

# Improved Functional Capacity and Cardiovascular Structure After Baroreflex Activation Therapy® in Resistant Hypertension Patients With Symptomatic Heart Failure: Results from European and United States Trials of the Rheos® System

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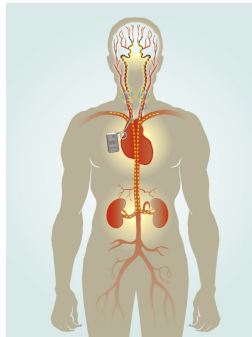
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## Introduction

- Patients with resistant hypertension (HTN) and symptomatic heart failure with preserved ejection fraction (HFpEF) are at a high risk to have left ventricular (LV) hypertrophy.
- These adverse structural changes to the heart, as well as abnormalities in LV diastolic function and arterial stiffness, are associated with poor outcome and may contribute to reduced functional capacity.
- The Rheos System uses Baroreflex Activation Therapy® (BAT®) technology to chronically activate the baroreflex and has been shown to significantly reduce systolic and diastolic blood pressure in patients with resistant hypertension.
- It is unknown if BAT improves functional capacity and/or cardiac structure in HTN patients with HFpEF.
- It was hypothesized that BAT would improve functional capacity and cardiac structure.

### Mechanisms of Rheos Therapy

The Rheos System is designed to electrically activate the carotid baroreceptors, the body's natural cardiovascular regulation sensors. When the baroreceptors are activated, signals are sent through neural pathways to the brain and interpreted as a rise in blood pressure. The brain works to counteract this perceived rise in blood pressure in part by sending signals to relax the blood vessels. These changes enable the heart to increase stroke volume, while maintaining or reducing workload, thereby reducing blood pressure.

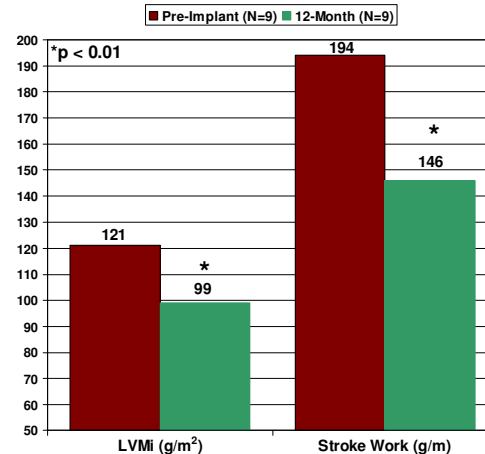


## Methods

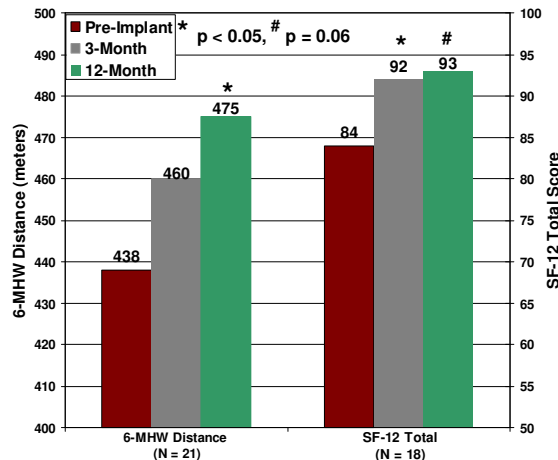
- Patients (mean age = 53.7 ± 10.1 yr) implanted with the Rheos system had Stage II HTN (systolic BP ≥ 160 mmHg), NYHA Class ≥ I, normal ejection fraction (mean EF = 64 ± 5), and were taking ≥ 3 anti-HTN drugs including at least one diuretic to treat their hypertension and heart failure. The patients are from a subset of the DEBuT and US Feasibility studies of the Rheos device. The device was activated 1 month after implant to deliver BAT.
- In this retrospective analysis, all patients who met the criteria of early stage HF (Stage A-B) via the ACC/AHA classification scheme were identified from a larger resistant hypertensive cohort.
- Six-minute hall walk (6-MHW) test (N = 21) and SF-12 Quality of Life Questionnaire (N = 18) was administered to assess functional health after 3 and 12 months of BAT.
- Echocardiographic data were collected in a subset of patients (N = 9) and analyzed at a blinded core lab.

## Results

### Sustained Reduction in Left Ventricular Mass Index and Stroke Work After BAT



### Improvements in 6-Minute Hall Walk Distance and SF-12 After BAT



### Improvement in Cardiac Function and Structure

<u>Cardiac Function</u>	<u>Pre-Implant</u> N = 9	<u>12-Month</u> N = 9
Ejection Fraction (%)	64 ± 5	64 ± 11
Rate Pressure Product (bpm x mmHg)	12466 ± 1917	9595 ± 2126*
<u>Cardiac Structure</u>		
Left Atrial Diameter (mm)	42.3 ± 8.6	41.0 ± 7.2
LV Mass (g)	252 ± 63	207 ± 88*
LV Posterior Wall (mm)	12.6 ± 1.7	11.1 ± 1.8*
LV Septal Wall (mm)	12.4 ± 1.9	11.2 ± 1.9#

Data are mean ± SD; \* P < 0.05

### Other Findings

- Systolic and Diastolic BP (Pre-Implant = 171 / 101 mmHg) were significantly ( $p$ , 0.01) reduced at 3 Months and all subsequent follow-up time points with the average drop in SBP and DBP at 3 years being (-32 / -22 mmHg; N = 10).
- A trend for a reduction in mitral A wave velocity (Pre-Implant = 75.6 ± 24.2 cm/s to Month 12 = 65.4 ± 16.1 cm/s,  $p$  = 0.08) coupled with decreased left atrial dimension and LV mass index suggests that the therapy reduced LV diastolic filling pressure.
- No significant change in medication load occurred over follow-up.
- No significant change in BMI was observed.

## Conclusions

- In addition to sustained BP reduction and improved cardiac function and structure, 1 year of chronic Rheos Therapy increased functional capacity in drug resistant hypertensive HFpEF patients.
- One potential mechanism explaining these findings is substantial left ventricular reverse-remodeling (structural remodeling) and potential improvements in diastolic filling (functional remodeling).
- Further study is in progress to confirm the potential benefit of Rheos Therapy on functional capacity, cardiac remodeling, and outcome in a larger HFpEF patient cohort.

CAUTION: The CVRx Rheos System is an investigational device and is limited by Federal (or United States) law to investigational use only.

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