Renal Denervation (RDN)
NOVEL CATHETER-BASED TREATMENT FOR HYPERTENSION

What is hypertension?
Hypertension, or high blood pressure, is a common disorder in which blood pressure remains abnormally elevated for a sustained period of time. Blood pressure is typically classified in terms of systolic (the maximum pressure during the cardiac cycle) and diastolic (the minimum pressure during the cardiac cycle) and is expressed as systolic blood pressure/diastolic blood pressure in millimeters of mercury (mmHg).

The United States Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure, European Society of Cardiology and European Society of Hypertension have established guidelines for blood pressure classification (see Table 1). Blood pressure above 140/90 mmHg is classified as uncontrolled hypertension and blood pressure below 120/80 mmHg is classified as normal.

Table 1. Blood Pressure Classifications

<table>
<thead>
<tr>
<th>Classification</th>
<th>Systolic (mmHg)</th>
<th>Diastolic (mmHg)</th>
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</thead>
<tbody>
<tr>
<td>Normal</td>
<td>90–119</td>
<td>60–79</td>
</tr>
<tr>
<td>Prehypertension</td>
<td>120–139</td>
<td>80–89</td>
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<tr>
<td>Uncontrolled hypertension</td>
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<td></td>
</tr>
<tr>
<td>Stage 1</td>
<td>140–159</td>
<td>90–99</td>
</tr>
<tr>
<td>Stage 2</td>
<td>≥160</td>
<td>≥100</td>
</tr>
</tbody>
</table>

Note that target blood pressure for diabetics is <130/80.

What causes hypertension?
The onset of hypertension has been correlated with several factors, including genetics, aging, diet and lifestyle. Although an asymptomatic condition, when left untreated, chronic hypertension poses serious health risks including significantly increased risk of heart attack, stroke, heart failure, kidney disease and death. In fact, among adults aged 40–70, each increment of 20 mmHg in systolic blood pressure or 10 mmHg in diastolic blood pressure doubles the risk of cardiovascular disease.

How prevalent is hypertension?
Hypertension is the leading attributable cause of death in the world, affecting approximately 1.2 billion people worldwide. It is associated with an increased risk of heart attack, stroke, heart failure, kidney disease and death, representing a significant and escalating global health issue. Although pharmaceutical therapy plays a primary role in hypertension management, drugs alone are sometimes not effective for all patients.

What are the consequences of hypertension?
Hypertension, sometimes called the “silent killer,” is often asymptomatic, yet it is the No. 1 risk factor for premature death worldwide. Hypertension is also costly. The estimated global healthcare expenditure directly attributable to hypertension is more than $500 billion annually.

How is hypertension treated?
Patients with mild hypertension are advised to make behavioral and dietary changes such as losing weight, exercising, reducing sodium intake and increasing potassium intake. If these approaches are unsuccessful, drug treatment is usually prescribed. While pharmaceutical therapy plays a role in hypertension management, drugs alone are sometimes not effective for all patients and despite
changes in lifestyle and the availability of modern antihypertensive agents, approximately 50 percent of patients with hypertension remain uncontrolled, and approximately 15–20 percent of those are resistant. As a result, new treatment approaches such as renal denervation (RDN) are needed.

What is RDN and why might it be effective?

RDN addresses uncontrolled hypertension by reducing the drive of the sympathetic nervous system, which is central to blood pressure regulation. It is a minimally invasive procedure that modulates the output of the sympathetic nerves located outside the renal artery walls and represents a breakthrough approach and first-of-its-kind device-based treatment for resistant hypertension.

Specifically, RDN involves selectively disabling renal nerves within the sympathetic nervous system. Denervation, which affects both the electrical signals going into the kidneys and those emanating from them, has the potential to impact the mechanical and hormonal activities of the kidneys themselves, as well as the electrical activation of the rest of the sympathetic nervous system. Physiology suggests that blocking sympathetic nerves leading to the kidneys will reverse fluid and salt retention, and reduce inappropriate renin release (stopping the deleterious hormonal renin-angiotensin-aldosterone-system [RAAS] cascade before it starts).

By blocking sympathetic nerves emanating from the kidneys, RDN may lower the level of activation of the whole sympathetic nervous system. In doing so, it may also decrease the electrical stimulation of other members of the sympathetic nervous system, such as the heart and blood vessels, thereby providing an additional antihypertensive effect. Blocking renal nerves has also been shown in various models to have beneficial effects on organs damaged by chronic sympathetic overactivity, since it may lower the level of cytokines and neurohormones that may be harmful to the blood vessels, kidneys and heart.

3 Chobanian A. 2003.

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