

Accuracy of cardiac output measurements with pulse contour analysis (PulseCO) and Doppler echocardiography during off-pump coronary artery bypass grafting

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Background and objective: During off-pump coronary bypass grafting, surgical manipulation and dislocation of the heart may cause cardiovascular instability. Monitoring of cardiac output facilitates intraoperative haemodynamic management but pulmonary artery catheters are often considered too invasive. Pulse contour analysis and transoesophageal echocardiography could serve as alternatives, but there is controversy about their accuracies. We validated pulse contour analysis using a standard radial arterial catheter (PulseCO) and aortic Doppler flowmetry with transoesophageal echocardiography in patients undergoing off-pump coronary bypass surgery. Pulmonary arterial thermodilution served as the reference technique.

Methods: In 20 patients undergoing off-pump coronary bypass, cardiac output was measured with bolus thermodilution (COTD), pulse contour analysis (COPC), and transoesophageal echocardiography (COecho) at fixed time intervals during the procedure. Data were compared using linear regression and Bland-Altman analysis. At the end of the procedure, dobutamine was infused at a rate of 2.5 microg kg(-1) min(-1) in six patients to study the agreement between methods in quantifying changes in cardiac output.

Results: Comparison between COPC and COTD showed a bias +/- limits of agreement of -0.03 +/- 1.30 L min(-1) (mean error 29%). Doppler echocardiography was not always feasible when the heart was displaced from the oesophagus and had lower accuracy: bias +/- limits of agreement vs. COTD was 0.45 +/- 1.93 (mean error 43%). Increases in cardiac output induced by dobutamine were well quantified both by pulse contour analysis (COPC = 0.76 x COTD + 0.58; r(2) = 0.65) and Doppler, although the latter tended to overestimate these changes (COecho = 1.58 x COTD - 0.13; r(2) = 0.53).

Conclusions: Calibrated pulse contour analysis using the PulseCO system is an acceptable technique to measure cardiac output non-invasively in off-pump coronary bypass patients. Doppler echocardiography performs less well and is not always feasible with transoesophageal echocardiography when the heart is displaced.