Comparison of Cardiac Output (CO) Measured by Ultrasound Dilution (UD) and Transpulmonary Thermodilution (TPD) in a Pediatric Animal Model

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BACKGROUND
• Available hemodynamic monitoring methods are not suitable for routine use with pediatric patients.
• COstatus® (Transonic Systems Inc., NY, USA) uses ultrasound dilution technology and an extracorporeal AV loop connected between in situ peripheral arterial and venous catheters. Normal saline indicator (0.5-1.0 ml/kg, 30 ml maximum) is injected into the venous limb of the loop to measure CO and blood volumes.

OBJECTIVE
To compare cardiac output measured by ultrasound dilution (COUD) with cardiac output measured by transpulmonary thermodilution (COTPD) in a pig model.

STUDY
• 5 Yorkshire pigs (17 - 45 kg) were instrumented with femoral artery and central venous catheters.
  - 10ml cold saline was injected into the venous catheter to measure PiCCO CO (Pulsion Medical Systems AG, Germany).
  - Body temperature saline was injected into venous side of the AV loop to measure COstatus® CO.
• 2-3 (average) consecutive measurements from each method was obtained for comparison.

RESULTS
• 39 sets of measurements were compared. Measurements correlated well (r^2=0.99).
• A correlation of R=0.97, COUD=1.0014*COTPD+0.013 L/min was observed between the methods.
• COTPD ranged from 1.38 to 5.64 L/min. COUD ranged from 1.46 to 5.85 L/min.
• Bland–Altman analysis showed a mean bias of -0.01 L/min between the methods.
• Percentage error (2SD/mean) was 23.7%.

CONCLUSION
• First comparison between CO measured by ultrasound dilution and transpulmonary thermodilution in a pediatric animal model demonstrated good agreement.
• Major advantage of COstatus® is that the entire system is extracorporeal and is not limited by the location or size of the arterial catheter. This offers an opportunity to routinely use COstatus® with neonatal and pediatric populations.

COSTATUS® OBSERVATIONS
• Measurements with the COstatus® system involves no blood loss.
• Ultrasound dilution method uses in situ central venous and arterial catheters.
• Therefore, COstatus® can be used with ICU patients of any size.

REFERENCES