Renal Sympathetic-Nerve Ablation for Uncontrolled Hypertension in a Patient With Single-Kidney Autosomal Dominant Polycystic Kidney Disease

To the Editor:

Hypertension is common in patients with autosomal dominant polycystic kidney disease (ADPKD). The prevalence is 50% to 62% when renal function is still normal and increases to almost 100% in patients with chronic renal failure.[1] Moreover, although the use of multidrug therapy in ADPKD is successful, achievement of blood pressure (BP) levels <130/80 mm Hg occurs in <30% of patients.

The pathogenesis of hypertension in ADPKD is complex and depends on many interrelated factors. As renal cysts enlarge, they compress the renal vasculature causing intra-renal ischemia, attenuation of the renal vasculature, sympathetic stimulation, and intra-renal activation of the renin-angiotensin-aldosterone system. Klein and colleagues[2] showed that hypertensive patients with ADPKD have increased sympathetic activity regardless of renal function. The finding of significantly higher levels of adrenaline and noradrenaline in hypertensive patients with ADPKD, regardless of their renal function, when compared with hypertensive patients without ADPKD, is consistent with these observations. Recent clinical studies demonstrated that renal denervation is effective and safe in reducing BP in patients with chronic kidney disease (CKD) and treatment-resistant hypertension[3]; however, no data are reported in the literature in patients with ADPKD or single-kidney ADPKD. The only data available at present are those of ADPKD patients with a history of chronic flank pain treated with renal sympathetic denervation to obtain relief of pain, in which the procedure has been associated with a delayed decrease in BP and an improvement in renal function.[4] Moreover, in a rat model of ADPKD, bilateral kidney denervation resulted in normalization of BP and in slowing of renal disease progression. On the basis of these observations, we performed renal denervation by radiofrequency ablation of the single renal artery in a patient with single-kidney ADPKD with resistant hypertension and CKD. Our patient, a 50-year-old woman with stage 4 CKD secondary to ADPKD, showed a 24-hour ambulatory BP (ABPM) of 190/110 mm Hg despite the use of 7 different antihypertensive drugs from different classes. The finding of hypokalemia and metabolic alkalosis, unusual in a patient with stage 4 CKD, suggested a diagnosis of hyperaldosteronism, which was then investigated. Although the laboratory tests performed were not consistent with renal artery stenosis, renal scintigraphy with assessment of individual renal function showed good perfusion of the right kidney with preserved function of 93%, and poor perfusion and excretion of the left kidney with a relative function of 7%. Magnetic resonance angiography showed a stenosis on the proximal two thirds of the left renal artery. Finally, renal arteriography, performed to confirm the diagnosis of left renal artery stenosis and in order to perform renal angioplasty, showed a hypoplasic left renal artery. Because of the constantly elevated BP values, the impossibility of performing angioplasty for the anatomical anomaly of the left renal artery, the reduction of left kidney functional capacity to less than 10% of total function, and the absence of evidence for significantly accelerated progression of renal failure when uninephrectomized patients were compared with matched nonuninephrectomized ADPKD patients, removal of the left kidney was performed, without complications or worsening of renal function. However, 3 months after the nephrectomy, the patient showed a progressive worsening of hypertension (BP >180/100 mm Hg). Because of the ineffectiveness of all pharmacologic and surgical therapeutic strategies, renal denervation by radiofrequency ablation of the right renal artery was finally performed. Under local anesthesia, via right femoral artery access, preliminary selective right renal artery angiography showed no significant atherosclerotic lesions and a lumen diameter >4 mm under fluoroscopy, a specially designed catheter connected to a radiofrequency generator in the distal segment of the renal artery. Radiofrequency energy (8 W) was delivered according to a prespecified protocol, and was then reapplied 6 times (120 seconds each) after rotating circumferentially and drawing back the catheter within the artery, in order to provide circumferential disruption of sympathetic nerves allocated in the adventitial layer of the vessel. After ablation, nonionic contrast injections showed no signs of renal artery abnormalities (vasospasm, stenosis, or dissection). The patient showed a decrease in the requirement of antihypertensive medication and, despite the use of only 2 antihypertensive drugs, the 24-hour ABPM showed a remarkable reduction to 140/80 mm Hg after 3 months, which was further reduced to 135/70 mm Hg after 6 months. We did not observe any uncontrollable adverse events during the procedure or during the short-term follow-up of 12 months. In particular, our patient did not experience a significant deterioration of renal function despite nephrectomy and renal denervation. This was in accordance with findings in a rat model of ADPKD, in which bilateral kidney denervation resulted in normalization of BP and in slowing of renal disease progression both structurally and functionally, likely through the modulation of renal renin release and angiotensin II activity. Possible explanations for the limited deterioration of the renal function in denervated rats may result from the lower BP and from an improvement in renal flow. Moreover, another possible mechanism could be that the reduction of sympathetic

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activity ameliorates the cyst enlargement because the angiotensin II is a known renal epithelial cell mitogen.

CONCLUSIONS

We conclude that renal denervation seems to be a safe and effective procedure for BP control in patients with treatment-resistant hypertensive single-kidney ADPKD secondary to CKD; however, larger prospective studies are underway examining the safety and benefits in a larger cohort of ADPKD patients.

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References

1. Gabow PA, Ikle DW, Holmes JH. Polycystic kidney disease: prospective analysis of nonazotemic patients and family members. *Ann Intern Med*. 1984;101:238–247.
2. Klein IHHT, Ligtenberg G, Oey PL, et al. Sympathetic activity is increased in polycystic kidney disease and is associated with hypertension. *J Am Soc Nephrol*. 2001;12:2427–2433.
3. Hering D, Mahfoud F, Walton AS, et al. Renal denervation in moderate to severe CKD. *J Am Soc Nephrol*. 2012;23:1250–1257.
4. Walsh N, Sarria JE. Management of chronic pain in a patient with autosomal dominant polycystic kidney disease by sequential celiac plexus blockade, radiofrequency ablation, and spinal cord stimulation. *Am J Kidney Dis*. 2012;59:858–861.