Publication Brief

A Novel Method to Measure Cardiac Output in the Pediatric ICU: Animal Validation and Preliminary Clinical Study

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OBJECTIVE
To determine whether ultrasound dilution technology (COstatus® Monitor, Transonic Systems Inc., Ithaca, NY) can be used to measure cardiac output in an animal model and in ICU pediatric patients.

STUDY
• 4 pigs (3.8-25 kg) were anesthetized and instrumented with arterial and venous catheters. A transit time ultrasound perivascular flow probe (Transonic Systems Inc.) was placed on the pulmonary artery to measure CO (COTT).
• Cardiac output was measured in 6 anesthetized and 5 sedated patients (3 months - 14 years; 2.7-110 kg).
• 2 or 3 discrete COstatus® measurements were performed over a 6-8 minute period by injecting 0.5-1 ml/kg isotonic saline through the venous limb of an extracorporeal loop connecting in situ arterial and venous catheters.

RESULTS
• Animal: 198 cardiac output measurements demonstrated a linear regression between ultrasound dilution (COD) and transit time ultrasound (COTT): (COD) = 1.06 (COTT) – 129.91; (r = 0.97) over the range of 0.2 - 4.5 L/min.
• By averaging three consecutive measurements from each method, a coefficient of variation of < 15% was observed between the methods.
• Human: CO ranged from 0.6 to 11.6 L/min.

CONCLUSION
• Preliminary results indicate that the proposed method is accurate and may offer a fast, safe, reproducible means of measuring CO in pediatric patients that can be used repeatedly over the course of a patients’ illness.
• The methodology worked reliably and independently of arterial (radial, femoral and foot artery) and venous (jugular and femoral) catheter sites.

COSTATUS® OBSERVATIONS
• No simple method currently exists to repeatedly measure cardiac output (CO) in intensive care pediatric patients.
• Patient setup time was less than 5 minutes and no adverse events (clotting, bubble detection, etc.) were noted.

REFERENCES