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**EVALUATION OF AN ENDOTRACHEAL CONTINUOUS
CARDIAC OUTPUT MONITOR IN PATIENTS
UNDERGOING CARDIAC SURGERY**

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INTRODUCTION: Perioperative cardiac output (CO) and cardiac index (CI) monitoring is a valuable diagnostic modality used for cardiovascular assessment. Pulmonary artery catheter (PAC) thermodilution (TD) measurement remains the gold standard for perioperative CO monitoring; however, PAC-associated morbidity emphasizes the need for a safe, reliable, and non-invasive alternative. An existing technology, thoracic electrical bioimpedance (TEB), provides accurate measurements but is limited by the signal to noise ratio, as electrical current (1-4 mA at 20-100 kHz) is affected by several anatomical structures in the thoracic cavity. A novel device, the endotracheal cardiac output monitor (ECOM), delivers a stable current (2 mA at 100 kHz) specifically to the ascending aorta and records impedance changes associated with systolic ejection. The aim of this study is to evaluate the accuracy of the ECOM device compared to PAC TD measurements in adult patients undergoing cardiac surgery.

METHODS: After IRB approval and informed patient consent, 12 adult patients undergoing cardiac surgery were studied. All study patients were intubated with ConMed 7.5mm ID ECOM endotracheal tubes (ETT). The modified ETT has 7 silver ink-penned plastic electrodes that allow for impedance measurements. A PAC was also placed via the internal jugular approach per routine care. PAC TD CO and CI measurements were compared to ECOM measurements at four time points: post-induction; immediately prior to the initiation of cardiopulmonary bypass (CPB); immediately after separation from CPB; and following sternal closure. Patients with moderate to severe aortic

regurgitation (AR) were placed in an individual subgroup for analysis. In order to compare PAC TD and ECOM CO and CI results, bias and precision statistics were performed and data were displayed as Bland-Altman plots.

RESULTS: Analysis of 186 paired data sets of ECOM and TD measurements showed a difference of means (bias) of 0.63 L/m with + 0.74 L/m precision for CO and a difference of means (bias) of 0.32 L/m/m² with + 0.37 L/m/m² precision for CI (Figure 1). Patients with moderate to severe AR showed a difference of means (bias) of 2.26 L/m with + 1.98 L/m precision and a difference of means (bias) of 0.68 L/m with + 0.70 L/m precision for CO pre-CPB and post-CPB, respectively. Patients with moderate to severe AR showed a difference of means (bias) of 1.22 L/m/m² with + 1.07 L/m/m² precision and a difference of means (bias) of 0.35 L/m/m² with + 0.35 L/m/m² precision for CI pre-CPB and post-CPB, respectively.

DISCUSSION: Preliminary results indicate that ECOM CO and CI measurements are highly accurate when compared with TD\ measurements in patients who undergo cardiac surgery and do not have moderate or severe AR. Further investigation is needed to evaluate the effect of regurgitant volumes on the accuracy of ECOM measurements in patients with aortic valve insufficiency