Treatment of Renovascular Hypertension Using Stent Implantation in an Elderly Patient with NIDDM

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Abstract

A 70-year-old man with NIDDM was diagnosed as having renovascular hypertension (RVH), based on a stenosis of the ostial portion of the left renal artery with markedly elevated plasma renin activity (PRA) in both the left renal vein and the peripheral blood, and positive captopril tests. After percutaneous transluminal renal angioplasty (PTRA), his blood pressure (BP) and PRA normalized. However, since restenosis occurred three months later, stent therapy was applied, and consequently BP and PRA normalized immediately after this procedure. During the one-year follow-up, side effects have not been noted. We propose that stent therapy may be feasible for ostial renal artery stenosis in elderly diabetic patients.

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Key words: PTRA, Atherosclerosis

Introduction

Renovascular hypertension (RVH) is one of the etiologies of secondary hypertension, and is found in about 1% of the entire hypertensive population (1–3). In such cases, a surgical procedure has generally been performed. In 1978, Grüntzig et al (4) first introduced percutaneous transluminal renal angioplasty (PTRA) for RVH due to renal arterial stenosis. This technique has been used widely because of its effectiveness, safety and low cost as compared with surgical revascularizations (5, 6). However, it was recently pointed out that PTRA might be less effective in cases of RVH due to ostial stenosis of the renal artery because of the relatively high incidence of restenosis (6).

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Angioplasty with balloon expansion and stent implantation, which was used for coronary arterial diseases (7), was first

applied for RVH in 1991 (8). Since then, angioplasty with stent implantation has been considered to be more successful than PTRA alone and decreased postoperative restenosis (9–11). With regard to the effectiveness of stent implantation on RVH, there are only a few reports in Japan (12–16), while many studies have been conducted in other countries (9–11).

We report here on an aged patient with diabetes mellitus in whom restenosis occurred three months after PTRA for RVH due to left renal arterial stenosis, and subsequent angioplasty with stent implantation was performed successfully.

Case Report

A 70-year-old man was admitted to our hospital because of vertigo on February 11, 1998. He had been treated for hypertension and diabetes mellitus at a local clinic for the past 20 years. On admission, physical examination showed a height of 169 cm, body weight of 65 kg, and BP of 160/104 mmHg with a regular pulse rate of 60 beats/min. Fundoscopy revealed hypertensive and sclerotic changes, and diabetic retinopathy classified as Scheie H₀ S₁ and Scott 0, respectively. His knee jerk was decreased. Abdominal bruit was not audible. The routine laboratory data were as follows: normal total cholesterol (180 mg/dl), low HDL-cholesterol (27 mg/dl), and high fasting blood glucose (301 mg/dl) and HbA_{1c} (9.0%). Coagulation parameters were within the normal ranges. The 24-hour urinary albumin excretion rate was 10.5 µg/min. The glomerular filtration rate (GFR) was 67.7 ml/min, indicating mild renal dysfunction. The remainder of the laboratory data were unremarkable.

Electrocardiogram was normal. Renogram showed slight deterioration in bilateral renal function (Fig. 1A). On abdominal computed tomography, no difference in kidney size was observed, but atherosclerotic changes in the abdominal aorta were present. The basal level of plasma renin activity (PRA) was elevated (4.8 ng/ml/h), and markedly responded to 10.0 ng/ml/h during a furosemide test (80 mg furosemide plus 4-hour upright posture). In a captopril test (25 mg captopril per orally administered), the PRA was elevated from 3.9 to 51.4 ng/ml/h. In a renogram performed simultaneously during this

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Stent Implantation for RVH

Figure 1. A) ^{99m}Tc-DTPA renogram showing bilateral mild renal dysfunction. However, no laterality of renal function was detected. **B)** ^{99m}Tc-DTPA renogram after 25mg captopril per orally administrated, showing a marked decrease in function of the left side kidney.

test, the difference in the bilateral renal blood flow became marked (17), and depression in the left renal function was revealed (Fig. 1B). Renal angiography showed approximately 80% ostial stenosis in the left renal artery (Fig. 2). Selective renal venous sampling revealed a marked elevation in PRA obtained from the left renal vein (2.9 ng/ml/h) as compared with the right side (1.1 ng/ml/h): the left to right ratio was 2.6, suggesting renin release from the left kidney. Thus, we diagnosed RVH due to the left renal artery stenosis.

PTRA was performed on May 6, 1998, resulting in improvement of the previously stenotic lesion of the left renal artery. Within 30 minutes of PTRA, BP level normalized to 120/72 mmHg. He was maintained without any anti-hypertensive drugs and discharged in 10 days. On August 14, three months after angioplasty, he was readmitted because of vertigo and headache with an increase in BP to 168/100 mmHg accompanying the elevated PRA (5.9 ng/ml/h). Angiography revealed restenosis in the same region, showing a diameter of 1.0 mm and length of 7.3 mm, which was 0.5 mm distance from the origin of the aortic trunk. For the treatment of this restenosis lesion, we selected PTRA with stent implantation. One Palmaz vascular stent (Johnson and Johnson Co, Warren, NJ, USA) was implanted in the ostial region of the main artery and the other in a branched artery in which mild stenosis continuing from main artery was recognized (Fig. 3). After the procedure, the patient was administered 300 mg of ticlopidine, an anticoagulant drug. One year after the therapy, he still has normal PRA and normal BP without any antihypertensive drugs.

Discussion

The present case of RVH showed a stenosis of 80% at the

Figure 2. Angiogram shows the stenosis in the left renal artery. PTRA was performed on this lesion.

ostial region of the left renal artery on aortogram, the PRA level at the left renal vein was 2.6-fold higher than at the right one, and there were positive findings in PRA and renogram with captopril loading. In particular, renogram with captopril

was effective for the diagnosis of RVH, and the underlying mechanism was thought to be as follows: the GFR of an affected kidney is dependent on the effects of angiotensin II on the efferent glomerular arterioles, so that inhibition of angiotensin converting enzyme produces a marked decrease in GFR. However, the changes in renal blood flow at the other side are less pronounced. Therefore, the characteristic effect of captopril in a kidney with a renal artery stenosis causes a decreased DTPA uptake (17) as observed in Fig. 1B.

Although we initially considered surgical revascularization in the present case, as previous reports (1, 5–7), PTRA was first chosen due to less invasiveness. After the PTRA, the stenotic region was expanded, and hyperreninemia as well as hypertension improved promptly. However, three months later,

Figure 3. Angiogram of the left renal artery. The arrowheads indicate the implanted stents for the restenotic lesions.

the PRA increased again and hypertension recurred with restenosis in the same region on angiograms. Therefore, we performed angioplasty with a stent implantation. Those abnormal findings improved rapidly, and the PRA and BP has remained within the normal range to date, one year after PTRA with stent implantations. Thus, this treatment was considered to have been successful in our case.

In cases with marked stenosis and an increase in renin release from the affected kidney, the risk of vascular complications or renal dysfunction is high, and PTRA has been thus performed (18). Since the first application of PTRA for the treatment of RVH in 1978 (4), PTRA, which is simpler, safer, and less expensive than surgical revascularization, has been used widely for the last 20 years. However, in patients who underwent PTRA for renal arterial stenosis caused by atherosclerosis, a high incidence of fatal complications such as cholesterol thrombosis (19, 20), rupture of the renal artery, renal arterial thrombosis, segmented renal infarction, hematoma, and myocardial infarction (19), have been reported as adverse events. Furthermore, a high rate of restenosis (35–65%) within about six months to one year after PTRA was reported (19, 21). Thus, although PTRA is safer than surgical procedure, stenosis recurs at a higher rate and its long-term effectiveness has been questioned (19, 21). Recently, various types of stents, including Palmaz stents, have been used widely for angioplasty in coronary arterial diseases (7). However, for angioplasty in RVH only a few studies (12–16) (Table 1) have been reported in Japan. Various reasons are conceivable for this situation. First, the medical insurance has only covered a stent implantation therapy for RVH since 1997. Secondly, with regard to racial difference Japanese have less degree of hyperinsulinemia and hyperlipidemia compared with American (22). In fact, the frequencies of various vascular events differ among races (23). Finally, stent therapy requires special skill. Since Palmaz stents were first implanted for patients with RVH in 1991 (8), prognostic data have been reported: i.e. the incidence of restenosis was about 16% (9, 10, 24), which was less than that in PTRA alone. As compared with surgical treatment, the treatment with stent was demonstrated to be technically less risky and to be equivalent in protection of renal blood flow and reduction in BP. Moreover, in a non-discriminative comparison study (25)

Table 1. Summary of Reported Japanese Cases of Stent Implantation Therapy for Renovascular Hypertension

Authors	Year	Age/Gender	Blood Pressure (mmHg)	Location (Renal artery)	Etiology	Stent	Underlying disease	Outcome
Hata M et al (12)	1997	57/Female	180/–	right	dissection of aorta (Stanford A type)	Palmaz stent	hypertension	successful
Hata M et al (13)	1997	56/Male	180/–	right	dissection of aorta (Stanford B type)	Scneider Wall stent	hypertension	successful
Miyajima A et al (14)	1998	62/Male	190/80	bilateral	atherosclerosis	Palmaz stent	hypertension	successful
Izumiya M et al (15)	1998	80/Male	240/90	bilateral	atherosclerosis	Palmaz stent	hypertension	successful
Tagami R et al (16)	1998	44/Male	220/118	left	unknown	Palmaz stent	none	successful

on PTRAs and treatment with stents limited to ostial atherosclerotic renovascular lesions, the PTRAs with stents showed a significantly lower incidence of restenosis even in long-term observation than PTRAs alone (25), suggesting that the treatment with stent is the first choice for initial angioplasty (25).

In the present case, we conducted anti-coagulant therapy with the same protocol used after treatment with stents for ischemic cardiac disease (26). However, it has not yet been established what type of anti-coagulant therapy is needed as a countermeasure against restenosis after treatment with stents in the renal artery. Moreover, it is necessary to define the further roles of treatment with stents, taking into consideration of the Japanese characteristics of lesions and the risk factors of individual patients such as advanced age or diabetes mellitus. In addition, multi-institutional analysis in Japan will be necessary to evaluate the role of stent implantation for RVH.

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