Rev Port Cardiol. 2016;35(4):225–228

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

ORIGINAL ARTICLE

Pulse pressure can predict mortality in advanced heart failure

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Received 18 July 2015; accepted 21 November 2015
Available online 19 March 2016

KEYWORDS
Pulse pressure;
Heart failure;
Left ventricular dysfunction

Abstract
Introduction: Pulse pressure (PP) is the difference between systolic and diastolic blood pressure (BP). PP rises markedly after the fifth decade of life. High PP is a risk factor for the development of coronary heart disease and heart failure. The aim of this study was to assess whether PP can be used as a prognostic marker in advanced heart failure.
Methods: We retrospectively studied patients in NYHA class III–IV who were hospitalized in a single heart failure unit between January 2003 and August 2012. Demographic characteristics, laboratory tests, and cardiovascular risk factors were recorded. PP was calculated as the difference between systolic and diastolic BP at admission, and the patients were divided into two groups (group 1: PP >40 mmHg and group 2: PP $\leq$40 mmHg). Median follow-up was 666$\pm$50 days for the occurrence of cardiovascular death and heart transplantation.
Results: During follow-up 914 patients in NYHA class III–IV were hospitalized, 520 in group 1 and 394 in group 2. The most important difference between the groups was in left ventricular dysfunction, which was greater in patients with lower PP. On Kaplan-Meier analysis, group 2 had higher mortality (38 vs. 24 patients, log-rank p=0.002).
Conclusions: PP is easily calculated, and enables prediction of cardiovascular death in patients with advanced heart failure.

PALAVRAS-CHAVE
Pressão de pulso;
Insuficiência cardíaca;
Disfunção ventricular esquerda

Pressão de pulso pode ser um preditor de mortalidade na insuficiência cardíaca avançada

Resumo
Introdução: A pressão de pulso (PP) é a diferença entre os valores da pressão arterial sistólica e diastólica (BP). A PP sobe acentuadamente após a quinta década de vida, sendo considerada

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http://dx.doi.org/10.1016/j.repc.2015.11.012

um fator de risco para o desenvolvimento de doenças cardiovasculares. O objetivo do estudo foi avaliar se a PP pode ser usada como um marcador de prognóstico em doentes com insuficiência cardíaca avançada.
Métodos: Foram estudados, retrospetivamente, 914 doentes em classe III-IV de NYHA, que foram internados numa unidade de insuficiência cardíaca, entre janeiro de 2003 e agosto de 2012. Foram recolhidos: características demográficas, análises laboratoriais e fatores de risco cardiovascular dos doentes incluídos. A PP foi calculada como a diferença entre a BP na admissão e os doentes foram divididos em dois grupos (PP > 40 mmHg e PP = 40 mmHg). O tempo médio de *follow-up* foi de 666 ± 50 dias. Os *endpoints* considerados foram a morte por causa cardiovascular e o transplante cardíaco.
Resultados: Durante o *follow-up* foram internados 914 doentes, sendo divididos em dois grupos: grupo I: PP > 40 mmHg (520 pacientes); grupo II: PP = 40 mmHg (394 pacientes). A diferença mais importante entre os grupos foi a depressão da função ventricular esquerda mais acentuada no grupo de doentes com PP menor. Na análise KaplanMeyer, o grupo II (PP = 40 mmHg) apresentou maior mortalidade (38 pacientes *versus* 24 pacientes, *log-rank* P = 0,002).
Conclusões: A PP é um parâmetro facilmente calculado que se correlaciona com o prognóstico dos doentes com insuficiência cardíaca avançada.

Introduction

Pulse pressure (PP) is the difference between systolic and diastolic blood pressure (BP) and is dependent on stroke volume and arterial wall elastic properties.[1]

In a young healthy person, each stroke volume received into the central vessels is accommodated by a stretching of these vessels in systole followed by subsequent elastic recoil in late systole and diastole. This is known as arterial compliance and has the effect of maintaining central and peripheral BP within a relatively narrow range. With aging, there is a disruption and fragmentation of the elastic lamellae of the central arteries, as well as alteration of the collagen-to-elastin ratio, leading to arterial stiffness, loss of compliance, and increased pulse wave velocity and therefore increased PP.[2]

An elevated PP consistently predicts increased cardiovascular (CV) risk, including for coronary heart disease, chronic heart failure (HF) and CV mortality.[3,4]

The prognostic value of PP in patients with chronic HF is less clear. The SOLVD investigators found that a high PP predicted adverse outcome, especially in patients in New York Heart Association (NYHA) class II or III.[5] In contrast, in patients hospitalized with acute HF, low PP appeared to be an independent predictor of mortality. A low PP ($\leq$40 mmHg) may represent a decrease in cardiac output and reflect a reduction of stroke volume due to left ventricular dysfunction.

The aim of this study was to assess whether PP can be used as a prognostic marker in advanced HF (NYHA class III or IV).

Methods

We retrospectively studied 914 patients in NYHA class III–IV hospitalized in a single advanced HF unit between January 2003 and August 2012.

Detailed histories of the patients including demographic characteristics, CV risk factors and medication were recorded.

Serum lipid, glucose, creatinine, sodium, potassium, and brain natriuretic peptide levels were measured by routine laboratory methods.

PP was calculated as the difference between systolic and diastolic BP at admission, and the patients were divided into two groups (group 1: PP >40 mmHg and group 2: PP $\leq$40 mmHg).

Median follow-up was 666±50 days for the occurrence of CV death (sudden cardiac death or death due to decompensated HF, acute coronary syndrome or arrhythmia) and heart transplantation.

Statistical analysis

All analyses were performed with SPSS 16.0. Continuous variables were presented as mean ± standard error of the mean. Continuous variables according to NYHA class or PP group were analyzed by means.

The Student's t test or Mann-Whitney test was used for binary dependent variables. A p value <0.05 was considered statistically significant.

Differences between survival curves were calculated using univariate log-rank survival analysis.

Results

During follow-up 914 patients in NYHA class III–IV were hospitalized, 520 in group 1 and 394 in group 2. Median follow-up was nearly two years.

Patients' baseline characteristics are presented in Table 1.

There were no significant differences between patients with lower and higher PP. Mean age was similar and most