



ORIGINAL ARTICLE

Effects of percutaneous renal sympathetic denervation on cardiac function and exercise tolerance in patients with chronic heart failure



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KEYWORDS

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Abstract

Introduction: Sympathetic hyperactivity, a vital factor in the genesis and development of heart failure (HF), has been reported to be effectively reduced by percutaneous renal denervation (RDN), which may play an important role in HF treatment.

Objective: To determine the effects of percutaneous RDN on cardiac function in patients with chronic HF (CHF).

Methods: Fourteen patients (mean age 69.6 years; ejection fraction [EF] <45%) with CHF received bilateral RDN. Adverse cardiac events, blood pressure (BP), and biochemical parameters were assessed before and six months after percutaneous operation. Patients also underwent echocardiographic assessment of cardiac function and 6-min walk test before and at six months after percutaneous operation.

Results: The distance achieved by the 14 patients in the 6-min walk test increased significantly from 152.9±38.0 m before RDN to 334.3±94.4 m at six months after RDN ($p<0.001$), while EF increased from 36.0±4.1% to 43.8±7.9% ($p=0.003$) on echocardiography. No RDN-related complications were observed during the follow-up period. In 6-month follow-up, systolic BP decreased from 138.6±22.1 mmHg to 123.2±10.5 mmHg ($p=0.026$) and diastolic BP from 81.1±11.3 mmHg to 72.9±7.5 mmHg ($p=0.032$). Creatinine levels did not change significantly (1.3±0.65 mg/dl to 1.2±0.5 mg/dl, $p=0.8856$).

Conclusion: RDN is potentially an effective technique for the treatment of severe HF that can significantly increase EF and improve exercise tolerance.

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PALAVRAS-CHAVE

Desnervação renal;
Sistema nervoso
simpático;
Insuficiência
cardíaca;
Pressão arterial

Efeitos da desnervação simpática renal percutânea na função cardíaca e na tolerância ao exercício, em doentes com insuficiência cardíaca crónica

Resumo

Introdução: Foi reportado que a hiperatividade simpática, um fator vital para a gênese e desenvolvimento da insuficiência cardíaca (IC), pode ser efetivamente reduzida pela desnervação simpática renal percutânea (DSR), que pode vir a desempenhar um papel importante no tratamento da IC.

Objetivo: Determinar os efeitos da DSR por via percutânea na melhoria da função cardíaca em doentes com insuficiência cardíaca crónica (ICC).

Métodos: Catorze doentes (idade média, 69,6 anos; fração de ejeção [FE], <45%) com ICC foram submetidos a RDN bilateral. Eventos cardíacos adversos, pressão arterial e índices bioquímicos foram realizados antes e seis meses após a intervenção. Os doentes também foram sujeitos a avaliação ecocardiográfica da função ventricular e ao teste de seis minutos de marcha, antes e seis meses após a intervenção.

Resultados: A distância percorrida pelos 14 doentes no teste de seis minutos de marcha aumentou de forma significativa, de $152,9 \pm 38,0$ m antes DSR para $334,3 \pm 94,4$ m, seis meses depois da DSR ($p < 0,001$), enquanto a FE aumentou de $36,0 \pm 4,1\%$ para $43,8 \pm 7,9\%$ ($p = 0,003$) no ecocardiograma. Não foram relatadas complicações da DRS durante o período de *follow-up*. Num *follow-up* de seis meses, a pressão sistólica desceu de $138,6 \pm 22,1$ mmHg para $123,2 \pm 10,5$ mmHg ($p = 0,026$) e a pressão diastólica de $81,1 \pm 11,3$ mmHg para $72,9 \pm 7,5$ mmHg ($p = 0,032$), sem alteração dos valores de creatinina (de $1,3 \pm 0,65$ mg/dl para $1,2 \pm 0,5$ mg/dl, $p = 0,8856$).

Conclusão: A DSR é potencialmente uma nova e eficaz técnica para o tratamento da ICC severa, porque pode aumentar significativamente a FE e melhorar a tolerância ao exercício.

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Introduction

Chronic heart failure (CHF) affects about 100 million patients throughout the world, and has a five-year survival rate of only 50%, although drug therapy can improve symptoms. As an important factor in the genesis and development of heart failure (HF), sympathetic hyperactivity is directly correlated with the severity and prognosis of HF.¹

Recently, it has been reported that a novel catheter-based renal sympathetic denervation (RDN) technique to ablate the renal afferent and efferent nerves² can reduce excessive sympathetic nerve activation and may have a potential therapeutic effect in diseases associated with sympathetic activation.³ In some studies on hypertension, RDN has been found to lower blood pressure (BP) in patients with resistant hypertension, with a mean reduction of 33/12 mmHg.^{4,5} A previous study confirmed that RDN using a 3.5F Symplicity ablation catheter can extend the 6-min walk distance of patients with HF,⁶ but does not improve ejection fraction (EF) and left ventricular volume as shown by echocardiography. Our study group has demonstrated in preliminary animal experiments that percutaneous RDN using a 5F ablation catheter (Medtronic Inc., Dublin, Ireland) can improve cardiac function and reduce left ventricular volume in pigs with rapid pacing-induced HF.⁷ In the present study, a 5F ablation catheter was used for RDN in patients

with CHF, and safety parameters such as cardiac function, exercise tolerance, BP, and creatinine (Cr) were assessed.

Methods**Study population**

Inclusion criteria were a diagnosis of CHF; EF <45% on echocardiography; >2 HF episodes in the previous six months; medication with HF drugs including beta-blockers, angiotensin-converting enzyme inhibitors (ACEIs) or angiotensin receptor blocker (ARBs) and spironolactone; and no acute HF decompensation in at least one month of drug therapy.

Exclusion criteria were a history or evidence on imaging of renal artery stenosis (RAS); glomerular filtration rate <30 ml/min/1.73 m²; type 1 diabetes; pregnancy or intended pregnancy during the study period; acute phase of myocardial infarction (MI) or cerebrovascular accident; and systolic BP <100 mmHg.

Fourteen patients including four with hypertensive HF, two with dilated cardiomyopathy and eight with coronary artery disease were enrolled in the study. Mean baseline BP was $138.6 \pm 22.1/81.1 \pm 11.3$ mmHg. All patients signed written informed consent forms for undergoing percutaneous

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