Measurement of cardiac output in coronary artery bypass grafting

Flotrac/Vigileo™ vs Aortic Doppler

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BACKGROUND AND GOAL OF STUDY

Intraoperative hemodynamic optimization based on cardiac output (CO) monitoring may improve outcome of high-risk patients undergoing major surgery. The Flo/Trac/Vigileo™ (FTV) is a device based on arterial pressure waveform analysis that allows continuous CO determination. The fact that it does not require previous external calibration can be an advantage, but previous studies showed that it may be a drawback in some clinical settings. The goal of this study was to evaluate the agreement between CO measured by FTV system (CO^{FT}) and CO measured by aortic Doppler flow (CO^{AD}) using transoesophageal echocardiography (TEE) in patients undergoing coronary artery bypass grafting.

MATERIALS AND METHODS

Thirty patients scheduled for coronary artery bypass grafting were included in the study. A preoperative transthoracic echocardiography exam was performed in all patients. Exclusion criteria were: cardiac rhythm disturbances, aortic valve disease, significant known subclavian artery stenosis and contraindication for TEE utilisation. Simultaneous CO measurements (CO^{FT} Software 4.0 and CO^{AD}) were performed at different times of surgery: after induction of anaesthesia (T1), before cardiopulmonary bypass (CPB) (T2), after cardiopulmonary bypass (T3) and at the end of surgery (T4).

$$CO_{FT} = PR \times (\sigma_{AP} \times \chi)$$

$$CO_{AD} = HR \times (VTIAo \times LVOTa)$$

PR = pulse rate
 σ_{AP} = standard deviation of arterial PP
 χ = scaling multivariate parameter proportional to the effects of vascular tone on pulse pressure
 $\chi = M (HR, \sigma_{AP}, C(P), BSA, MAP, \mu_{3AP}, \mu_{4AP}...)$

HR = heart rate
VTIAo = aortic flow velocity-time integral
LVOTa = left ventricular outflow tract area
 $LVOTa = \pi \times (LVOTd^2/4)$

For the comparison of CO measurements Bland-Altman method was applied. The percentage of error was calculated as described by Critchley and Critchley. Approval of the study protocol by the institutional review board was obtained

RESULTS AND DISCUSSION

30 patients scheduled for coronary artery bypass grafting were included. A total of 190 pairs of CO measures were performed and analysed. The number of measures per patient was **6,3 ± 1,5 (4 to 8)**. The bias was **0,47 litre min⁻¹** (95% CI -1,5-2,5 litre min⁻¹). Precision was **0,87±0,73 litre min⁻¹**. The percentage of error calculated by Critchley and Critchley method was **48%**.

A total of 96 pairs of CO measures were performed and analysed before CPB. The number of measures per patient was **3,2 ± 0,9 (2 to 5)**. The bias was **0,69 litre min⁻¹** (95% CI -1,2-2,6 litre min⁻¹). Precision was **0,93±0,73 litre min⁻¹**. The percentage of error calculated by Critchley and Critchley method was **37%**.

A total of 94 pairs of CO measures were performed and analysed after CPB. The number of measures per patient was **3,1 ± 0,8 (1 to 4)**. The bias was **0,24 litre min⁻¹** (95% CI -1,8-2,3 litre min⁻¹). Precision was **0,81±0,74 litre min⁻¹**. The percentage of error calculated by Critchley and Critchley method was **46%**.

CONCLUSION

Despite de upgraded algorithm, the CO measured by the FTV device still showed a high percentage of error compared with CO measured by aortic Doppler flow using TEE in patients undergoing coronary artery bypass grafting.

REFERENCES

1.Savaas, E. *Variations in arterial blood pressure are associated with parallel changes in FlowTrac/Vigileo®-derived cardiac output measurements: a prospective comparison study.* Crit Care 2009;13(6):R179
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Patient characteristics	(n=30)
Age (years, mean ± SD)	63,8 ± 1,76
Men/Women (n/n)	20/10
Body mass index (Kg/m ² , mean ± SD)	27,29 ± 0,56
ASA score III/IV	18/12
Ejection fraction (n,%)	
EF < 35%	1 (3,57%)
EF 36-44%	2 (7,14%)
EF 45-54%	3 (10,78%)
EF > 55%	22 (78,57%)