Reliability of cardiac output measurements using LiDCOrapid™ and FloTrac/Vigileo™ across broad ranges of cardiac output values

Asamoto M, Orii R, Otsuji M, Bougaki M, Imai Y, Yamada Y. J Clin Monit Comput. 2017;31(4):709-716. doi:10.1007/s10877-016-9896-7

Knowing a patient's cardiac output (CO) could contribute to a 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 a pulmonary artery catheter (PAC) remains the clinical gold standard for CO measurements. LiDCOrapid™ (LiDCO, London, 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 do not require calibration. Here, we evaluated LiDCOrapid™ and FloTrac/Vigileo™ during off-pump coronary artery bypass graft (OPCAB) and living-donor liver transplantation (LDLT) surgery. This observational, single-center study included 21 patients (11 OPCAB and 10 LDLT). We performed simultaneous measurements of CO at fixed sampling points during surgery using both devices (LiDCOrapid™ version 1.04-b222 and FloTrac/Vigileo™ version 3.02). The thermodilution technique via a PAC was used to obtain the benchmark data. LiDCOrapid™ and FloTrac/Vigileo™ were used in an uncalibrated fashion. We analyzed the measured cardiac index using a Bland–Altman analysis (the method of variance estimates recovery), a polar plot method (half-moon method), a 4-quadrant plot and compared the widths of the limits of agreement (LOA) using an F test. One OPCAB patient was excluded because of the use of an intra-aortic balloon pumping during surgery, and 20 patients (10 OPCAB and 10 LDLT) were ultimately analyzed. We obtained 149 triplet measurements with a wide range of cardiac index. For the FloTrac/Vigileo™, the bias and percentage error were −0.44 L/min/m2 and 74.4 %. For the LiDCOrapid™, the bias and percentage error were −0.38 L/min/m2 and 53.5 %. The polar plot method showed an angular bias (FloTrac/Vigileo™ vs. LiDCOrapid™: 6.6° vs. 5.8°, respectively) and radial limits of agreement (−63.9 to 77.1 vs. −41.6 to 53.1). A 4-quadrant plot was used to obtain concordance rates (FloTrac/Vigileo™ vs. PAC and LiDCOrapid™ vs. PAC: 84.0 and 92.4 %, respectively). We could compare CO measurement devices across broad ranges of CO and SVR using LDLT and OPCAB surgical patients. An F test revealed no significant difference in the widths of the LoA for both devices when sample sizes capable of detecting a more than two-fold difference were used. We found that both devices tended to underestimate the calculated CIs when the CIs were relatively high. These proportional bias produced large percentage errors in the present study.