

Progression of Renal Artery Stenosis After Renal Denervation

– Impact on 24-Hour Blood Pressure –

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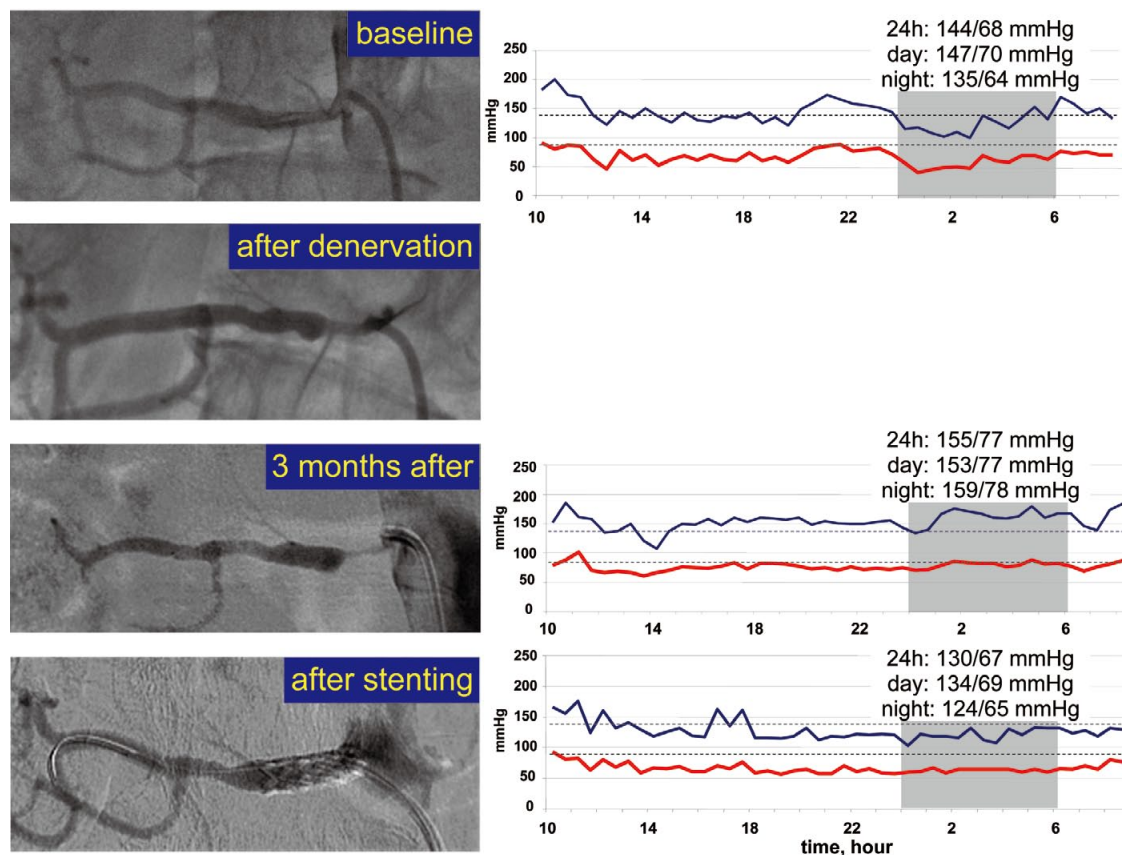


Figure. Selective angiography of the right main renal artery and 24-h systolic and diastolic blood pressure profile at (Top) baseline, (Upper middle) immediately after and (Lower middle) 3 months after renal sympathetic denervation, and (Bottom) after stenting.

A 73-year-old woman was referred to hospital for long-lasting uncontrolled hypertension despite treatment with 5 drugs, including full-dose angiotensin-II receptor blocker, thiazide diuretic, central α_2 -adrenergic agonist,

calcium channel blocker, and β -blocker. Office blood pressure (BP) was 196/98 mmHg, and uncontrolled hypertension was confirmed on 24-h ambulatory BP monitoring (average 24-h BP, 144/68 mmHg; **Figure, Top panel**). Secondary hyperten-

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sion was excluded on appropriate tests. Renal angiography showed a non-hemodynamically significant (40%) stenosis of the right renal artery at the origin. Renal sympathetic denervation (RSD) was performed with a Symplicity Catheter System (Medtronic Ardian, Palo Alto, CA, USA). The procedure included 6 radiofrequency (RF) ablations on each side in a spiral pattern at a minimum distance of 5 mm, as indicated by the manufacturer, the most proximal being approximately 3 mm distal to the stenosis. The procedure was carried out without complications, and angiography immediately after the procedure showed a further minor reduction in the lumen size (**Figure, Upper-middle panel**). After 3 months, office BP was still uncontrolled (198/94 mmHg) despite continued BP-lowering drug treatment, and 24-h BP was markedly increased (155/77 mmHg), with a loss of nocturnal BP fall. Repeated renal angiography showed progression of stenosis in the right renal artery, with a 90% lumen narrowing (**Figure, Lower-middle panel**), which was successfully stented. One month after the procedure, 24-h ambulatory BP was normalized (130/67 mmHg; **Figure, Bottom panel**), as well as office BP (140/78 mmHg).

The aim of catheter-based RSD is to induce thermal injury of the afferent and efferent renal sympathetic nerve fibers located in the external layers of the renal arteries, which are more sensitive to heat than the surrounding tissue, and are thought to play a role in the development and maintenance of hypertension.^{1,2} Information on long-term safety of the procedure is still limited. Two cases of renal artery stenosis following RSD with RF raised some concerns about its possible causal role.^{3,4} Two cases of progression of a pre-existing renal artery stenosis were described in the Symplicity HTN-1 and Symplicity HTN-2 studies.^{5,6}

In the present case, the short time interval (3 months) and the comparison of the pre- and post-procedural angiographic findings supports a causal role for RF ablation in renal artery stenosis progression. We also document for the first time a sustained increase in 24-h BP after post-procedural progression of renal artery stenosis. Although data on renal artery histological changes after RSD are not available in humans, medial and adventitial fibrosis have been observed 6 months after RSD in pigs.⁷ Optical coherence tomography, however, recently provided evidence that diffuse renal artery constriction and local tissue damage at the ablation site with edema and thrombus formation often occur after RSD, although such lesions may not be apparent on angiography.⁸ The presence of calcified and fibrotic tissue in the plaque may theoretically

interfere with the RF-based wave transmission along tissues. This may require a higher power to obtain therapeutic effects in the periadventitial nerves, thus exposing inner layers of the renal artery to a greater risk of thermal injury.

Contraindications to RF-based RSD include severe renal artery stenosis.^{1,6} The present case suggests that the potential risk of stenosis progression should be carefully weighed when considering RSD in subjects with even mild forms of renal artery stenosis, who might represent up to one-third of the patients with resistant hypertension. Other approaches aimed at reducing the risk of local complications due to tissue injury, such as use of smaller tipped catheters, energy titration and saline irrigation, should also be evaluated. The hypothesis that RF application may worsen the progression of pre-existing renal artery atherosclerotic lesions deserves to be evaluated in future research.

Disclosures

None.

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