

## 015

**Bioimpedance Monitoring in Patients with Chronic Heart Failure**

Marjorie Funk,<sup>1</sup> Karin V. Nystrom,<sup>1</sup> Charmaine Hutchinson,<sup>3</sup> Stuart D. Katz,<sup>2</sup> Forrester A. Lee<sup>2</sup>—<sup>1</sup>Yale University School of Nursing, New Haven, CT; <sup>2</sup>Internal Medicine - Section of Cardiology, Yale University School of Medicine, New Haven, CT; <sup>3</sup>Howard University, Washington, DC

Bioimpedance monitoring is a non-invasive technique that measures thoracic electrical impedance, and is being used with increasing frequency to monitor hemodynamic changes in patients with heart failure. Although its accuracy has been tested in other patient populations, its accuracy in patients with chronic heart failure has not been firmly established. **Purpose:** To determine, in patients with chronic heart failure, if hemodynamic measurements obtained from bioimpedance monitoring are equivalent to hemodynamic measurements obtained simultaneously from a pulmonary artery (PA) catheter. **Methods:** We obtained 51 sets of measurements simultaneously from a bioimpedance monitor (IQ, Wantagh, Inc.) and PA catheter (Edwards Lifesciences) on 28 patients in the cardiac catheterization lab and coronary care unit at Yale-New Haven Hospital over a 1 year period. Values of cardiac output (CO) and afterload (systemic vascular resistance [SVR]), which are measured on the same scale, were compared by calculation of bias (mean between method difference) and precision (standard deviation of bias), as well as Pearson correlation. Values of preload (right atrial [RA] pressure, pulmonary artery diastolic [PAD] pressure, pulmonary capillary wedge pressure [PCWP], and thoracic fluid content [Zo]) and contractility (left ventricular stroke work index [LVSWI] and acceleration contractility index [ACI]), which are measured on different scales, were compared by Pearson correlation. **Results:** The sample of 28 patients was 68% male and 75% white, with a mean age  $53.3 \pm 11.8$  years and a mean LVEF of  $20.2 \pm 10.3\%$ . The correlation, bias, and precision values between measures of CO and afterload (SVR) obtained by PA catheter versus those obtained by bioimpedance are shown below:

Comparison of CO and SVR Values Obtained by PA Catheter and Bioimpedance

Measure	r	p	Bias	Precision	Lower Limit of Agreement	Upper Limit of Agreement
CO	.596	<.0001	.248	1.414	-2.581	3.077
SVR	.435	.0057	-136.367	743.718	-1623.802	1351.069

The correlation coefficient (r) of the comparison of measures of preload and contractility obtained by PA catheter versus those obtained by bioimpedance are shown below:

Comparison of Preload and Contractility Values Obtained by PA Catheter and Bioimpedance

Measure	PA Catheter	Bioimpedance	r	p
Preload	RA Pressure	Zo	-.227	.110
	PAD	Zo	-.169	.236
	PCWP	Zo	-.044	.765
Contractility	LVWSI	ACI	.582	.014

**Conclusions:** Although commonly used in practice, thoracic fluid content (Zo) is *not* an accurate measure of either right or left heart preload in patients with heart failure. Bioimpedance measures of CO, SVR, and ACI should be used with caution in patients with heart failure.