Comparison between CO measurement methods in cardiac bypass grafting surgery: uncalibrated pulse wave analysis vs aortic Doppler

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Background and Goal of Study

High-risk patients undergoing major surgery may benefit from accurate measurement of cardiac output (CO) during the perioperative period. The goal of this study was to compare CO measurements by FloTrac/Vigileo version 4 (CO^{FT}) and PRAM/Mostcare (CO^{MC}) versus aortic Doppler flow (CO^{AD}) using transesophageal echocardiography (TEE) in patients undergoing coronary artery bypass surgery.

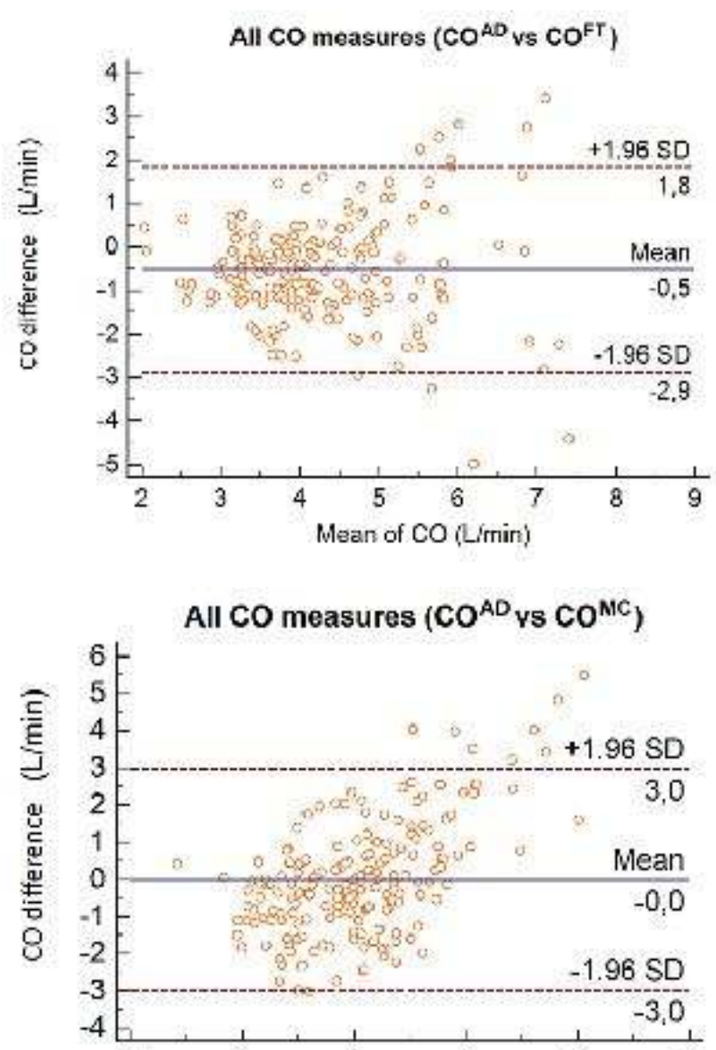
Materials and Methods

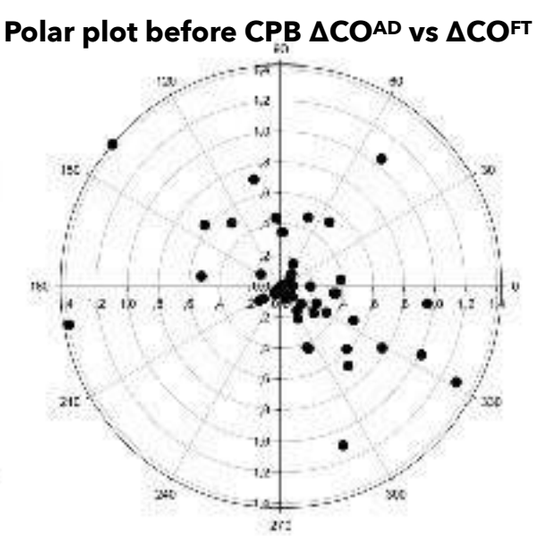
After approval from the ethical review committee, all consecutive patients scheduled for coronary artery bypass grafting were included. Exclusion criteria were: cardiac rhythm disturbances, aortic valve disease, significant subclavian artery stenosis and contraindication for TEE use.

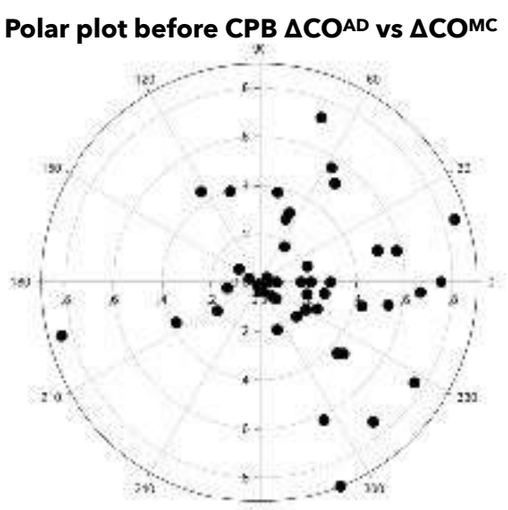
Simultaneous CO measurements were taken after induction of anesthesia (T1), before cardiopulmonary bypass (CPB) (T2), after CPB (T3) and at end of surgery (T4). For the comparison of CO measurements, Bland-Altman method was applied(1). The percentage of error (PE) was calculated as described by Critchley and Critchley. We considered a PE limit of 30% as acceptable. A polar plot analysis was made to check the trending ability following the criteria described by Critchley(2).

Results and Discussion

A total of 189 pairs of measurements from 27 patients were analyzed (6.96±1.3; 3 to 8 per patient). For CO^{FT} vs CO^{AD} , the bias was -0.524 liter min-1 (IC 95% -2.88 to 1.83), precision 1±0.84 liter min-1 and PE 54.89%. For CO^{MC} vs CO^{AD} the bias was -0.015 liter min-1 (IC 95% -2.993 to 2.963), precision 1.16±0.98 liter min-1 and PE 73.94%. There wasn't correlation between changes in blood pressure and changes in CO measurements.







A polar plot of values before CPB was made with ΔCO calculated between T1 and T2 measurements. Pre-CBP angular bias for ΔCO^{FT} vs ΔCO^{AD} was 0.54(IC 95% -46.18 36) and for CO^{MC} vs CO^{AD} it was -1.8 (IC 95% -16,23 28,18).

	Before CPB (T1-T2)		After CPB (T3-T4)	
	CO^{AD} vs CO^{FT}	CO^{MC} vs CO^{AD}	CO^{AD} vs CO^{FT}	CO^{AD} vs CO^{FT}
Bias	-0.65	-0. 786	-0.37	0.90
IC 95%	-2.53 1.22	-2.95 1.38	-3.16 2.44	-1.93 3.72
PE	51.85 %	59.88 %	62.2 %	62.6 %

Conclusion

CO^{FT} and CO^{MC} measurements showed a high percentage of error compared with CO^{AD} in patients undergoing coronary artery bypass grafting. The results also showed that before CPB there was a poor ability to detect changes in CO.

References

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(2)Critchley LA, Yang XX, Lee A: Assessment of trending ability of cardiac output monitors by polar plot methodology. J. Cardiothorac. Vasc. Anesth. 25:536-546, 2011

Euroanaesthesia 2018 Copenhagen, Denmark 2-4 June 2018 The European Anaesthesiology Congress

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