#### RESEARCH ARTICLE

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## Accuracy of an autocalibrated pulse contour analysis in cardiac surgery patients: a bi-center clinical trial

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#### Abstract

**Background:** Less-invasive and easy to install monitoring systems for continuous estimation of cardiac index (CI) have gained increasing interest, especially in cardiac surgery patients who often exhibit abrupt haemodynamic changes. The aim of the present study was to compare the accuracy of CI by a new semi-invasive monitoring system with transpulmonary thermodilution before and after cardiopulmonary bypass (CPB).

Methods: Sixty-five patients (41 Germany, 24 Spain) scheduled for elective coronary surgery were studied before and after CPB, respectively. Measurements included CI obtained by transpulmonary thermodilution (Cl<sub>1970</sub>) and autocalibrated semi-invasive pulse contour analysis (Cl<sub>1970</sub>). Percentage changes of CI were also calculated.

Results: There was only a poor correlation between  $Cl_{BPD}$  and  $Cl_{BPD}$  both before  $(r^2 = 0.34, p < 0.0001)$  and after  $(r^2 = 0.31, p < 0.0001)$  CPB, with a percentage error (PE) of 62 and 49 %, respectively. Four quadrant plots revealed a concordance rate over 90 % indicating an acceptable correlation of trends between  $Cl_{BPD}$  and  $Cl_{BPD}$  before (concordance: 93 %) and after (concordance: 94 %) CPB. In contrast, polar plot analysis showed poor trending before and an acceptable trending ability of changes in Cl after CPB.

Conclusions: Semi-invasive CI by autocalibrated pulse contour analysis showed a poor ability to estimate CI compared with transpulmonary thermodilution. Furthermore, the new semi-invasive device revealed an acceptable trending ability for haemodynamic changes only after CPB.

Trial registration: ClinicalTrials.gov: NCT02312505 Date: 12.03.2012

Keywords: Cardiac Index, Pulse contour analysis, Haemodynamic monitoring, Transpulmonary thermodilution

#### Background

Most of the studies applying algorithms for haemodynamic optimization of high-risk surgical patients have used cardiac index (CI) as one important target. Furthermore, these investigations could demonstrate that optimization of CI was associated with a significant lower rate of postoperative morbidity and mortality [1]. In the past, estimation of CI was mostly performed by pulmonary or transpulmonary thermodilution (TPTD) which due to their invasiveness are associated with considerable complications [2-4]. Therefore, interest has focused on less-invasive, readily available
and easy to install techniques which are based for example
on continuous arterial waveform analysis [5-7]. By using
established arterial catheters, pulse contour analysis offers
the opportunity for continuous estimation of Cl and other
haemodynamic variables like systemic vascular resistance
or streke volume variation, enabling the clinician to respond quickly and effectively to abrupt haemodynamic
changes. The recently introduced semi-invasive monitoring
system PulsioFlex (Pulsion Medical Systems, Munich,
Germany) was developed for continuous Cl trending and
consists of an algorithm that provides beat-to-beat estimation of Cl by analysis of the arterial blood pressure tracing.
By using a proprietary "autocalibration" mode this software

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