A Extracorporeal Arteriovenous Ultrasound Measurement of Cardiac Output in Small Children

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BACKGROUND
Cardiac output (CO) and blood volume measurement technology has been developed based on blood dilution with a small bolus of physiologic body temperature saline, which, after transcardiopulmonary mixing, is detected with ultrasound/dilution sensors attached to an extracorporeal arteriovenous loop using existing central venous and peripheral arterial catheters.

OBJECTIVE
To compare the precision and agreement of this technology to measure cardiac output with a reference method, a perivascular flow probe placed around the aorta, in young children. The null hypothesis is that the methods are equivalent in precision, and there is no bias in the cardiac output measurements.

METHODS
• Prospective single-center comparison study.
• Subjects: 43 children scheduled for cardiac surgery; mean age was 354 days (range, 30 to 1,303 days); mean weight was 7.1 kg (range, 2.7 to 13.6 kg).
• Following corrective cardiac surgery, five consecutive repeated cardiac output measurements were performed simultaneously by both methods.

RESULTS
• A total of 215 cardiac output measurements were compared in 43 children.
• Precision, assessed as two times the coefficient of error, was 3.6% for the ultrasound dilution method and 5.0% for the flowprobe.
• Bias (Mean CO ultrasound: 1.28 L/min; Mean CO flowprobe: 1.20 L/min) was 0.08 L/min;
• Limits of agreement was ±0.32 L/min;
• Percentage error was 26.6%.

CONCLUSION
The technology to measure cardiac output with ultrasound detection of blood dilution after a bolus injection of saline yields comparable precision as cardiac output measurements by a periaortic flow probe. The difference in accuracy in the measured cardiac output between the methods can be explained by the coronary blood flow, which is excluded in the cardiac output measurements by the periaortic flow probe.

DISCUSSION TAKE HOME POINTS
• Landmark COstatus validation study in small children.

REFERENCE