Reliability of Cardiac Output Measurements Using LiDCOrapid™ and FloTrac/Vigileo™ Across Broad Ranges of Cardiac Output Values

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Abstract

Purpose

Knowing a patient’s cardiac output (CO) is important for safe, optimized hemodynamic control during surgery. Precise CO measurements can serve as a guide for resuscitation therapy, catecholamine use, differential diagnosis, and intervention during a hemodynamic crisis. Despite its invasiveness and intermittent nature, the thermodilution technique via pulmonary artery catheter (PAC) remains the accepted gold standard for CO measurements. LiDCOrapid™ (LiDCO, UK) and FloTrac/Vigileo™ (Edwards Lifesciences, Irvine, CA) are less invasive continuous CO monitors that use arterial waveform analysis. Their calculations are based on arterial waveform characteristics and need no calibration. We evaluated LiDCOrapidTM and FloTrac/VigileoTM during off-pump coronary artery bypass graft (OPCAB) and living-donor liver transplantation (LDLT) surgery.

Methods

This observational, single-center study included 21 patients (11 OPCAB and 10 LDLT). We performed simultaneous measurements of CO at the fixed sample points during surgery with both devices (LiDCOrapid™ version 1.04-b222 and FloTrac/Vigileo™ version 3.02) and used the thermodilution technique via PAC as a benchmark. LiDCOrapid™ and FloTrac/Vigileo™ were used in an uncalibrated fashion. We analyzed the measured cardiac index using modified Bland–Altman analysis and polar plot method.

Results

One OPCAB patient was excluded because of intra-aortic balloon pumping used during surgery, and 20 patients (10 OPCAB and 10 LDLT) were enrolled. We obtained 149 available triplet measurements that ranged over wide areas of cardiac index and systemic vascular resistance index. Bland–Altman analysis revealed biases (FloTrac/Vigileo™ vs. PAC and LiDCOrapid™ vs. PAC: 0.71 L/min/m2 and 0.53 L/min/m2, respectively) and percentage errors (80.8% and 55.1%, respectively). The polar plot method showed angular bias (FloTrac/VigileoTM vs. LiDCOrapidTM: 8.1° vs. 6.0°, respectively) and radial limits of agreement [(−61.0, 77.1) vs. (−36.1, 48.0)].

Conclusions

Both devices tended to underestimate when the cardiac index was high. These tendencies produced large percentage errors in our study setting. Neither device showed good trending abilities when we used a reported criterion.