

TITLE : NON-INVASIVE CARDIAC OUTPUT: EFFECT OF HEART RATE AND RHYTHM ON MEASUREMENT
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INTRODUCTION:

Thoracic bioimpedance (BI) and Doppler ultrasonography (DOPP) are two noninvasive methods of measuring cardiac output (CO) that have been shown to correlate with CO by thermodilution (C0td) (1,2). We studied the effects of sinus tachycardia (ST) and dysrhythmias (DYS) on CO determination in patients admitted postoperatively to the ICU.

METHODS:

This study was approved by the institutional review board. Patients requiring pulmonary artery catheters for fluid management were eligible for inclusion. Patients were divided into 3 groups: ST 100-120 BPM, ST 120, and DYS including ectopic beats > 5/min, and irregular-irregular rhythms such as multifocal atrial tachycardia and atrial fibrillation CO by Doppler (C0dopp) was measured by a Lawrence 3000 (Paramus, NJ) with a suprasternal probe and software versions 3.50 and 3.61. CO by bioimpedance (C0bi) was measured by a Bomed NCCOM 3 (Irvine, CA) monitor. C0td was measured with Edwards Swan-Ganz (Irvine, CA) or Abbott (Mountain View, CA) Oximetrix pulmonary artery catheters. Simultaneous measurements of C0bi, C0dopp, and C0td were obtained by 2 data collectors. EKG rhythm strips and simultaneous radial A-line blood pressure traces were analyzed for cardiac rhythm. C0dopp and C0bi were compared to C0td by correlation (r), regression slope (x) and intercept (b), bias, and precision.

RESULTS:

Twenty-nine patients were studied. The data are summarized in Table 1. Both methods (C0dopp and C0bi) agreed well (r = .74 and .70; x = .96 and 1.19 respectively) with C0td in patients with ST 100-120. C0dopp and C0bi agreed less with C0td in patients with DYS. In the ST > 120 group, C0dopp

did not agree well with C0td (r = .11, x = .18) whereas C0bi agreed better (r = .60, x = .48).

Table 1 - C0td vs C0dopp and C0bi

	n	r	x	b	bias
BI HR 100-120	71	.70	1.19	-1.73	-.46±1.76
Dopp HR 100-120	66	.74	.96	-.50	-.76±1.23
BI HR > 120	27	.60	.48	2.85	-.67±1.08
Dopp HR > 120	32	.11	.18	4.23	-.96±2.13
BI DYS	88	.57	.41	3.04	-.71±2.13
Dopp DYS	117	.50	.45	3.23	-.25±2.25

DISCUSSION:

The highest agreements with thermodilution for both doppler and bioimpedance were in the ST 100-120 groups. Both BI and Dopp agreed less well with thermodilution in the DYS groups. The Doppler method in the ST > 120 group agreed with thermodilution least of all. Probe placement and user experience did not seem to be reasons why Dopp functioned poorly in patients with ST > 120. CO by Dopp should be interpreted with caution in patients with ST > 120.

REFERENCES:

1. Appel PL, Kram HB, Mackabee J, Fleming AW, and Shoemaker WC: Comparison of measurements of cardiac output by bioimpedance and thermodilution in severely ill surgical patients. Crit Care Med 14: 933-935, 1986.
2. Huntsman LL, Stewart DK, Barnes SR, Franklin SB, Colocousis JS, and Hessel EA: Noninvasive doppler determination of cardiac output in man: Clinical validation. Circulation 67:593-597, 1983.