technology is based on arterial pressure waveform analysis and needs no calibration. We report its use during a haemodynamically unstable situation where the FloTrac device was compared to a pulmonary arterial catheter (PAC) for the measurement of CO.

Case report

A 34-yr-old female presented for surgical management of multiple endocrine neoplasia type IIa (MEN IIa). She was scheduled for elective bilateral adrenal tumour removal and total thyroidectomy. After induction of general anaesthesia, radial artery catheter and PAC (continuous CO 7.5 F catheter; Edwards Lifescience) were inserted. The FloTrac device was then attached to the arterial canula and connected to the Vigileo monitor (version 1.10). Concurrent recording of CO indexed to body surface area (cardiac index, CI) were performed on the FloTrac (CI_FloTrac) and the PAC (CI_PAC) during and after the surgery. Additional information collected included heart rate, arterial pressure, anaesthetic and surgical events. During phaeochromocytoma surgery, we observed an episode of severe hypertension (MAP = 140 mmHg) treated by deepening of anaesthesia and a bolus of urapidil (25 mg). After adrenalectomy, hypotension was treated with ephedrine boluses, neosynephrine and then norepinephrine (up to $0.6 \mu\text{g kg}^{-1} \text{min}^{-1}$) (Fig. 1).

Postoperative recovery was marked by the rapid resolution of arterial hypotension.

A total of 38 pairs of CI measurements were analysed. CI_FloTrac values ranged from 2.1 to $6.1 \text{ L min}^{-1} \text{ m}^{-2}$ (mean \pm SD $3.4 \pm 0.7 \text{ L min}^{-1} \text{ m}^{-2}$) and CI_PAC from 3.3 to 5.2 (mean $4 \pm 0.4 \text{ L min}^{-1} \text{ m}^{-2}$). Simple regression and Bland–

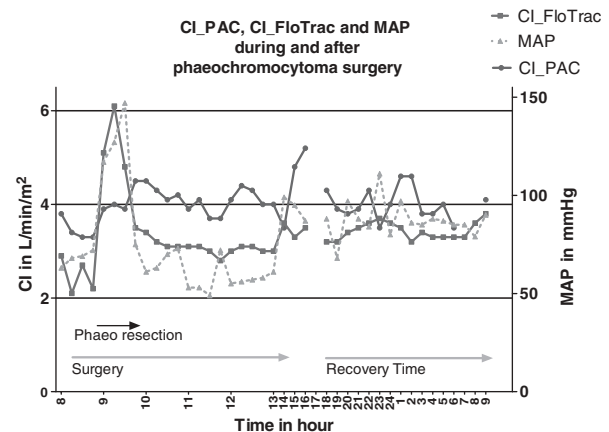


Figure 1.

CI_PAC, CI_FloTrac, MAP during and after phaeochromocytoma surgery. CI_PAC: cardiac index (CI) measured with the pulmonary arterial catheter in $\text{L min}^{-1} \text{ m}^{-2}$; CI_FloTrac: CI measured with the FloTrac device in $\text{L min}^{-1} \text{ m}^{-2}$; MAP: mean arterial pressure in mmHg. Arrows indicate durations of the different periods: Surgery, Phaeochromocytoma resection ('Phaeo resec'), Recovery period.

Altman analysis were used to compare the two methods of CI measurement. Simple regression was used to compare mean arterial pressure (MAP) and CI_FloTrac. The CI measured by the two methods did not correlate well (simple regression $r^2 = 0.026$, $P = 0.33$; Bland–Altman test $r^2 = 0.23$, bias = $-0.66 \text{ L min}^{-1} \text{ m}^{-2}$, precision $\pm 0.75 \text{ L min}^{-1} \text{ m}^{-2}$, limits of agreement: -2.13 and $+0.81 \text{ L min}^{-1} \text{ m}^{-2}$). CI_FloTrac was moderately correlated with the MAP: $r^2 = 0.56$, $P < 0.001$. Concurrent analysis of CI_FT, CI_PAC and MAP during phaeochromocytoma manipulation showed a dramatic increase in MAP (from 70 to 147 mmHg) and in CI_FloTrac (from 2.2 to $6.1 \text{ L min}^{-1} \text{ m}^{-2}$), whereas CI_PAC only slightly increased (from 3.3 to $4 \text{ L min}^{-1} \text{ m}^{-2}$).

Discussion

Phaeochromocytoma surgery usually necessitates standard and continuous arterial pressure monitoring. Measurement of pulmonary arterial occlusion pressure (PAOP) and CI with a PAC may be helpful to detect cardiac insufficiency and cardiogenic shock, particularly during manipulation of the tumour. PAC is usually proposed for patients with

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dramatic clinical manifestation and/or with pre-operative cardiac dysfunction. In our case, we used a PAC considering the size of the bilateral tumours and the type of tumour (MEN IIa) overproducing all catecholamines. The use of the PAC has been increasingly criticized because it is an invasive technique and because of its unclear risk–benefit ratio [1–3]. Several haemodynamic devices have been developed using calculation of CI based on peripheral arterial pressure waveform analysis [4,5]. These devices need to be initially calibrated by either transpulmonary thermodilution or pulmonary artery thermodilution to correct for arterial compliance in the calculation. The recently introduced FloTrac/Vigileo device calculates continuous CI on peripheral arterial pressure waveform characteristics but does not require external calibration. Individual data including height, weight, age, gender and the real-time arterial pressure waveform analysis are used to estimate arterial compliance. However, we found only five clinical studies assessing FloTrac as a CO monitor, most of them included cardiac surgery patients and compared CO measured by FloTrac and by PAC or PiCCO [6–10]. Two studies showed satisfactory correlation [6,9], one study showed moderate correlation [7] and two studies showed limited correlation [8,10]. There is no data exploring FloTrac reliability during unstable haemodynamic situations such as haemorrhagic or catecholamine crisis.

We report the case of one patient for which 38 time points measurement of CI_FloTrac were compared to 38 measurements of CI_PAC. Of course, our data have to be interpreted very carefully and are insufficient to accurately define the global relationship between CI_FloTrac and CI_PAC. However, anaesthetists and intensivists have to tailor patient treatment individually and in our case, the FloTrac would have misled the physician on the patient's haemodynamic status during the unstable period. Moreover, in our case report, CI_FloTrac values were better correlated to MAP than to CI_PAC values. The CI_FloTrac curve seemed to follow the huge increase in MAP during severe hypertension, whereas CI_PAC was only slightly increased. The FloTrac device needs demonstrative data before being considered as a monitor of CO for haemodynamically unstable patients.

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