Effect of cardiac arrhythmias on PulseCO calibration and performance

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Introduction: Arrhythmias are common among high-risk surgical and ICU patients. The PulseCO pressure waveform algorithm is used for both LiDCO™plus and LiDCOrapid hemodynamic monitors, which are frequently used to estimate cardiac output (CO) in critically ill patients. Cardiac arrythmias could increase the variation of both the lithium dilution (LiDCO) and/or the PulseCO measurement. At set-up the algorithm is calibrated by comparing the PulseCO CO estimate, averaged over 30 seconds, with a known CO (normally LiDCO) to generate a calibration factor (CF) [1]. This study was designed to explore the effect of arrythmias on the accuracy of CF generation in the PulseCO monitor.

Methods: LiDCO™plus hemodynamic data files were obtained retrospectively from a university hospital medical/surgical ICU. Files were separated into those records with and without arrhythmia - defined as heart rate variation >5% during at least one additional CF determination after monitor set-up. Previous studies have established the coefficient of variation (CV) of a single LiDCO determination at 8% [2] and the PulseCO measurement at 2.4% [3]. A combined CV, reflecting the effect of calibration, is estimated at 8.5%, resulting in an expected precision for the CF of 17%. Data were analysed for variation in CF against HRV using linear regression and the Student's t test.

Results: Twenty-eight records were collected and analysed. Twenty-one records contained 32 post set-up calibration events. Of these 17 occurred with HRV ≤5% (median = 1%, range: 0 to 5%) and 15 occurred while HRV >5% (median: 19%, range: 7 to 26%). The average variation in CF during HRV was 5.4 ± 4.0% and for high HRV was 8.9 ± 8.1% of the initial value. The t test indicated no difference in the mean variation of CF (P = 0.162) or median. There was no correlation between HRV and CF variation (r2 = 0.002). Ninety-one per cent (29/32) of the observed CF variation were less than 17% of the initial CF value.

Conclusions: CF determinations are not significantly affected by HRV. PulseCO estimates CO acceptably in the presence of arrhythmias. Interpretation of the data is enhanced by using at least 30 second averaging.