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TITLE: Lithium Dilution versus Thermodilution Cardiac Output Measurement in Cardiac Surgery Patients

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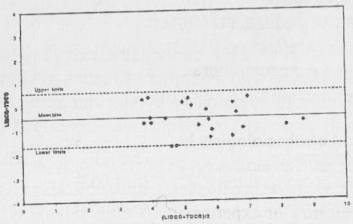
A method of cardiac output (CO) monitoring using lithium dilution (LiDCO Ltd, London, UK) has been recently introduced.[1] Lithium chloride is administered into a central vein and a lithium-sensitive electrode attached to a catheter is used to measure arterial lithium concentration. CO is calculated from the resulting lithium dilution curve. The aim of this study was to compare the accuracy of the lithium dilution (LiDCO) method to standard thermodilution cardiac output (TDCO) in postoperative cardiac surgery patients.

Following IRB approval and patient consent, 23 patients with pulmonary artery catheters were studied in the intensive care unit immediately following cardiac surgery. TDCO and LiDCO measurements were repeated three times in each patient and the mean COs were compared.

The differencebetween pairs of measurements was plotted against the mean value for these pairs [2] to determine bias -0.532 liter min^{-1} (mean difference) and limits of agreement ±1.28 liter min^{-1} (mean bias ± 2 SD).



The close agreement of LiDCO and TDCO indicates that LiDCO provides an accurate measure of CO. The bias analysis shows a consistent overestimation of CO of 0.53 liter $min^{-1}$by the TDCO technique. Different algorithms for analysis of thermal versus lithium dilution curves could explain this bias. Furthermore, TDCO measures CO over several heartbeats, while the lithium method measures CO over several respiratory cycles, thereby providing a better average measurement of CO. The limits of agreement were 0.748 to – 1.81 liter min^{-1} (±23.1%). This compares favorably to published acceptable limits of agreement of ±28.3% when comparing CO measurement methods.[3] Our results suggest that LiDCO provides accurate measurement of CO when compared to TDCO in postoperative cardiac surgery patients. Use of LiDCO in this setting may reduce the need for pulmonary artery catheterization and its attendant risks.

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1. BJA 1993;71(2):262-6.
2. Lancet 1986;1(8476):307-10.
3. J Clin Monit 1999;15:85-91.

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More Reliable Oximetry Improves Caregiver Efficiency

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Introduction: Monitors that require frequent attention to maintain or verify their accuracy divert caregivers from other clinical tasks, decrease their efficiency and increase costs of care. Improved monitor function should improve caregiver efficiency and this improvement should be measurable.

Methods: We prospectively evaluated the effects on caregiver activities and patient outcome of two pulse oximetry technologies. The Masimo SET® uses a novel signal processing technology to identify arterial saturation which is resistant to movement artifacts and low flow states. We compared this technology to a conventional pulse oximeter, Ohmeda 3740. After obtaining Human Use Committee approval, 48 patients with good preoperative ventricular function were enrolled to be studied following CABG surgery. On arrival in the ICU, both an Ohmeda 3740 (OH) and a Masimo SET ® (MAS) oximeter was attached to each patient and the output from both monitors continuously recorded until 4 hours following extubation or for a maximum of 24 hours. Patients were randomly assigned to have the output of only one of the devices available to bedside caregivers with the other device "blinded". We determined the non-functional time of each monitor (when actually used or blinded), time until weaning to FiO_2 =0.4, time until extubation, and number of ABGs during weaning. Differences were analyzed using students t for paired and non-paired data and non-parametric techniques, when appropriate. Significance was determined at $p<.05$.

Results: The MAS was non-functional significantly less often when clinically used (0.3±0.4% vrs. 5.4±6.6% of total monitored time) or when blinded (0.4±0.6% vrs. 6.6±8.1% of total monitored time), p=0.02. Total monitored time was 918±413 minutes and was not different between any of the groups. There was no difference in time to extubation (693±348 (MAS) vrs. 650±403 (OH) minutes) or the number of ventilator changes (2.6 (MAS) vrs. 2.5 (OH)) in weaning to FiO_2 = 0.4. There were significantly fewer ABGs performed when the MAS oximeter was used unblinded, 2±0.9 vrs. 3.4±1.6, p=0.03, and the time to FiO_2 = 0.4 was significantly shorter, 135±68 vrs. 232±130 minutes, p=0.04.

Discussion: We have confirmed that the MAS provides oximetry data more constantly than a conventional oximeter and that this improvement translates to more efficient care. While extubation time was not different, the number of ABGs obtained were fewer and the time to wean to a low FiO_2 was over an hour and a half less. Caregivers had more confidence in the data from the Masimo device. While accuracy of monitored data is often reported in studies of monitors, impact on caregiver behavior is a more relevant method of monitor evaluation.

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