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Using non-invasive impedance cardiography to assess hemodynamic determinants of autonomic dysfunction among ambulatory heart failure patients

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Topic(s):
Chronic Heart Failure – Treatment

Citation:

Funding Acknowledgements:
Memorial University School of Nursing Research Fund

Background/Introduction: Autonomic dysfunction among persons with heart failure (HF) results in orthostatic drop in blood pressure (BP). These orthostatic changes are responsible for increased cardiovascular-related mortality and morbidity due to reduced left cardiac contractile function. Impedance cardiography (ICG) is a non-invasive modality that allows measurement/estimation of various hemodynamics that mimic left ventricular function.

Purpose: This study aimed to identify ICG hemodynamic measures that predict orthostatic BP changes among ambulatory HF patients.

Methods: Ambulatory patients at a nurse practitioner-led HF clinic in Atlantic Canada were invited to participate in the study. In supine resting position, ICG measures of consented participants (n=41) were assessed using BioZ Dx ICG (Sonosite Inc., San Diego, CA, USA). Blood pressure was measured in active-standing challenge (supine-to-standing) using conventional cuff and stethoscope. A stepwise multiple regression analysis was performed to determine which ICG hemodynamic measures best predict autonomic dysfunction.

Data analysis was performed using IBM SPSS for Windows v.25 (IBM SPSS Statistics, Armonk, NY).

Results: Active-standing challenge resulted in a mean change in systolic and diastolic BP of 5.0 ± 6.5 mmHg, -1.0 ± 7.9 mmHg, respectively. Seven participants (16%) met the criteria required to determine orthostatic hypotension (a drop in systolic/diastolic pressure of ≥20/10 mmHg). Controlling for medication profile and other comorbidities, a stepwise multiple regression was performed to determine ICG predictors of participants’ orthostatic BP changes. The regression models indicated Left Cardiac Work Index [LCWI] predicted orthostatic changes in BP. LCWI accounted for 18% of variance in diastolic BP (F (1,39)=8.51, p<0.001; β = 0.75, p<0.01) and 15% of variance in systolic BP (F (1,39)=6.99, p<0.05; β = 0.39, p<0.05).

Conclusion: Hemodynamic measures obtained using ICG demonstrated how an increase in cardiac work (LCWI) among individuals with HF predicted autonomic dysfunction. Ventricular contractile function related to autonomic dysfunction among individuals with HF can be monitored and evaluated using ICG.