Electrical Cardiometry in Extracorporeal Membrane Oxygenation Patients

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**INTRODUCTION:**
Cardiac output (CO) monitoring is important in patient connected to extracorporeal membrane oxygenation (ECMO) either Veno-Venous (VV) ECMO or veno-arterial (VA) ECMO. In VV ECMO patient's adequate oxygenation is achieved with ECMO flow above 60% of cardiac output and in VA ECMO patients adequate hemodynamic is maintained with ECMO flow 50-70 ml/kg/min.

**AIM:**
Validate cardiac output measured by electrical cardiometry (ICON™) using transthoracic echocardiography in patients connected to ECMO (either VA ECMO or VV ECMO).

**METHODS:**
CO was estimated using electrical cardiometry (ICON OSYPKA medical, Germany) using bioimpedance technology through 4 electrodes connected to the left side of the body with good signal quality for accuracy of measurements (signal quality indicator (SQI) ranging from 70 to 100).

- Echocardiography measurements were taken using Pulsed Wave (PW) doppler over left ventricular outflow track (LVOT) (2-3 cm away from aortic valve in apical 3 or 5 chamber views) to calculated LVOT Velocity Time Integral (LVOT VTI). - Stroke Volume (SV) = LVOT VTI × Cross sectional area (CSA) of LVOT (calculated from parasternal long axis 0.5 cm from aortic valve). - CO = SV × Heart Rate (HR)

The two measurements were taken at the same time in 10 patients treated with ECMO (6 patients were connected on VV ECMO (675 paired values) and remaining 4 patients on VA ECMO (343 paired values) - In VV ECMO patients, CO calculated by echocardiography and estimated by ICON equal native CO. While CO estimated by ICON in VA ECMO patients equals native CO measured by echocardiography and ECMO flow.

**RESULTS:**
There were significant correlations between cardiac output estimated using ICON compared to echocardiography in both patients connected to VV (4.8 to 12.7 L/min with mean 8.97 L/min ± 2.1 Vs 4.6 to 12.4 L/min with mean 8.42 L/min ± 1.84 by echocardiography) and VA ECMO (4.3.61 to 8.46 L/min with mean 8.535 L/minute ± 1.13 Vs 4.01 to 7.25 L/minute with mean 5.2 L/min ± 0.72 by echocardiography) (r = 0.915 and 0.808 for VV and VA respectively) (p < 0.001). Intraclass Correlation coefficient and Cronbach's Alpha analysis were used to assess the agreement between the two measurements and there was a statistically significant agreement (P value > 0.001).

**CONCLUSION:**
ICON is a valuable noninvasive and continuous tool for the assessment of cardiac output in patients supported with ECMO.

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