Rev Port Cardiol. 2016;35(6):343–350

Revista Portuguesa de Cardiologia
Portuguese Journal of Cardiology
www.revportcardiol.org

ORIGINAL ARTICLE

The arterial baroreflex effectiveness index in risk stratification of chronic heart failure patients who are candidates for cardiac resynchronization therapy

João Fernandes Serôdio[a,*], Mário Martins Oliveira[a,b], Sérgio Matoso Laranjo[a], Cristiano Tavares[a], Pedro Silva Cunha[b], Ana Abreu[b], Luísa Branco[b], Sandra Alves[b], Isabel Rocha[a], Rui Cruz Ferreira[b]

[a] *Institute of Physiology, Faculty of Medicine, University of Lisbon, Lisbon, Portugal*
[b] *Department of Cardiology, Santa Marta Hospital, Lisbon, Portugal*

Received 1 September 2015; accepted 22 November 2015

KEYWORDS
Heart failure;
Cardiac resynchronization therapy;
Arterial baroreflex

Abstract
Introduction: Baroreflex function is an independent marker of prognosis in heart failure (HF). However, little is known about its relation to response to cardiac resynchronization therapy (CRT). The aim of this study is to assess arterial baroreflex function in HF patients who are candidates for CRT.
Methods: The study population consisted of 25 patients with indication for CRT, aged 65±10 years, NYHA functional class ≥III in 52%, QRS width 159±15 ms, left ventricular ejection fraction (LVEF) 29±5%, left ventricular end-systolic volume (LVESV) 150±48 ml, B-type natriuretic peptide (BNP) 357±270 pg/ml, and peak oxygen consumption (peak VO_2) 18.4±5.0 ml/kg/min. An orthostatic tilt test was performed to assess the baroreflex effectiveness index (BEI) by the sequence method. This group was compared with 15 age-matched healthy individuals.
Results: HF patients showed a significantly depressed BEI during tilt (31±12% vs. 49±18%, p=0.001). A lower BEI was associated with higher BNP (p=0.038), lower peak VO_2 (p=0.048), and higher LVESV (p=0.031). By applying a cut-off value of 25% for BEI, two clusters of patients were identified: lower risk cluster (BEI >25%) QRS 153 ms, LVESV 129 ml, BNP 146 pg/ml, peak VO_2 19.0 ml/kg/min; and higher risk cluster (IEB ≤25%) QRS 167 ms, LVESV 189 ml, BNP 590 pg/ml, peak VO_2 16.2 ml/kg/min.
Conclusions: Candidates for CRT show depressed arterial baroreflex function. Lower BEI was observed in high-risk HF patients. Baroreflex function correlated closely with other clinical HF parameters. Therefore, BEI may improve risk stratification in HF patients undergoing CRT.

* Corresponding author.
E-mail address: jserodio@campus.ul.pt (J. Fernandes Serôdio).

PALAVRAS-CHAVE
Insuficiência cardíaca;
Ressincronização cardíaca;
Reflexo barorrecetor arterial

O índice de eficácia do barorreflexo na estratificação de risco de doentes com insuficiência cardíaca crónica candidatos à terapêutica de ressincronização cardíaca

Resumo
Introdução: O barorreflexo arterial é comprovadamente um marcador independente de prognóstico na IC. Contudo, pouco se sabe sobre a relação entre a função do barorreflexo e a resposta à TRC. Assim, o objetivo deste estudo é avaliar a função barorreflexa em doentes com IC candidatos a TRC.
Métodos: A população deste estudo prospetivo consistiu em 25 doentes com 65±10 anos, classe NYHA ≥III em 52%, QRS 159±15 ms, fração de ejeção do ventrículo esquerdo (FEVE) 29±5%, volume telessistólico do ventrículo esquerdo (VTSVE) 150±48 mL, péptido natriurético tipo-B (BNP) 357±270 pg/ml, consumo máximo de oxigénio (VO2 max) 18,4±5,0 ml/kg/min. Foi implementado um teste de ortostatismo passivo para avaliar o índice de eficácia do barorreflexo (IEB), através do método sequencial. O grupo controlo foi constituído por 15 indivíduos saudáveis emparelhados para a idade.
Resultados: Os doentes com IC apresentaram um IEB significativamente reduzido durante o tilt (31±12% *versus* 49±18%, p=0,001). Um IEB diminuído associou-se a um BNP elevado (p=0,038), a um VO2 diminuído (p=0,048) e a um VTSVE aumentado (p=0,031). Aplicando um *cut-off* 25% para o IEB, foram identificados dois clusters de doentes: cluster de risco menor risco (IEB>25%) QRS 153 ms, VTSVE 129 mL, BNP 146 pg/mL, VO2 max 19,0 mL/kg/min; cluster de maior risco (IEB≤25%) QRS 167 ms, VTSVE 189 mL, BNP 590 pg/mL, VO2 max 16,2 mL/kg/min.
Conclusões: Doentes candidatos a TRC apresentam barorreflexo deprimido. O BEI diminuído foi observado nos doentes de maior risco. O barorreflexo correlacionou-se bem com outros parâmetros de gravidade de IC. Desta forma, o BEI pode contribuir para a estratificação de risco dos doentes com IC submetidos a TRC.

List of abbreviations

ACE	angiotensin-converting enzyme
ANS	autonomic nervous system
BEI	baroreflex effectiveness index
BNP	brain-type natriuretic peptide
BP	blood pressure
CRT	cardiac resynchronization therapy
HF	heart failure
HR	heart rate
HRV	heart rate variability
LBBB	left bundle branch block
LV	left ventricular
LVEDV	left ventricular end-diastolic volume
LVEF	left ventricular ejection fraction
LVESV	left ventricular end-systolic volume
NBR	number of baroreflex events per minute
NYHA	New York Heart Association
RR	R-R interval on electrocardiogram
SBP	systolic blood pressure
VO_2	oxygen consumption

Introduction

Chronic heart failure (HF) is a clinical syndrome that affects millions of people worldwide[1] and is responsible for high mortality and morbidity and decreased quality of life.[2] Although HF affects 1% of the adult population, its prevalence reaches 6-10% of people over the age of 65 years[1] and it is responsible for at least 20% of all hospital admissions among the elderly.[3] Nearly 30% of patients with HF with decreased ejection fraction also present left ventricular (LV) electrical dyssynchrony that results in a QRS interval greater than 120 ms, most commonly with a left bundle branch block (LBBB) pattern.[4] LV electrical dyssynchrony results in decreased diastolic time, anomalous septal motion and increased mitral regurgitation, with an overall reduction in left ventricular ejection fraction (LVEF).[1,5]

Cardiac resynchronization therapy (CRT) has shown important clinical benefits in the treatment of HF patients with systolic dysfunction (LVEF <35%) and electrical dyssynchrony (QRS >120 ms).[4,6] By reducing ventricular electrical dyssynchrony, CRT improves LV systolic function while reducing myocardial oxygen consumption,[7] which results in improvement of symptoms and quality of life and in a significant reduction in mortality.[4,8,9] However, up to 30% of patients do not respond to CRT (nonresponders).[10–12] CRT responders undergo LV reverse remodeling, which is characterized by decreases in intraventricular conduction delay and LV end-systolic volume (LVESV) and reduction in mitral regurgitation area, with a consequent increase in LVEF.[8,12,13] LV reverse remodeling is thought to be responsible for the clinical improvement in responders to CRT, but the mechanisms underlying reverse remodeling are not well understood.