Clinical Policy Title: Renal denervation

Clinical Policy Number: 09.03.04

Effective Date: February 1, 2017
Initial Review Date: November 16, 2016
Most Recent Review Date: January 11, 2018
Next Review Date: January 2019

Related policies:
CP# 04.01.03 Ambulatory blood pressure monitoring

Coverage policy

AmeriHealth Caritas Pennsylvania HealthChoices considers the use of renal denervation to be investigational and, therefore, not medically necessary.

Limitations:

All other uses of renal denervation are not medically necessary.

Alternative covered services:

- Antihypertensive medications.
- Diuretic therapy.

Background
The sympathetic nervous system is part of the autonomic nervous system responsible for preparing the body for stressful or emergency situations, i.e., “fight or flight.” Its effects target kidney function and systemic hemodynamics. Renal injury or hypoxia further enhances systemic and renal sympathetic activity. Sympathetic hyperactivity has been implicated in the initiation and progression of multiple conditions including arterial hypertension, sleep apnea, metabolic syndrome, myocardial hypertrophy and heart failure, and cardiac arrhythmias (Bohm, 2014).

Renal denervation, also referred to as renal sympathetic ablation, is a minimally invasive percutaneous procedure that uses a radiofrequency catheter inserted through the femoral artery to selectively engage the sympathetic nerve fibers surrounding the renal artery. The desired result is to interrupt the influence of the sympathetic reflexes on the kidney and systemic hemodynamics. The procedure usually takes from 45 minutes to 60 minutes with a single catheter or less time with a multi-electrode or balloon catheter, and analgesia and sedation are required (Bohm, 2014).

Renal denervation has been proposed as a nonpharmacologic treatment for treatment-resistant hypertension, which is common in patients with pre-existing comorbid atherothrombotic disease and obesity, and for other sympathetically driven conditions (Bohm, 2014). In the United States, renal denervation devices are available for investigational use only; none has received FDA approval for commercial use (FDA, 2017a and 2017b).

**Searches**

AmeriHealth Caritas Pennsylvania HealthChoices searched PubMed and the databases of:
- UK National Health Services Centre for Reviews and Dissemination.
- Agency for Healthcare Research and Quality’s National Guideline Clearinghouse and other evidence-based practice centers.
- The Centers for Medicare & Medicaid Services (CMS).

We conducted searches on November 3, 2016. Search terms were: “renal denervation,” “ablation,” and “treatment resistant hypertension.”

We included:
- **Systematic reviews**, which pool results from multiple studies to achieve larger sample sizes and greater precision of effect estimation than in smaller primary studies. Systematic reviews use predetermined transparent methods to minimize bias, effectively treating the review as a scientific endeavor, and are thus rated highest in evidence-grading hierarchies.
- **Guidelines based on systematic reviews.**
- **Economic analyses**, such as cost-effectiveness, and benefit or utility studies (but not simple cost studies), reporting both costs and outcomes — sometimes referred to as efficiency studies — which also rank near the top of evidence hierarchies.

**Findings**
We included four systematic review/meta-analyses, three professional guidelines, and one cost-effectiveness analysis for this policy. Two systematic reviews/meta-analyses (Sharfi, 2016; Fadl Elmula, 2015), the cost-effectiveness analysis (Geisler, 2012), and all three guidance documents (Lobo, 2015; Schlaich, 2013; National Institute for Health and Clinical Excellence [NICE], 2012) evaluated renal denervation for treatment-resistant hypertension. Two systematic reviews examined the role of renal denervation for treatment of type 2 diabetes mellitus and obstructive sleep apnea (Pan, 2015; Shantha, 2015).

There is insufficient evidence to support the clinical use of catheter-based renal denervation for any indication. The evidence comprises observational data from multiple small case series and limited comparative clinical trials using the SYMPLICITY™ Renal Denervation System (Medtronic, Inc., Santa Rosa, California). The SYMPLICITY trials enrolled patients with severe treatment-resistant hypertension who were receiving a stable antihypertensive regimen of at least three drugs, including a diuretic, and had adequate renal function:

- SYMPLICITY HTN-1 was the first in-human, proof-of-concept and safety study of 45 patients (Krum, 2014).
- SYMPLICITY HTN-2 was a multi-site, randomized controlled trial (RCT) of 106 patients (Esler, 2014).
- SYMPLICITY HTN-3 was a multi-site RCT with sham controls of 535 patients (Bakris, 2014; Bhatt, 2014).

The evidence suggests that renal denervation in patients with treatment-resistant hypertension is safe, may be cost-effective, and lowers systolic blood pressure in the short term and medium term, but the results are highly variable. Long-term safety data beyond three years follow-up are lacking. Reduction in systolic blood pressure after renal denervation was greater in observational studies than randomized studies, and in studies that used office blood pressure measurement rather than ambulatory blood pressure measurement as an efficacy endpoint. To note, while the most rigorously designed SYMPLICITY HTN-3 trial met its primary safety endpoint with a major adverse event rate of only 1.4 percent, it failed to meet its primary and secondary efficacy endpoints with no statistically significant difference in either blood pressure measurement between the renal denervation treatment and sham control arms.

Results of the SYMPLICITY studies cannot be extrapolated to less severe forms or secondary forms of hypertension or to other catheter-based systems. Several factors may influence the findings such as ethnicity, age, renal status, other comorbidities, and technical proficiency; efforts to address the design of future studies have been reported (Lobo, 2015; White, 2014). A growing body of evidence from nonrandomized smaller studies suggests a potentially important role for renal denervation in the management of other disease states characterized by sympathetic nerve overactivation. Further research using randomized, appropriately controlled, blinded designs and large-scale registries is needed to identify optimal candidates for renal denervation, refine the technology, define procedural success and clinical efficacy of renal denervation in reducing blood pressure, and improve important clinical outcomes (e.g., risk of stroke, myocardial infarction, heart failure, and death).
Policy updates:

In 2017, we added one new Cochrane review that found low- to moderate-quality evidence from RCTs did not support a clear benefit of renal denervation for treatment-resistant hypertension, and long-term outcomes were lacking (Coppolino, 2017). The FDA has still not approved renal denervation for commercial use in the United States. No policy changes are warranted.

Summary of clinical evidence:

<table>
<thead>
<tr>
<th>Citation</th>
<th>Content, Methods, Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coppolino (2017)</td>
<td>Key points:</td>
</tr>
<tr>
<td>Renal denervation for</td>
<td>• Systematic review and meta-analysis of 12 RCTs (1,149 total participants): renal denervation vs. sham (four RCTs); proximal ablation vs. complete renal artery denervation (one RCT); renal denervation vs. standard or intensified antihypertensive therapy (seven RCTs).</td>
</tr>
<tr>
<td>resistant hypertension</td>
<td>• None of the included trials was designed to look at hard clinical endpoints as primary outcomes.</td>
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<tr>
<td>Cochrane review</td>
<td>• Data were sparse or absent for all-cause mortality, hospitalization, fatal cardiovascular events, quality of life, atrial fibrillation episodes, left ventricular hypertrophy, sleep apnea severity, need for renal replacement therapy, and metabolic profile.</td>
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<tr>
<td></td>
<td>• Renal denervation:</td>
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<tr>
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<td>- Does not change major cardiovascular events, and renal function (low-quality evidence).</td>
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<tr>
<td></td>
<td>- Does not change blood pressure (moderate-quality evidence).</td>
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<td>- Caused an increase of bradycardia episodes (low-quality evidence).</td>
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<td>• Future trials measuring patient-centered instead of surrogate outcomes, with longer follow-up periods, larger sample size, and more standardized procedural methods are necessary to clarify the utility of this procedure in this population.</td>
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<td>Sharfi (2016) for AHRQ</td>
<td>Key points:</td>
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<tr>
<td>Renal denervation for</td>
<td>• Systematic review and meta-analysis of nine RCTs, eight comparative cohorts, and 66 noncomparative cohorts (7,660 total patients).</td>
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<td>resistant hypertension in the Medicare population</td>
<td>• Overall quality: variable.</td>
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<td>• Results depend in part on type of blood pressure measurement and study design:</td>
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<td>- RCTs using 24-hour systolic ambulatory blood pressure measurement (ABPM) found small mean between-group differences (range: -8.0 mm Hg to +2.1 mm Hg).</td>
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<td></td>
<td>- Studies using office blood pressure measurement (OBPM) found higher within-group differences for RCTs and comparative cohorts (range: -42.0 mm Hg to -8 mm Hg) and noncomparative cohorts (range: -58.2 mm Hg to 12 mm Hg). Likely overestimated due to white coat effect, observation bias, and placebo effect.</td>
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<tr>
<td></td>
<td>• Scant available data on long-term clinical endpoints (e.g., stroke, myocardial infarction, kidney events, hospitalization, or death).</td>
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<td>• Uncommon but potentially serious adverse effects (e.g., hematoma, pseudoaneurysm,</td>
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### Fadl Elmula (2015)

**Renal denervation for resistant hypertension**

**Key points:**
- Meta-analysis of seven RCTs using renal denervation with SYMPLICITY catheters (985 total patients).
- Overall quality: moderate. Six months follow-up.
- Age averaged 58.1 years; average OBPM 168.5/93.3 mmHg; 24 h ABPM 151.8/86.1 mmHg; estimated glomerular filtration rate (eGFR) 79.3 ml/min/1.73 m².
- Pooled effects (control minus renal denervation): OBPM -4.9/-3.5 mmHg (95% CI -20.9 to 11.1/-8.9 to 1.9); 24 h ABPM -2.8/-1.5 mmHg (-6.5 to 0.8/-3.3 to 0.4); eGFR 0.81 ml/min/1.73 m² (-1.69 to 3.30).
- Adverse events: 7.4% in controls and 9.9% in renal denervation group (p = 0.24).
- In selected patients with resistant hypertension on antihypertensive drugs, renal denervation with the SYMPLICITY system does not significantly decrease blood pressure but is safe.
- Future trials with next-generation catheters should aim at identifying responders in patients with evidence of sympathetic nervous overactivity.

### Lobo (2015) for the Joint UK Societies

**Consensus statement on renal denervation for resistant hypertension**

**Key points:**
- Renal denervation not recommended for treatment of resistant hypertension in routine clinical practice.
- Recommends maintaining current moratorium on renal denervation in the UK until level 1 evidence supports use of renal denervation.
- Continued research encouraged with recommendations for improving design and conduct of future randomized studies.

### Pan (2015)

**Renal denervation and type 2 diabetes mellitus**

**Key points:**
- Narrative review of one nonrandomized controlled study and four observational studies (53 total patients).
- Overall quality: low with high risk of bias, small study sizes, no control groups, varied patient selection.
- Conflicting results regarding improvement in hypertension and glycemic control.
- Inconclusive. Large-scale RCTs needed to confirm results.

### Shantha (2015)

**Renal denervation and apnea-hypopnea index (AHI) in patients with obstructive sleep apnea**

**Key points:**
- Systematic review and meta-analysis of four before and after studies and one compared continuous positive airway pressure with renal denervation (49 total patients).
- Six months post-renal denervation:
- Significant reduction in mean AHI (weighted mean difference -9.61, 95% confidence interval [CI] -15.43 to -3.79, P = 0.001).
- One study reported improvement in oxygen desaturation index and Epworth sleepiness scale.
- Promising results require validation in RCTs.
<table>
<thead>
<tr>
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<th>Content, Methods, Recommendations</th>
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</thead>
</table>
| International Expert Consensus Statement    | • Consensus primarily based on data from SYMPLICITY HTN-1 and SYMPLICITY HTN-2 trials.  
• Renal denervation improves blood pressure control in patients with resistant hypertension, with acceptable safety up to three years for the degree and reliability of blood pressure improvement. The effects may extend beyond blood pressure control. Long-term safety data are lacking.  
   – Resistant hypertension = systolic OBPM ≥ 160 mm Hg or ≥ 150 mm Hg in patients with type 2 diabetes, despite treatment with ≥ three antihypertensive drugs of different types, including one diuretic agent.  
• Contraindications to renal denervation: Hemodynamically or anatomically significant renal artery abnormalities (e.g., stenosis or fibromuscular dysplasia), previous renal artery interventions including renal stent procedures, unstable clinical conditions (e.g., acute cardiovascular events), or in children or patients with preeclampsia (insufficient evidence).  
• Renal denervation not recommended outside of research settings for less severe forms of HTN or in other conditions characterized by heightened renal sympathetic nerve activity, such as heart failure, metabolic syndrome, heart arrhythmias (e.g., atrial fibrillation), chronic and end-stage renal disease, and others (insufficient evidence). |
| Geisler (2012)                                | Key points:                                                                                                                                                                                                                       |
| Cost-effectiveness and clinical effectiveness of renal denervation for resistant hypertension | • Assumptions based on SYMPLICITY HTN-2 study findings.  
• Renal denervation substantially reduced event probabilities (10-year/lifetime relative risks: stroke 0.70/0.83; myocardial infarction 0.68/0.85; all coronary heart disease 0.78/0.90; heart failure 0.79/0.92; end-stage renal disease 0.72/0.81).  
• Median survival: renal denervation 18.4 years versus standard of care 17.1 years.  
• Discounted incremental cost-effectiveness ratio (ICER) was $3,071 per quality-adjusted life-year (QALY); 95% credible interval for ICER was cost-saving to $31,460 per QALY.  
• Stable over various input parameters except for systolic blood pressure reduction, baseline systolic blood pressure, and effect duration. OBPM used in calculations.  
• Results are not generalizable to other renal denervation systems. |
| NICE (2012)                                   | Key points:                                                                                                                                                                                                                       |
| Renal denervation for resistant hypertension   | • Limited evidence suggests short- and medium-term efficacy with a low incidence of serious periprocedural complications.  
• Insufficient evidence of long-term efficacy, which is important for treating resistant hypertension.  
• Renal denervation should only be used with special arrangements for clinical governance, consent, and audit or research. |

**References**

**Professional society guidelines/other:**


**Peer-reviewed references:**


**CMS National Coverage Determinations (NCDs):**

No NCDs identified as of the writing of this policy.

**Local Coverage Determinations (LCDs):**


**Commonly submitted codes**

Below are the most commonly submitted codes for the service(s)/item(s) subject to this policy. This is not an exhaustive list of codes. Providers are expected to consult the appropriate coding manuals and bill accordingly.

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<tr>
<td>0339T</td>
<td>Transcatheter renal sympathetic denervation; bilateral</td>
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<table>
<thead>
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