Orchestrating Sympathovagal Balance with Barostim

Navid Madershahian, MD

Cologne University Heart Centre
Department of Cardiothoracic Surgery
Director: Univ.-Prof. Dr. Th. Wahlers
Disclosure

Speaker name: **Navid Madershahian, M.D.**

I have the following potential conflicts of interest to report:

- ✔ Consulting
- ☐ Employment in industry
- ☐ Stockholder of a healthcare company
- ☐ Owner of a healthcare company
- ☐ Other(s)
- ☐ I do not have any potential conflict of interest
Introduction

- Sympathetic Overactivity
- Baroreflex Activation Therapy (Barostim)
  - Barostim Device
  - Device Implantation
Sympathetic Nervous System Overactivity is associated with several Cardiovascular Diseases.

- Hypertension
- Stroke
- Coronary Heart Disease
  - Heart Failure
  - Cardiac Arrhythmia
- Nephrosclerosis
- Nephropathy
- Obesity
Sympathetic Overactivity

Evidence of Sympathetic Activation in Essential Hypertension

Goldstein D.S. Hypertension 1983

NE: Norepinephrine
MSNA: Muscle Sympathetic Nervous Activity

* P<0.05; ** P<0.01
Sympathetic Overactivity

Sympathetic Profile according to MDRD Quartiles in Patients with renal insufficiency

MDRD: Modification of Diet in Renal Disease
MSNA: Muscle Sympathetic Nervous Activity

Grassi G et al. Hypertension 2011
Sympathetic Overactivity

Urinary and Plasma Norepinephrine Levels in Chronic Heart Failure

Mancia G. Eur Heart J 1990
Mechanisms of Baroreflex

- **Afferents**
  - Arterial Baroreceptors

- **CNS**
  - Parasympathetic
  - Sympathetic

- **Efferents**
  - Heart Rate
  - Adverse Cardiac Effects
  - Sodium Reabsorption
  - Renin
  - Renal Vascular Resistance
  - Peripheral Vascular Resistance

- **Effector Changes**
  - NE decreases
  - ACh increases

Adapted from Floras, J Am Coll Cardiol 2009
Baroreceptors

Sensing pressure changes by responding to change in the tension of the arterial wall.
Barostim Therapy
Barostim Therapy

Carotid Baroreceptor Stimulation

Brain

Autonomic Nervous System
Inhibited *Sympathetic* Activity
Enhanced *Parasympathetic* Activity

↓ HR
↓ Irritability
↓ Stiffness

↑ Vasodilation

↑ Diuresis
↓ Renin secretion
Clinical Practice

Heusser et al. Hypertension 2010, 55;619-626
CVRx® Rheos System
Rheos™ vs neo™
Differences in the Electrical Field

First generation (bilateral)

Rheos™

New generation (unilateral)

neo™
The Barostim neo™ System

- Last generation device
- Unilateral implantation (less trauma)
- 2 mm electrode
- Small neck incision
- Programmable via telemetry
- Therapy individually optimizable
Implantation
The Interdisciplinary Team
Thank you.
Side Preference

- Right side preferred for implant
  - Review duplex ultrasound from pre-op workup
  - Verify at least one side is adequate for implant
    - Accessibility of the bifurcation
    - Absence of stenosis >50%
- Right side preferred based on results from previous trials

<table>
<thead>
<tr>
<th></th>
<th>Right</th>
<th>Left</th>
<th>Bilateral</th>
</tr>
</thead>
<tbody>
<tr>
<td>N (%)</td>
<td>163 (54%)</td>
<td>96 (32%)</td>
<td>43 (14%)</td>
</tr>
<tr>
<td>Delta SBP mmHg</td>
<td>-32 ± 2.5</td>
<td>-35 ± 3.6</td>
<td>-32 ± 6.0</td>
</tr>
<tr>
<td>Delta HR bpm</td>
<td>-2.2 ± 1.1</td>
<td>0.0 ± 1.5</td>
<td>-2.9 ± 2.2</td>
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</tbody>
</table>
Exposure level of carotid artery bifurcation

Careful dissection of periadventitial tissues to preserve intrinsic innervation

Toorop et al 2009, stained cadaver tissue, magnification 6x
Implant & Anesthesia Procedure Flow

Anesthesia phase

Phase I
Anesthesia must not blunt the baroreflex

Step 1
Carotid sinus exposure

Step 2
Electrode mapping
Electrode fixation
Final testing

Phase II
Deeper anesthesia ok

Step 3
IPG pocket creation
Lead tunneling
Final closure

Surgery Steps

Approximate timeline

0 min
20 min
60 min
80 min

neo OFF
neo ON / OFF
neo OFF

Functional Baroreflex

Anesthesia must not blunt the baroreflex

Phase I

Deeper anesthesia ok

Phase II

Implant & Anesthesia Procedure Flow
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