Publication Brief

Validation of Novel Ultrasound Dilution Cardiac Output Method for Pediatric and Neonatal Patients

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OBJECTIVE
To validate dilution measurements in different size animals with direct readings with “gold-standard” transit time ultrasound technology.

STUDY
• Transit-time Flow Measurements: Transit-time perivascular flow probes (2.5mm, 12mm and 24mm, Transonic Systems Inc.) were positioned on the ascending aorta or pulmonary artery in six rats (230g-712g), three pigs (15-21 kg) and a sheep (65 kg).
• Ultrasound Flow/Dilution Measurements: A disposable AV loop, filled with heparinized saline, was connected between the arterial and venous catheters inserted in the animal. A peristaltic pump circulated blood (4–12 ml/min) from the artery to the vein for 3-5 min to perform 2-3 measurements. Two UV sensors were clamped onto the arterial and venous sides of the AV loop. Isotonic saline was injected into the AV loop upstream from the venous sensor. CO was calculated from the dilution curve recorded by arterial sensor and by a HCP101 Monitor (Transonic Systems Inc.)

RESULTS
Ultrasound dilution and transit time readings closely agreed in all size animals.

STUDY’S CONCLUSIONS
The AV loop approach based on UV dilution offers:
• An accurate means to measure CO independent of the patient size;
• A non-invasive rapid set up with no blood loss, using extant venous and arterial catheters;
• The use of innocuous indicator.

COSTATUS® OBSERVATIONS
• Early COstatus animal validation study.
• Small blood vessel size limits the ability to measure cardiac output (CO) in pediatric and neonatal patients.
• This problem was surmounted by:
  a) Using ultrasound velocity (UV) dilution technology to produce dilution curves by injecting isotonic saline (UV=1533 m/sec) into blood (UV=1570-90m/sec);
  b) Using an extracorporeal AV tubing loop connected to extant arterial and venous catheters through a peristaltic pump.

REFERENCES

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