

Cardiac output measurement during cardiac surgery: esophageal Doppler versus pulmonary artery catheter

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摘要

Abstract

BACKGROUND: Bolus thermodilution cardiac output (BCO) measurement has been considered as the "gold standard" for cardiac output (CO) measurement. However, it requires placement of a pulmonary artery (PA) catheter, and questions have been raised regarding the risk/benefit ratio of this invasive technique. Furthermore, great variations between measurements have been reported. Continuous thermodilution CO (CCO) measurement is reported to be a better alternative, but it still requires the placement of a PA catheter. Esophageal echo-Doppler ultrasonography (ED) provides non-invasive continuous measurement of CO (ED-CO). This study was thus designed to compare the agreement between ED-CO and both thermodilution techniques (BCO and CCO). **METHODS:** Twenty-four patients undergoing primary coronary artery bypass graft surgery were randomized to have a PA catheter placed for measurement of either BCO or CCO. All patients also had an ED probe placed. In Group I patients (n = 12), BCO measurement was carried out every 15 minutes throughout the surgery except during cardiopulmonary bypass, with concurrent ED-CO reading recorded at the same time point. In Group II patients (n = 12), CCO and ED-CO measurements were recorded at the same designated points of time as in Group I. The agreement between methods (BCO vs. ED-CO or CCO vs. ED-CO) was assessed using Bland-Altman method. **RESULTS:** The range of measured CO of each method was 2.1 to 9.4 l/min for BCO, 2.4 to 9.2 l/min for CCO and 2.3 to 8.9 l/min for ED-CO. ED-CO and CCO had excellent agreement with a linear regression coefficient (r^2 value) of 0.846, and a bias (mean difference) and SD of bias of 0.05 +/- 0.49 l/min. In contrast, the agreement between BCO and ED-CO was poorer; correlation was low (r^2 value 0.406) and both the bias and SD of bias were high (0.11 +/- 1.12 l/min). Furthermore, BCO measurements had poor reproducibility, whereas both ED-CO and CCO measurements had good reproducibility. **CONCLUSIONS:** Esophageal echo-Doppler ultrasonography is a satisfactory alternative for cardiac output measurement because it gives a value in good agreement with CCO measurement. With significant between-measurement

variations, the accuracy and precision of BCO are uncertain, and it should not be considered as the "gold standard".