Publication Brief

Measurement of Cardiac Output (CO) and Blood Volumes (BV) Using Ultrasound Dilution (UD) Methods in Neonates: Animal Study

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BACKGROUND
To evaluate the ability of UD technology to measure small flows and volumes relevant to neonates on a rat model.

STUDY
- 9 anesthetized rats had an extracorporeal AV loop connected between the carotid artery and the jugular vein.
- A 1Fr Millar catheter was placed into femoral artery for mean arterial pressure (MAP).
- Hemorrhage was induced by bleeding out 3 mL/100gm in 3-4 steps.
- ULTRASOUND FLOW/DILUTION MEASUREMENTS: Isotonic saline 0.3mL body temperature isotonic saline was injected into the AV loop.

RESULTS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Baseline</th>
<th>After Hemorrhage</th>
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</thead>
<tbody>
<tr>
<td>CI (mL/kg)</td>
<td>251.5 ± 42.4</td>
<td>56.9 ± 18.7</td>
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<tr>
<td>CBVI (mL/kg)</td>
<td>9.0 ± 1.4</td>
<td>3.7 ± 0.8</td>
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<td>TEDVI (mL/m²)</td>
<td>5.5 ± 1.1</td>
<td>2.4 ± 0.6</td>
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<tr>
<td>ASVI (mL/kg)</td>
<td>44.4 ± 6.8</td>
<td>15.1 ± 4.2</td>
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<td>MAP (mmHg)</td>
<td>96.2 ± 8.8</td>
<td>29.8 ± 11.6</td>
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<tr>
<td>HR (bpm)</td>
<td>295.3 ± 39.9</td>
<td>212.2 ± 39.8</td>
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</tbody>
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STUDY’S CONCLUSIONS
- CI and BV drop significantly after hemorrhage suggesting their use as early quantitative indicators of volume status.
- COstatus can be used even with low weight neonates to routinely measure CI and BV.
- The authors recommended that further studies are needed to establish clinical utility.

COSTATUS® OBSERVATIONS
- Novel COstatus® (Transonic Systems Inc.) system measures, at a bedside, important hemodynamic parameters including cardiac index, central blood volume index, total end diastolic volume index and active circulation volume index. Active systemic volume index (ASVI), which represents the peripheral systemic part of ACVI is calculated as (ACVI-CBVI).
- Because COstatus was proven to be able to successfully measure cardiac output and blood volumes in a rat model, the authors suggested that it can be used even with low weight neonates to routinely measure CI and BV.

REFERENCES
Thuramalla NV, Callahan MF, Kisluhkin VK, Krivitski NM, Smith TL, ”Measurement of Cardiac Output (CO) and Blood Volumes (BV) Using Ultrasound Dilution (UD) Methods in Neonates: Animal Study,” Ped Crit Care Med 2008; 33: 9(3). Poster presentation at the World Summit on Pediatric and Congenital Heart Surgery Services, Education and Cardiac Care in Children and Adults with Congenital Heart Disease, June 19-21, 2008, Montreal, Canada. (LC07645A)