CASE REPORT

Successfully treated bilateral renal artery stenosis in a patient with coronary artery disease

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SUMMARY

Renal artery stenosis (RAS) is the most common cause of secondary hypertension and accounts for approximately 1–3% of all causes of hypertension. Over 90% of RASs are caused by atherosclerosis; atherosclerotic RAS is increasingly common in aging populations, particularly elderly people with diabetes, hyperlipidaemia, aortoiliac occlusive disease, coronary artery disease or hypertension. Three therapeutic options are currently available for patients with renovascular hypertension: medical antihypertensive therapy, surgical revascularisation and transluminal angioplasty including stent implantation. We present in this report a male patient with bilateral severe ostial stenosis and coronary artery disease, and who was successfully treated with renal stent implantation in one session.

BACKGROUND

Renal artery stenosis (RAS) is the most common cause of secondary hypertension and accounts for approximately 1–3% of all causes of hypertension. Over 90% of RASs are caused by atherosclerosis, the remainder are caused by fibromuscular dysplasia. Atherosclerotic RAS is increasingly common in aging populations, particularly elderly people with diabetes, hyperlipidaemia, aortoiliac occlusive disease, coronary artery disease or hypertension.¹

Three therapeutic options are currently available for patients with renovascular hypertension: medical antihypertensive therapy, surgical revascularisation and transluminal angioplasty including stent implantation.²

We present a male patient with bilateral severe ostial stenosis and coronary artery disease, and successfully treated with renal stent implantation in one session.

CASE PRESENTATION

Case

A 55-year-old man was referred for coronary angiography because of chest pain, breathlessness and headache. This patient had uncontrolled systemic arterial hypertension for 15 years and had been treated with β -blockers, diuretic and angiotensin receptor-blocker and calcium channel blockers. Despite this therapy, on physical examination, his blood pressure was 185/120 mm Hg with no difference between the two arms. He had no history of diabetes, but he was a smoker.

Laboratory test results were blood urea nitrogen (BUN) 32 mg/dl, creatine 1.0 mg/dl, creatine clearance was calculated at 75 ml/min, potassium 5.4 mEq/l, sodium 133 mEq/l and chloride

99 mEq/l. His heart rate was 88 bpm. Chest radiographic results demonstrated an enlargement of the cardiac silhouette and enlarged hilar vessels. Transthoracic echocardiographic results revealed left ventricular hypertrophy, normal systolic (left ventricular ejection fraction 54%) and grade 1 diastolic function, regional wall motion abnormality (anterolateral hypokinesia) and mild mitral regurgitation.

Coronary angiography was performed and it documented 80% narrowing at the left circumflex coronary artery and proximal total occlusion of right coronary artery (figure 1). Since the patient had resistant hypertension, renal angiography was performed. His renal angiogram showed 60% stenosis of the left superior renal artery, 90% stenosis of the left inferior renal artery and 99% stenosis of the right renal artery (figures 2A and 4A).

First, a bolus of 7500 IU heparin was administered and soft-tipped renal guide catheters were used to engage the left inferior renal arterial ostium. The lesion was crossed with the coronary guidewire (diameter, 0.014"). A balloon-expandable renal stent (6.0×18 mm) was implanted at 12 atm without residual stenosis (figure 2, online supplementary video 1). After stent placement, there was a plaque shift with narrowing at the ostium of the left superior renal artery. The lesion was crossed with the second guidewire and balloon angioplasty was performed using 4.0×20 mm coronary balloon; residual stenosis was not determined (figure 3, online supplementary video 2). Later, same catheter was placed to right renal arterial ostium, and the lesion was crossed with the same guidewire. Predilation was performed using a balloon catheter (4.0×15 mm), but the balloon separated from balloon catheter and it was caught and retrieved with a snare (figure 4C arrows, D). After predilation, a balloon-expandable renal stent (7.0×18 mm) was implanted at 14 atm without residual stenosis (figure 4, online supplementary video 3). As a result, bilateral renal angioplasty and stent placement (6.0×18 mm and 7.0×18 mm stents) were achieved without a complication in a single session. After the procedure, the femoral access was manually closed with sutures at the catheterisation laboratory, and the patient was sent to the coronary care unit for close monitoring. On the first day after the procedure, bilateral renal Doppler ultrasound-guided was performed and Renal Resistive Index (RRI) was found <0.8 in both arteries.

Blood pressure of the patient dropped dramatically to a normal range after renal angioplasty and stent placement: around 110–120 mm Hg of systolic pressure and 70–80 mm Hg of diastolic

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Figure 1 Coronary angiography documented 80 % narrowing at left circumflex coronary artery and proximal total occlusion of right coronary artery.

pressure. The patient recovered uneventfully and was discharged on the third day after the procedure, on 100 mg of acetyl salicylic acid lifelong and 75 mg of clopidogrel for 3 months. At the end of the first week, the patient's blood pressure was within normal limits on the same antihypertensive regimen.

INVESTIGATIONS

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Renal angiogram showed 60% stenosis of the left superior renal artery, 90% stenosis of the left inferior renal artery and 99% stenosis of the right renal artery.

After the procedure, bilateral renal Doppler USG was performed and RRI was found to be <0.8 in both arteries.

TREATMENT

First, a bolus of 7500 IU heparin was administered and soft-tipped renal guide catheters were used to engage the left inferior renal arterial ostium. The lesion was crossed with the coronary guidewire (diameter, 0.014"). A balloon-expandable renal stent (6.0×18 mm) was implanted at 12 atm without residual stenosis (figure 2, online supplementary video 1). After stent placement, there was a plaque shift with narrowing at the ostium of the left superior renal artery. The lesion was crossed with the second guidewire and balloon angioplasty was performed using 4.0×20 mm coronary balloon; residual stenosis was not determined (figure 3, online supplementary video 2). Later, same catheter was placed to right renal arterial ostium, and the lesion was crossed with the same guidewire. Predilation was performed using a balloon catheter (4.0×15 mm), but the balloon was separated from balloon catheter and it was caught and retrieved

with a snare (figure 4C arrows, D). After predilation, a balloon-expandable renal stent (7.0×18 mm) was implanted at 14 atm without residual stenosis (figure 4, online supplementary video 3). As a result, bilateral renal angioplasty and stent placement (6.0×18 mm and 7.0×18 mm stents) was achieved without a complication in a single session.

OUTCOME AND FOLLOW-UP

After the procedure, the femoral access was manually closed with sutures at the catheterisation laboratory, and the patient was sent to the coronary care unit for close monitoring. On the first day after the procedure, bilateral renal Doppler USG was performed and RRI was found <0.8 in both arteries.

Blood pressure of the patient dropped dramatically to a normal range after renal angioplasty and stents placement, around 110–120 mm Hg of systolic pressure and 70–80 mm Hg of diastolic pressure. The patient recovered uneventfully and was discharged on the third day after the procedure, on 100 mg of acetyl salicylic acid lifelong and 75 mg of clopidogrel for 3 months. At the end of the first week, the patient's blood pressure was within normal limits on the same antihypertensive regimen.

DISCUSSION

Atherosclerotic RAS is a progressive disease that may occur alone or in combination with hypertension and ischaemic heart disease as in our case.¹ Although the prevalence of atherosclerotic renal artery stenosis is poorly defined, it may vary from 30% among patients with coronary artery disease identified by angiography to 50% among elderly people or those with diffuse atherosclerotic vascular diseases.^{2–4} Only around 5% of patients with RAS have normal hearts on echocardiography,

Figure 2 Soft-tipped renal guide catheters were used to engage the left inferior renal arterial ostium. A balloon expandable renal stent (6.0×18 mm) was implanted without residual stenosis.

Figure 3 After stent placement, there was a plaque shift with narrowing at the ostium of the left superior renal artery. Balloon angioplasty was performed and residual stenosis was not determined.

and a longitudinal study has shown that the cardiac abnormalities progress over time.⁵ Cardiorenal syndrome can be diagnosed in the following conditions: hypervolaemia in advanced renal failure, co-occurrence of heart and kidney failure (eg, ischaemic heart disease and obstructive arterial disease), malignant hypertension leading to the development of simultaneous heart and kidney failure and bilateral RAS or unilateral RAS.⁶

Treatment of renovascular hypertension includes medical management with antihypertensive agents, interventional approaches such as balloon angioplasty and, more recently, stent placement has provided us with new treatment modality which is now widely applied to the adult patients with RAS.⁷ Revascularisation by surgical reconstruction is generally done only in patients with complicated renal artery anatomy or in those who require pararenal aortic reconstructions for aortic aneurysms or severe aortoiliac occlusive disease.⁸

Percutaneous revascularisation techniques are alternatives that are less invasive than surgery. Stent revascularisation, with its gratifying success rates, acceptable procedural risks, beneficial impact on blood pressure control (reduction in the number of antihypertensive drugs) and renal function.⁹ Surgical results after revascularisation for RAS show patency rates of about 93%. Several reports have shown especially that the introduction of stent angioplasty improved the technical success rates in interventional treatment for RAS from 83% to 98% or even 100%. Renal artery stenting has replaced surgery as the standard treatment of renal artery stenosis.¹⁰

Despite the procedural success of the interventional treatment of atherosclerotic renal artery stenosis, it is recognised that this is a local complication of a systemic disease. Thus, patients should receive secondary prevention measures including statins, platelet inhibitors and antihypertensive therapy.¹¹ In

our case, we inhibited platelet function after renal artery stent implantation with aspirin (100 mg/day) and clopidogrel (75 mg/day for 3 months) and we used same antihypertensive regimen.

In addition, a single retrospective study had suggested that the Doppler measurement of the RRI <0.8 might be highly predictive of the success of revascularisation in patients with RAS.¹² In our case, Doppler measurement was performed after the procedure and RRI was 0.7 on left renal arteries and 0.75 on right renal artery.

Chronic bilateral renal artery occlusion is rare, and the overall success of revascularisation therapy depends on the functionality of collateral circulation to maintain renal viability.¹³ Conlon performed abdominal aortography on 3987 patients immediately following cardiac catheterisation and found $>75\%$ atherosclerotic RAS in 4.8% with bilateral RAS in 0.8%.¹⁴ Bilateral, severe renal artery stenosis stimulates the renin-angiotensin aldosterone system and, as it reduces the physiological natriuretic response, it may lead to fluid overload, renovascular hypertension, heart failure and impaired renal function. In addition, bilateral disease was associated with the 4-year survival of 47% as compared with 59% for patients with unilateral disease.¹⁵

The imaging of the renal arteries during coronary angiography in all patients with hypertension as a screening measure is not recommended. However, it seems reasonable to have a low threshold for offering renal angiography as part of a coronary procedure to patients with a high pretest probability of having renal artery stenosis on clinical grounds and/or from the results of non-invasive testing. It may be efficient to perform renal arteriography as part of the coronary procedure with little additional risk provided the total amount of radio contrast is limited.¹⁶

Figure 4 The same catheter was placed to right renal arterial ostium, and predilation was performed using, but balloon separated from balloon catheter and it was caught and retrieved with a snare (C arrows and D). After predilation, a balloon-expandable renal stent was implanted.

Learning point

- Treatment with bilateral percutaneous transluminal angioplasty and stenting resulted in remission of hypertension. These excellent results make primary renal artery stenting an attractive treatment option and explain why renal artery angioplasty with stenting has largely replaced surgical revascularisation as the treatment of choice for atherosclerotic renal artery stenosis.¹⁷
- An association between heart and renal failure and bilateral renal artery stenosis needs to be promptly established.
- Appropriate early treatment prevents end-stage renal disease development and reduces the risk of death associated with pulmonary oedema. It also, in some cases, allows to reverse fully cardio-renal syndrome manifestations.¹⁵

Competing interests None.

Patient consent Obtained.

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