Ann Surg 2003; 238: 663–73.
2 *Grieve PP, Whitta RK.* Pleural puncture: an unusual complication of a thoracic epidural. Anaesth Intensive Care 2004; 32: 113–6.
3 *Patt RB, Reddy S, Wu CL, Catania JA.* Pneumothorax as a consequence of thoracic subarachnoid block. Anesth Analg 1994; 78: 160–2.
4 *Miura K, Tomiyasu S, Cho S, Sakai T, Sumikawa K.* Pneumothorax associated with epidural anesthesia. J Anesth 2004; 18: 138–40.
5 *Koch J, Nielsen JU.* Rare misplacements of epidural catheters. Anesthesiology 1986; 65: 556–7.

Comparison of the accuracy of two different modes of continuous cardiac index measurement following rapid volume infusion

To the Editor:

Despite the current debate about the usefulness of the pulmonary artery catheter (PAC),[1] cardiac index (CI) assessment by the thermodilution technique remains a frequently used technique.[2] A PAC with a rapid-response thermistor provides nearly continuous assessment of CI (CCI) and eliminates measurement variability associated with the intermittent bolus technique. We compared the accuracy of two different operation modes of CCI assessment (TREND mode, CCI_{TREND} and STAT mode, CCI_{STAT}) with bolus thermodilution CI (CI_{TD}) measurement regarding their response to rapid volume infusion.

With approval of the local Ethics Committee and written informed consent, we studied 21 patients (17 males), aged 53 to 78 yr (mean, 65.7 yr) undergoing elective coronary artery bypass grafting. Following induction of anesthesia, a right heart ejection fraction catheter (CCOmboV 774HF75; Edwards Lifesciences, Irvine, CA, USA) was inserted and connected to the Vigilance monitor system (Edwards Lifesciences,) for CCI and intermittent CI_{TD} measurement. The methodology of CCI measurement based on the pulsed warm thermodilution technique has been previously described in detail.[3] CCI_{TREND} reflects an average flow over the previous six to ten minutes and is updated every 30 to 60 sec. CCI_{STAT} does not contain a moving average filter but depends on some previous data for artefact suppression, and is also updated every 30 to 60 sec. Hemodynamic measurements were performed simultaneously after induction of anesthesia, when CCI_{TREND} had stabilized (T1) and following volume replacement by infusion of 6% HES 200/0.5 (7 $mL \cdot kg^{-1}$) with a rate of 1 $mL \cdot kg^{-1} \cdot min^{-1}$ (T2).

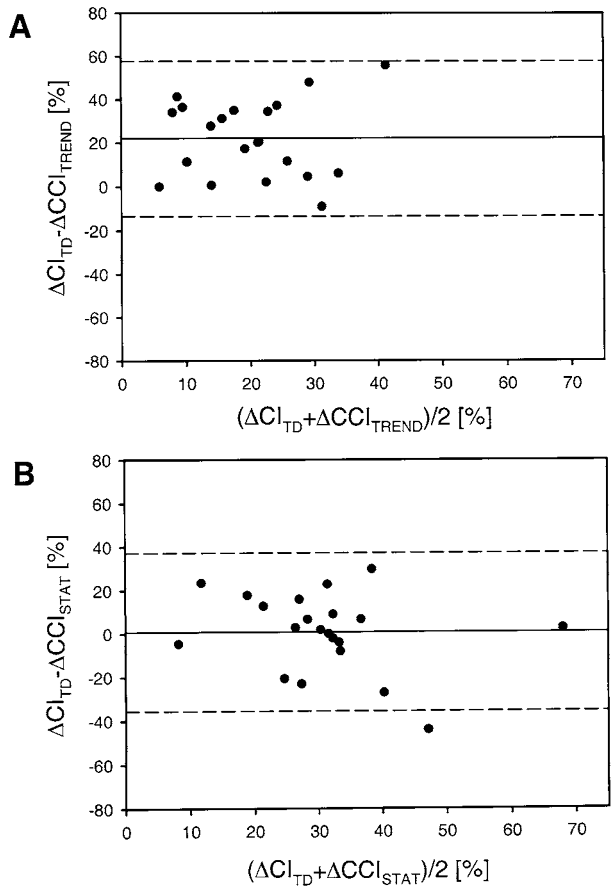

FIGURE Bland and Altman plot for comparison between cardiac index with bolus thermodilution (CI_{TD}) and continuous assessment of cardiac index and TREND mode (CCI_{TREND}) (A) and between CI_{TD} and continuous cardiac index and STAT mode (CCI_{STAT}) (B) for percent differences. The solid line represents the mean difference (bias) and the dashed lines represent the limits of agreement (mean difference ± 2SD of the difference).

In all patients fluid challenge caused an increase in CI_{TD} (range 5.9% to 69.2%). The bias between ΔCI_{TD}-ΔCCI_{TREND} was 22.2% with a precision (SD of bias) of 17.8%, and the bias between ΔCI_{TD}-ΔCCI_{STAT} was 0.86% with a precision of 18.2%, respectively. The relative error, defined as $100\{(CI_{TD}\text{-}CCI)/[(CI_{TD}+CCI)/2]\}$, was within 15% for just 27 out of 42 comparisons between the pooled data of CI_{TD} and CCI_{TREND}, compared with 40 measurements within 15% between the pooled data of CI_{TD} and CCI_{STAT}.

These results suggest that CCI_{TREND} failed to identify dynamic changes in hemodynamics caused by rapid volume application. CCI_{TREND} underestimated the increase in CI_{TD} following fluid challenge by more than 20% (Figure A), whereas CCI_{STAT} showed good agreement in CCI assessment at all timepoints of measurement (Figure B). Comparable results were observed by other authors during acute hemorrhage[4] or following an increase in pacing rate.[5]

Therefore, STAT mode of operation should be used whenever dynamic changes in a patient's hemodynamic state are expected.

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References

1 *Sandham JD, Hull RD, Brant RF, et al.* A randomized, controlled trial of the use of pulmonary-artery catheters in high-risk surgical patients. N Engl J Med 2003; 348: 5–14.

2 *Jacka MJ, Cohen MM, To T, Devitt JH, Byrick R.* The use of and preferences for the transesophageal echocardiogram and pulmonary artery catheter among cardiovascular anesthesiologists. Anesth Analg 2002; 94: 1065–71.

3 *Yelderman M, Quinn MD, McKown RC.* Thermal safety of a filamented pulmonary artery catheter. J Clin Monit 1992; 8: 147–9.

4 *Poli de Figueiredo LF, Malbouisson LM, Varicoda EY, Carmona MJ, Auler JO Jr, Rocha e Silva M.* Thermal filament continuous thermodilution cardiac output delayed response limits its value during acute hemodynamic instability. J Trauma 1999; 47: 288–93.

5 *Lazor MA, Pierce ET, Stanley GD, Cass JL, Halpern EF, Bode RH Jr.* Evaluation of the accuracy and response time of STAT-mode continuous cardiac output. J Cardiothorac Vasc Anesth 1997; 11: 432–6.

Airway management for postoperative respiratory failure: use of the laryngeal mask airway

To the Editor:
We report the case of a morbidly obese patient with acute postoperative respiratory failure and the use of a laryngeal mask airway (LMA) to avoid tracheal re-intubation.

A 52-yr-old male patient presented for inguinal hernia repair under general anesthesia. Past medical history included chronic obstructive pulmonary disease, morbid obesity (body mass index 48 $kg \cdot m^{-2}$), claustrophobia, and sleep apnea. After premedication (midazolam 2 mg *iv*, fentanyl 50 µg *iv*), a rapid sequence induction was performed with *iv* propofol (200 mg) and succinylcholine (160 mg), and tracheal intubation was easy. Anesthesia was maintained with desflurane and nitrous oxide. After an uneventful operation, the patient was extubated, as he was wide awake, followed commands, and was breathing spontaneously (respiratory rate = 20/min, tidal volume = 500 mL, SpO_2 = 99% with supplemental oxygen). However, shortly after his arrival in the postanesthesia care unit, the patient developed upper airway obstruction and acute respiratory failure (pH = 7.26, pCO_2 = 68 mmHg, pO_2 = 53 mmHg). To avoid additional sedation associated with tracheal re-intubation and the risk of prolonged weaning from the ventilatory support due to his body habitus, non-invasive ventilation was considered a therapeutic option as the patient demonstrated good pharyngeal reflexes. However neither a facial nor nasal mask was tolerated. In contrast, a LMA #5 (LMA North America, Inc, San Diego, CA, USA), placed after topical anesthesia of the upper airway was tolerated without gagging or agitation. Pressure support ventilation (10 cm H_2O, positive end-expiratory pressure 5 cm H_2O) was applied for alveolar recruitment. Thereafter, the patient's breathing pattern normalized, as did the arterial blood gas analysis. The LMA was removed after two hours of ventilatory support. The patient was transferred to the floor and discharged home the next day.

In comparison to conventional mask ventilation, LMA results in higher tidal volumes and lower dead space ventilation during spontaneous ventilation.[1] In anesthetized patients, the LMA is not associated with significant gastric insufflation[2] and has been used for emergence from anesthesia in patients with severe reactive airway disease.[3] However, its utility in the management of transient postoperative respiratory failure is largely unknown. Postoperative non-invasive