

Renovascular Hypertension: Lessons Learned from Three Clinical Cases

Hipertensión renovascular: lecciones aprendidas a partir de tres casos clínicos

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Hypertension (HTN) is the leading risk factor for cardiovascular disease and death worldwide. (1) The prevalence of secondary HTN is 10–35%, reaching up to 50% in patients with resistant HTN. Renovascular hypertension (RVH) is defined as occlusion or stenosis of the renal arteries that reduces renal perfusion pressure, leading to renal dysfunction and eventual atrophy. This process activates the renin-angiotensin-aldosterone system (RAAS) and the sympathetic nervous system, resulting in elevated blood pressure. (2) Atherosclerotic renovascular disease is estimated to be present in 14% to 40% of adults with hypertension; however, only 0.1% to 5% of cases are considered hemodynamically significant to result in RVH. (1) The prevalence of RVH is notably higher in patients with severe or resistant HTN.

Renal artery stenosis is the most common cause of renovascular disease. Other causes of secondary HTN include fibromuscular dysplasia, renal artery arteritis, renal artery dissection, extrinsic compression, and extrarenal embolism.

We present three medical records of patients with secondary HTN due to renovascular disease.

CLINICAL CASE 1

A 64-year-old female patient with a medical history of obesity, heavy smoking, and ischemic heart disease was diagnosed with HTN 10 years ago, with typical blood pressure (BP) readings of 170/70 mmHg. The patient is currently being treated with six medications at the maximum tolerated doses and has good adherence to treatment. Transthoracic echocardiography (TTE): left ventricular (LV) mass 106 g/m², left ventricular ejection fraction (LVEF) 46%. Ambulatory blood pressure monitoring (ABPM): sustained daytime and nighttime systolic HTN, non-dipper pattern. Renal artery Doppler ultrasound: renal asymmetry due to left kidney atrophy, lobulated contours, and decreased parenchymal thickness. Peak systolic velocity up to 47 cm/s. Computed tomography angiography

(CTA) of the aorta: atheromatous plaque at the origin of the left renal artery. Patent right renal artery with atheromatous plaque at the origin. Stenosis of the left common iliac artery with a diameter of 4 mm and stenosis of the ipsilateral external iliac artery. Atrophic left kidney. A stent was placed in the left iliac artery, resulting in effective control of BP and kidney function. The patient is currently being treated with losartan, bisoprolol, hydrochlorothiazide, and amlodipine.

CLINICAL CASE 2

A 78-year-old female patient with a history of tobacco use and HTN diagnosed at the age of 40, with typical blood pressure readings of 150/80 mmHg, currently being treated with four medications at the maximum tolerated doses. TTE: moderate aortic stenosis. LV mass 141 g/m². LVEF 60%. Ambulatory blood pressure monitoring (ABPM): daytime and nighttime systolic and diastolic HTN. Renal artery Doppler ultrasound: indirect signs of proximal stenosis of both renal arteries. CTA of the abdomen: ostial occlusion of the left renal artery. Atrophic left kidney. Unsuccessful angioplasty and endovascular revascularization, with post-operative stroke and death.

CLINICAL CASE 3

A 43-year-old female patient with a history of HTN diagnosed at age 40 is currently being treated with two medications at the maximum tolerated doses. Maximum systolic BP readings of 210 mmHg. TTE: LV mass 148 g/m². LVEF 60%. ABPM: nighttime HTN, increased BP upon waking. Renal artery Doppler ultrasound: increased velocities of up to 320 cm/s in the proximal third of the right renal artery. CTA of the abdomen: stenosis of the right renal artery measuring 7 mm in length, immediately distal to the origin, with a minimum diameter of 3.8 mm and a 6 mm post-stenotic dilation. The patient is currently under clinical follow-up and evaluation by vascular surgeons.

Renal artery stenosis accounts for approximately

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90% of cases of renovascular disease, with fibromuscular dysplasia accounting for about 9%. (2)

Renovascular hypertension is rare in the general population with HTN (<1%), although its prevalence increases significantly in patients with severe HTN and manifestations of atherosclerosis, reaching up to 35%. (2) It should be particularly suspected in patients > 50 years with cardiovascular risk factors or established vascular disease.

The American Heart Association (AHA) recommends screening for renovascular disease in patients with resistant HTN, HTN of abrupt onset or worsening or increasingly difficult to control, as well as early-onset HTN. (3) It also suggests considering assessment of renal artery stenosis in situations such as onset of severe HTN in adults > 55 years, worsening kidney function after initiating renin-angiotensin system inhibitors or antagonists, severe HTN in the context of diffuse atherosclerosis, significant kidney asymmetry or unexplained atrophic kidney, episodes of decompensated heart failure with kidney dysfunction, and presence of a murmur in the lateral abdominal wall. (1)

Moderate stenosis may be asymptomatic, and its progression is often associated with the development of HTN and target organ damage. The three cases presented corresponded to secondary HTN due to atherosclerotic renovascular disease.

In cases of clinical suspicion, the diagnosis must be confirmed by imaging tests. (4) Renal angiography is the gold standard, as it allows quantification of the gradient across the stenosis. In symptomatic patients, a gradient > 20 mmHg or a distal/proximal ratio < 0.9 suggests significant stenosis. However, Doppler ultrasound of the renal arteries is usually the initial test due to its availability and low cost, with sensitivity and specificity of 85% and 92%, respectively. (3) A luminal diameter reduction $\geq$ 60% combined with a peak systolic velocity exceeding 200–300 cm/s strongly indicates hemodynamically significant stenosis. (3) The limitations of this method include operator dependence and technical difficulties.

The usefulness of captopril renal scan and plasma renin activity measurement is limited due to their lower sensitivity and specificity compared with other methods. Therefore, they are not recommended as screening tests. Computed tomography angiography has high sensitivity and specificity (90–100%) for assessing vascular anatomy, although it does not provide direct hemodynamic information. Magnetic resonance imaging with gadolinium-based contrast agent also enables an adequate diagnosis, although stenosis severity may be overestimated.

Endovascular revascularization, which was introduced in 1978, has become the primary interventional method. (5) However, multiple clinical trials comparing revascularization and optimal medical therapy did not demonstrate a significant benefit in patients with atherosclerotic stenosis for controlling blood pressure, kidney function, or the development of cardiovascu-

lar events. Nevertheless, certain subgroups—such as those with uncontrolled HTN, progressive kidney dysfunction, or acute pulmonary edema—may derive greater benefit.

Among the most relevant trials, the DRASTIC, ASTRAL, and STAR studies showed no differences in blood pressure control between balloon angioplasty and medical therapy. The CORAL trial concluded that stenting did not significantly reduce major cardiovascular events compared with medical therapy. More recently, a retrospective study conducted in 2022 evaluated stent placement in patients with resistant HTN, kidney injury, or acute cardiorenal syndrome. The intervention produced favorable results even for patients who had been excluded from previous studies, suggesting that appropriate patient selection is a key aspect.

Regarding the previously presented cases, clinical case 1 achieved an adequate clinical and blood pressure response following stent placement, with improved kidney function. In clinical case 2, the intervention was unsuccessful, and the patient developed a fatal postoperative cerebrovascular complication. Conversely, in clinical case 3, the decision was to optimize medical treatment with adequate BP control. These scenarios reflect the heterogeneous disease progression and the need to individualize therapeutic decisions.

In asymptomatic patients or in those with adequate BP control with medical therapy, invasive revascularization is not recommended; instead, strict control of cardiovascular risk factors should be prioritized. (3) Stenting is generally reserved for stenoses > 70%, with a clear clinical correlation and presence of resistant HTN. (3, 5)

While retrospective studies suggest that revascularization may reduce the medication burden in patients with resistant HTN, controlled clinical trials show differences compared to medical therapy alone. The intervention has been reported to reach success rates of 90%, although restenosis may occur in up to 15% of cases. (6) Therefore, the indication should be based on an individualized risk-benefit assessment and a multidisciplinary approach.

Renovascular hypertension represents a significant cause of secondary HTN, particularly in patients with resistant HTN and atherosclerotic disease. This case series illustrates the variability in clinical presentation, course, and response to treatment, underscoring the importance of appropriate workup and tailored therapeutic strategies. While revascularization may be beneficial in selected patients, optimal medical treatment remains the cornerstone of management, with interventional procedures reserved for situations with a clear clinical indication and potential benefit.

Conflicts of interest

None declared.

(See conflicts of interest forms on the website).

Ethical considerations

Not applicable.

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