Renal artery stenosis in a young female patient with severe hypertension - a case report

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ABSTRACT

Renal artery stenosis is a frequent cause of secondary hypertension, but the diagnostic and therapeutic management of these hypertensive patients is controversial. We report a case of secondary hypertension due to renal artery stenosis, treated with the implantation of a drug-eluting stent.

Introduction

About 5-15% of patients with hypertension have a secondary cause, which may be treatable with a specific intervention.[1]

Renal artery stenosis (RAS) is one of the most important causes of secondary hypertension, and affects 1 to 5% of all hypertensive patients.[2] Atherosclerosis and fibromuscular dysplasia are the most common etiologies; less frequent causes of RAS are Takayasu arteritis, renal artery entrapment by the diaphragmatic crus, type 1 neurofibromatosis, vascular Ehlers-Danlos syndrome and other congenital diseases;[3] strategies of treatment include medical therapy, percutaneous interventions with balloon angioplasty or stent implantation and surgery, but the identification of the best approach remains controversial.

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Case Report

A 27-year-old woman was referred to our outpatient clinic to perform a screening for secondary hypertension, after incidental detection of elevated blood pressure during hospitalization for cholecystectomy.

On admission, blood pressure was 160/110 mmHg, without relevant information from clinical history (absence of: sweating, pounding headache, palpitations or flushing; variation of body weight; smoking status or use of medications and illicit drugs; family history of secondary hypertension) and electrocardiogram. Physical examination did not provide important findings: her weight was normal, and she did not show any abdominal bruit; her blood pressure did not differ between upper-lower extremities or between right-left arm. She underwent 24 h ambulatory blood pressure monitoring (ABPM), which showed mean awake values of 147/111 mmHg, a peak pressure of 176/133 mmHg late in the evening and dipping pattern, with mean asleep values of 131/91 mmHg (Figure 1, panel A).

She underwent standard Doppler echocardiography,[4] which showed no evidence of cardiac target organ damage.

A full screening for secondary causes of elevated blood pressure was scheduled, including laboratory tests (complete blood count, potassium, sodium, creatinine, fasting glucose, fasting lipid profile, urinalysis, thyroid-stimulating hormone, renin and aldosterone plasma levels, 24 h urinary free cortisol, erythrocyte sedimentation rate, and C-reactive protein), carotid and peripheral vascular ultrasonography, renal ultrasound for evaluation of renal arterial blood flow. Antihypertensive treatment with amlodipine and then doxazosin was given. Elevated levels of plasma renin and aldosterone were found (normal aldosterone-to-renin ratio) with normal renal function and electrolytes (Table 1). Carotid and peripheral vascular

ultrasound did not show any alteration. Renal ultrasound and doppler ultrasound of renal arteries showed reduced size of right kidney, with normal parenchymal morphology; normal size and structure of left kidney; no evidence of hydronephrosis or calculus. Left renal artery showed normal peak systolic velocity and normal flow of intrarenal vasculature. Right renal artery was not well visualized at the origin, but demonstrated a tardus-parvus pattern waveform at the interlobar arteries. On suspicion of renal artery stenosis due to fibromuscular dysplasia, a magnetic resonance angiogram was done and revealed right renal artery stenosis, confirmed by subsequent invasive angiography, right before the bifurcation with a polar superior branch, with mild post stenotic dilatations (Figure 2, panel A).

We made the decision to implant a drug-eluting stent due to close anatomical proximity of the diaphragmatic pillar, with optimal resolution of the stenosis (Figure 2, panel B). Dual antiplatelet therapy

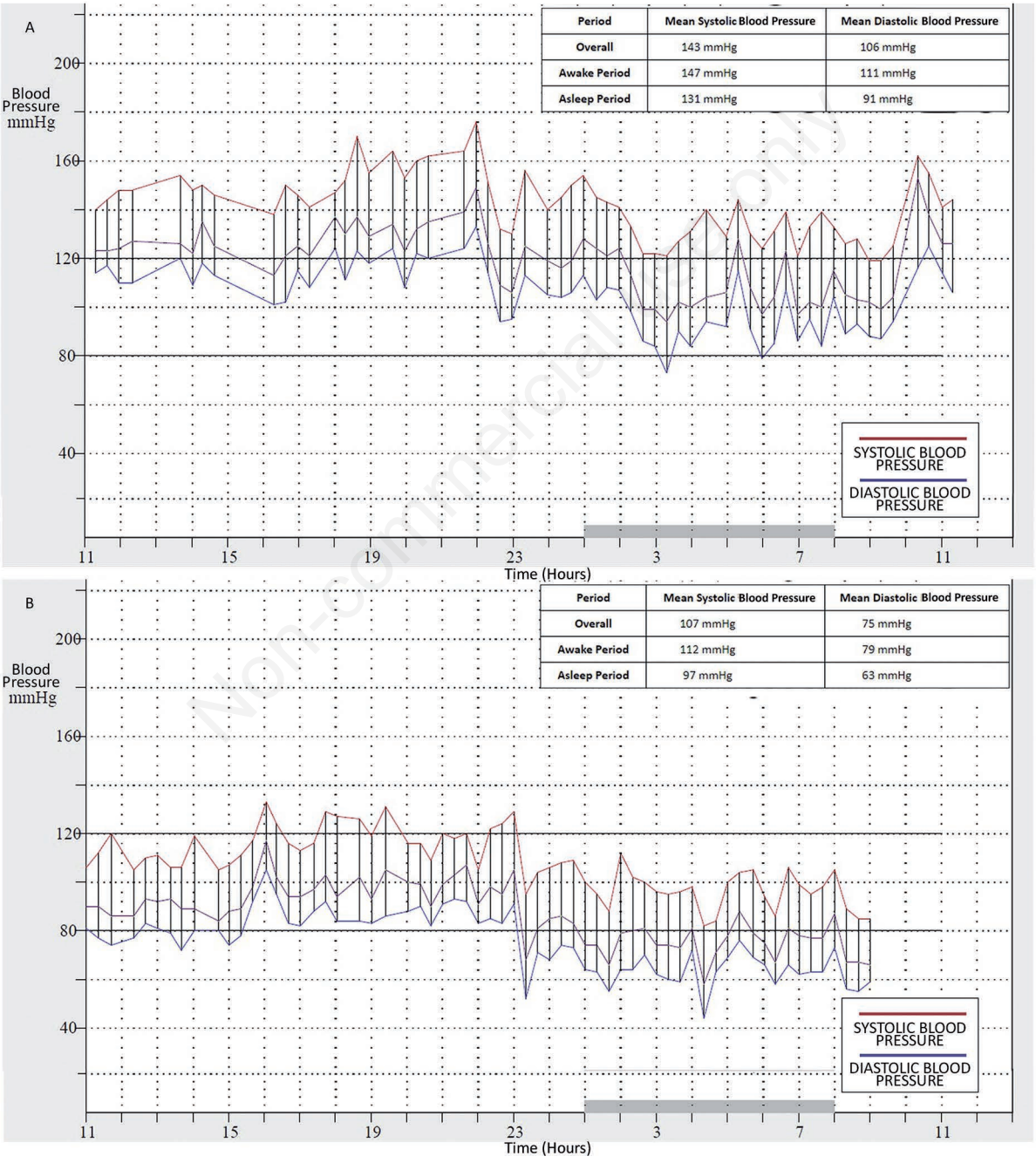

Figure 1. Ambulatory blood pressure monitoring result A) before and B) after stenting.

was started. The first day after stenting, the patient's blood pressure was 110/70 mmHg without medical therapy, her renal function was unchanged, her renin plasma concentration and Doppler intrarenal blood flow were normalized (Table 1). After 40 days of follow-up, the patient was asymptomatic, referred normal blood pressure at home monitoring without any antihypertensive drug; her renal function and renin/aldosterone plasmatic levels persisted in normal range. We performed ABPM that showed excellent blood pressure control during 24 h (Figure 1, panel B). During the last follow-up, after 10 months, the patient exhibited a home blood pressure monitoring of 120/75 mmHg, normal renal function and serum electrolytes. We performed a renal ultrasound with evidence of a normal pattern at Doppler evaluation of right intrarenal vasculature, and an ABPM that confirmed the optimal blood pressure control with mean awake values of 113/80 mmHg, mean asleep values of 96/63 mmHg and overall values of 107/74 mmHg (Figure 3). Dual antiplatelet therapy was stopped after 12 months, without any adverse event.

Discussion

Secondary hypertension, defined as hypertension due to an identifiable cause, is commonly related to conditions as renovascular disease, obstructive sleep apnea, endocrine causes (primary aldosteronism, pheochromocytoma, Cushing's syndrome, thyroid disease), coarctation of the aorta, genetic causes, medications or illicit drugs and affects about 5-15% of all subjects with hypertension.

Screening all hypertensive patients is not feasible; however, in the presence of suggestive characteristics (age <40 years, resistant or severe hypertension, acute worsening of hypertension in a patient with previously stable control, hypertension emergency, extensive hypertension-mediated organ damage, clinical features suggestive of obstructive sleep apnea, family history of pheochromocytoma) screening should be considered after confirming that blood pressure is elevated with ABPM.[1]

Through screening we excluded primary aldosteronism because of normal aldosterone-to-renin ratio sup-

Table 1. Laboratory tests.

	Pre-stenting	Post-stenting	Follow-up (40 days)	Reference range
Supine plasma renin (pg/mL)	450	23.4	15.8	2.52-35.82
Upright plasma renin (pg/mL)	582	45.8	28.1	3.1-59.5
Supine plasma aldosterone (pg/mL)	808	<37	69	40-310
Upright plasma aldosterone (pg/mL)	758	187	125	40-432
Serum creatinine (mg/dL)	0.7	0.7	1	0.6-1.1
Serum sodium (mmol/L)	139	139	138	136-145
Serum potassium (mmol/L)	3.8	4.1	3.9	3.5-5.1

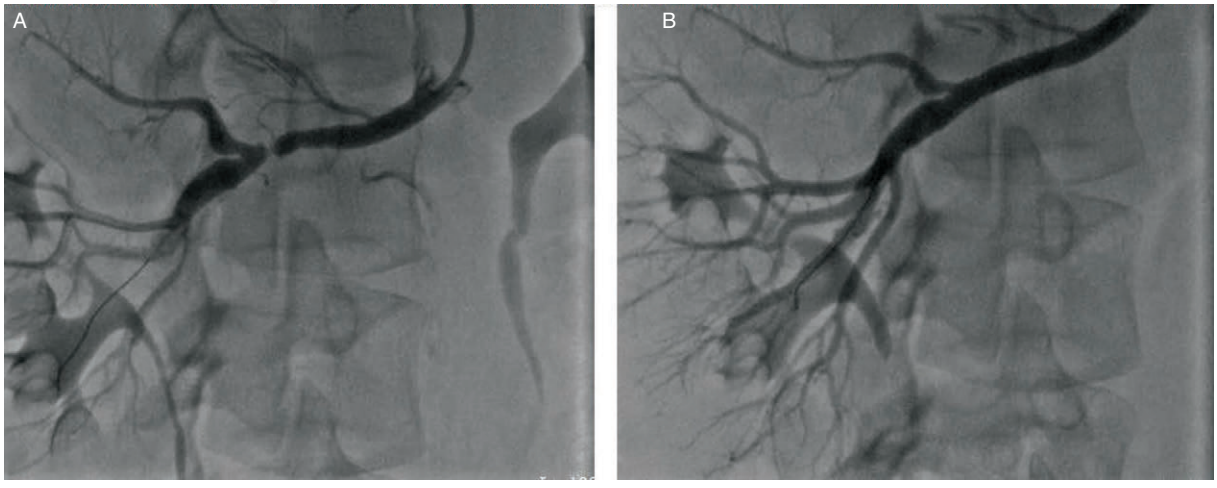

Figure 2. Renal arteriogram A) before and B) after stenting.

ported by normokalemia, although only a minority of patients (about 30%) have hypokalemia.[5] Other endocrine causes of secondary hypertension have been excluded given the normal function test, while coarctation of the aorta have been excluded using echocardiography. Further investigations revealed right renal artery stenosis, and the absence of atherosclerotic plaque or vascular thickening, diabetes or dyslipidemia, the normality of measures of systemic inflammation, the lack of familial or syndromic disease, and the young age established as most likely diagnosis renal artery stenosis from unifocal fibromuscular dysplasia.[3]

RAS is a frequent cause of secondary hypertension, and affects 1 to 5% of all hypertensive patients. Regardless of etiology the management of patients with RAS is not well defined and a real challenge for clinicians is to identify patients with renovascular disease who can potentially benefit from revascularization.

ABPM is a better predictor of cardiovascular mortality than clinic measurement[6] and is useful to assess the severity of hypertension and the response to treatment.[7]

Data in the current literature concerning the role of ABPM before and after RAS revascularization are not frequent, but the available evidence demonstrates that a finding of high blood pressure values at ABPM is a strong predictor of satisfactory response to invasive treatment.[8] According to these data, we considered severe hypertension demonstrated by ABPM an important factor for the choice of revascularization. In addition, ABPM was helpful for the demonstration of stenting efficacy during follow-up and, similarly, it could be useful for prompt detection of restenosis at long-term evaluation.

One of the least clear aspects of RAS management is, in fact, the identification of patients who are likely to benefit from percutaneous intervention: the detection of a hemodynamically significant stenosis predicts improvement in hypertension after revascularization.[9] In addition to ABPM, another important clinical element of decision was the coexistence of normal glomerular filtration rate (GFR) with high circulating plasma renin (CPR) that strongly suggests that the compensatory mechanism implemented by kidney in response to RAS to keep GFR normal was fully operating in our patient and was also confirmed by the persistent normalization of GFR together with the abrupt fall of CPR after stenting, a proof of the efficacy of revascularization.

Doppler ultrasonography, in addition to being helpful for diagnosis of RAS, could be a further tool to screen patients for revascularization; a low intrarenal arterial resistance is predictive of good response to invasive treatment, since it is suggestive of a kidney without structural alterations in intraparenchymal vascularization induced by long-standing hypertension.[10-12] The parvus-tardus waveform that we found upon Doppler ultrasound denotes low intrarenal arterial resistance, a parameter that normalizes immediately after stenting.

In order to make the decision of revascularization, we considered the following: recent onset hypertension, young age, severe and uncontrolled hyperten-

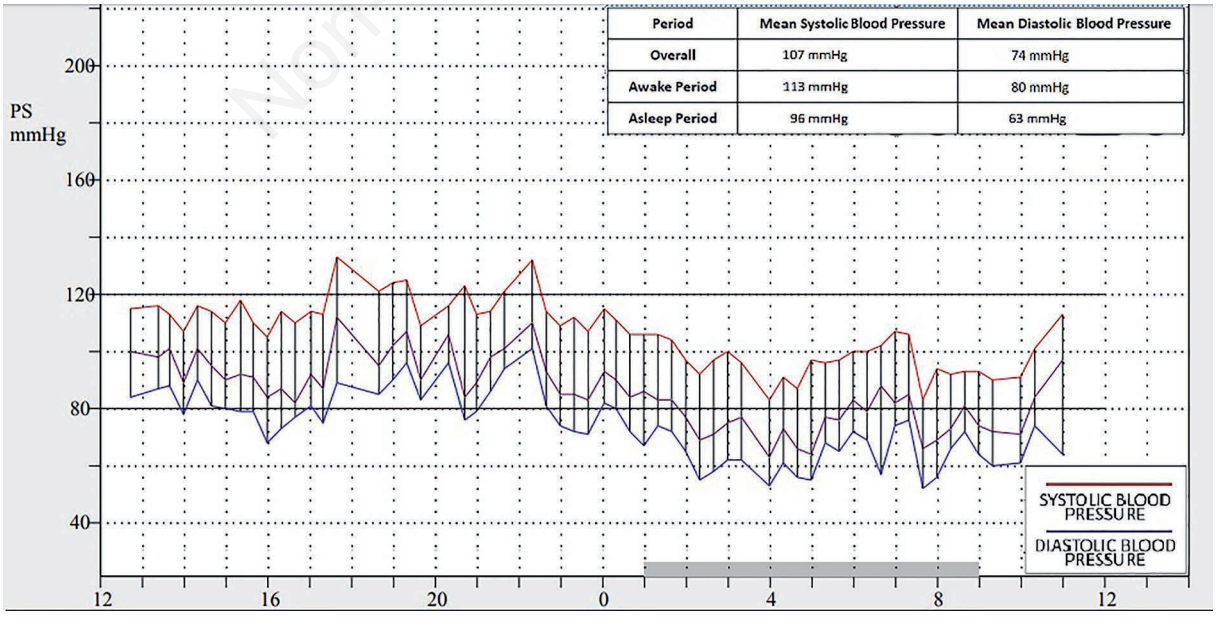

Figure 3. Ambulatory blood pressure monitoring result after 10 months of follow-up.

sion, significant stenosis, compensatory increased activities of renin-angiotensin system.

Renal angioplasty with stent placement is a common option of treatment for renovascular hypertension, particularly in case of atherosclerotic stenosis, with low periprocedural complications and good results on blood pressure control and renal function, especially among patients with normal GFR.[13]

The utilization of coronary drug-eluting stent (DES) for renal artery is growing, because of the increasing and encouraging, albeit preliminary, data.[14] DES might be useful in patients with small renal arteries (associated with higher risk of restenosis), and in case of in-stent restenosis, as successfully described in a case of recurrent stenosis of a bare metal stent.[15,16]

Conclusions

In conclusion, the diagnostic and therapeutic management of patients with renal artery stenosis is challenging. Integration of information from ABPM, intrarenal doppler evaluation, plasma renin levels and GFR is of crucial importance to characterize patients and identify the best treatment option.

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