# [症例報告]AORTO-RENAL AUTOVEIN BYPASS FOR RENOVASCULAR HYPERTENSION : A CASE REPORT

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# AORTO-RENAL AUTOVEIN BYPASS FOR RENO-VASCULAR HYPERTENSION: A CASE REPORT

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## Abstract

A Japanese man suffering from a headache and a hemorrhage in his bilateral eye-grounds due to renovascular hypertension was successfully treated with aorto-renal autogenous vein bypass graft. He had a severe stenosis at the orifice of the right renal artery. Nine months prior to his admission, he underwent percutaneous transluminal angioplasty for a stenotic lesion of the right renal artery, but it failed due to the recurrence of hypertension. Preoperative arteriography revealed a severe stensosis at the orifice of the right renal artery. An autogenous vein bypass graft between the infrarenal abdominal aorta and the mid-portion of the right renal artery was performed. The autogenous vein graft was reinforced by wrapping technique using Dacron mesh to prevent postoperative aneurysmal dilatation. Blood pressure reverted from 200/140 mmHg preoperatively to 140/80 mmHg postoperatively, without any medications.

Key words : renovascular hypertension, aorto-renal autovein bypass, Dacron mesh wrapping

## Introduction

Renovascular hypertension (RVH) is characterized by diastolic hypertension secondary to stenotic or occlusive lesions of the renal artery. The incidence of RVH among the hypertensive patients varies from 1 to 6%.[1~5] Although RVH appears at all ages, younger patients with severe diastolic hypertension are the prime suspect and are often irresponsive to pharmacotherapies. Revascularization of the diseased renal artery is recommended in the treatment of RVH.[2~7] Recently, the percutaneous transluminal angioplasty (PTA) is preferred choice in the treatment of stenotic lesions at the orifice or in the proximal third of the renal artery.[8~10] However, recurrence of stenotic lesions was reported in about two-thirds of these patients in the follow-up after PTA.[10] For such instances with recurrence of the lesion, reconstructive surgery, e.g. aortorenal bypass is the recommendable procedure.

We report a case of recurrent renovascular hypertension due to severe stenosis of the right renal artery which was successfuly treated by an aorto-renal autogenous vein graft.

## CASE

A 43-year-old Japanese man was admitted to the Ryukyu University Hospital on January 23, 1986, because of a severe hypertension with headache and visual disturbance related to hemorrhage in the bilateral eye-grounds. In May, 1985, the patient was found to have hypertension with a blood pressure of 220/140 mmHg. His blood pressure did not respond to the medical treatment, and the ancillary examination revealed that he had a severe stenosis at the orifice of the right renal artery Subsequently, he underwent PTA. (Fig. 1−A,B). The patient was normotensive for 9 months after PTA. However, in January, 1986, he became hypertensive again and the blood pressure rose back 200/140 mmHg.


Fig. 1 Aortogram in 1985. A considerable stenosis localized at the orifice of the right renal artery is demonstrated (A). The stenotic lesion of the right renal artery was relieved after PTA (B).

Physical and laboratory examination:

Upon admission, his blood pressure was 200/140 mmHg. There was a grade III sclerotic changes in his bilateral eye-grounds. The abdomen did not reveal any bruit.

The laboratory examinations revealed no abnormalities except for a slight increase in serum creatinine and total cholesterol levels, and a slight decrease in HDL-cholesterol and creatinine clearance level, as shown in Table 1.

Table 1 Preoperative data in laboratory examinations

| | | | |
|---|---|---|---|
| WBC | 6,600/mm³ | Serum TP | 7.4 g/dl |
| RBC | 525 x 10⁴/mm³ | Alb | 4.7 g/dl |
| Hb | 14.6 mg/dl | A/G | 1.74 |
| Ht | 42.1% | BUN | 15 mg/dl |
| Platelet | 25.9 x 10⁴/mm³ | Cr | 1.12 mg/dl |
| ESR | 2mm/hr | Ccr | 61 ml/min |
| | | Gul | 91 mg/dl |
| Electrolides | | GOT | 16 IU/L |
| Na | 141.0 mEq/L | GPT | 33 IU/L |
| K | 3.1 mEq/L | LDH | 307 IU/l |
| Cl | 101.0 mEq/L | r-GTP | 49 IU/L |
| Ca | 4.8 mEq/L | T.Chol. | 182 mg/dl |
| | | TG | 193 mg/dl |
| Urinalysis | | HDL-Chol. | 38 mg/dl |
| Protein | ± | | |
| sugar | − | PSP test | |
| Urobilinogen | ± | 15min. | 24% |
| pH | 7.0 | 30 min. | 47% |
| RBC | − | 45 min. | 72% |
| WBC | − | 120 min. | 91% |
| volume | 1700 ml/day | | |

A rapid sequence excretory pyelography revealed a delay in appearance of contrast medium. The nephrogram showed that the length of the right kidney was 1.5 cm smaller than that of the left kidney (Fig. 2). Decreased acceleration gradient of the secretory phase and

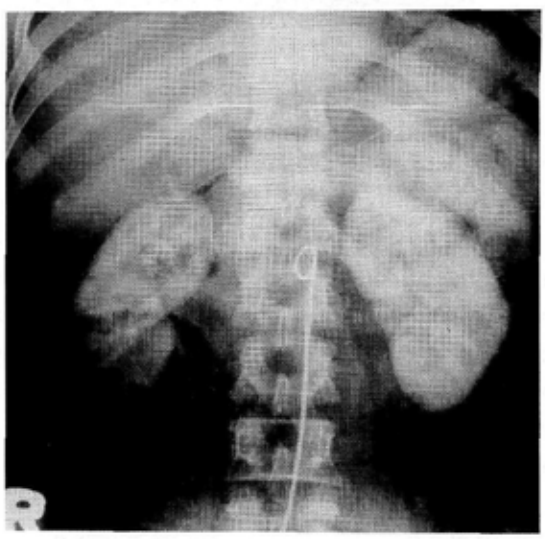

Fig. 2 Nephrogram in rapid sequence excretory pyelography. The right kidney is 1.5 cm smaller than that of the left kidney.

delayed peak time were demonstrated in a radio-active renogram in the right kidney (Fig. 3). A severe stenosis of about 90% decrease in diameter at the orifice of the right renal artery was demonstrated in the preoperative arteriogram (Fig. 4). The preoperative plasma renin activities were evidently elevated and they were 15.04 ng/ml in the right renal vein, 13.55 ng/ml in the left renal vein, 14.11 ng/ml in the supra-renal vena cave and 13.55 ng/ml in the infrarenal vena cava, respectively.

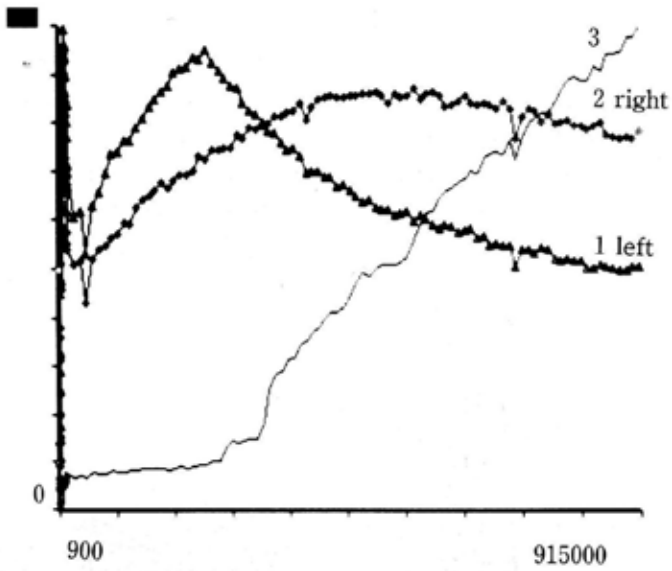


Fig. 3 Radio-active renogram. Decreased acceleration gradient of secretory phase and prolongation of peak time in the right kidney is demonstrated.

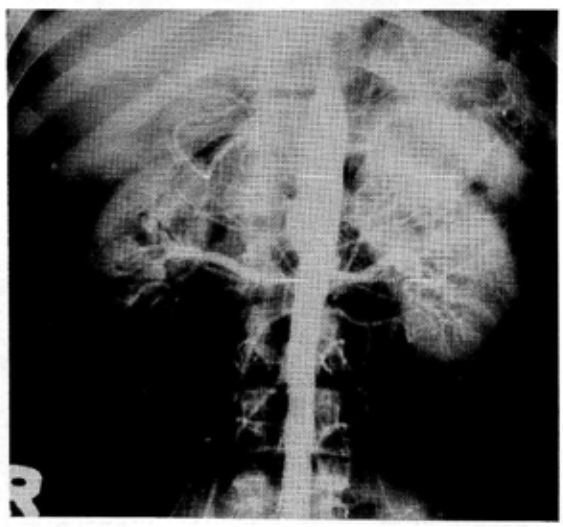

Fig. 4 Preoperative aortogram in 1986. A considerable stenotic lesion, 90% decrease in diameter, is demonstrated at the orifice of the right renal artery.

Operative technique:

An aorto-renal autogenous vein bypass graft was performed on February 13, 1986, due to a severe stenosis of the right renal artery. The right renal artery and abdominal aorta were exposed through an abdominal approach. The palpation showed that the aorta and renal artery were soft without obvious sclerotic changes. However, there was a considerable induration at the orifice of the right renal artery. Thereby, the lesion of the renal artery was thought to be due to fibromuscular hyperplasia.

An aortic clamp was placed on the right side wall of the aorta 2 cm distal to the renal artery. A great saphenous vein with a size of 5 mm in diameter and 6 cm in length was used as autogenous vein graft and was anastomosed to the right side wall of the aorta in an end-to-side fashion, using 4-0 polypropylene interrupted simple sutures (Fig. 5-A). After completion of the anastomosis, a bulldog vascular clamp was placed across the vein graft, and the blood flow of the aorta was restored. The graft was passed through a tunnel which was made beneath the inferior vena cave and right renal vein (Fig. 5-B). The distal anastomosis of

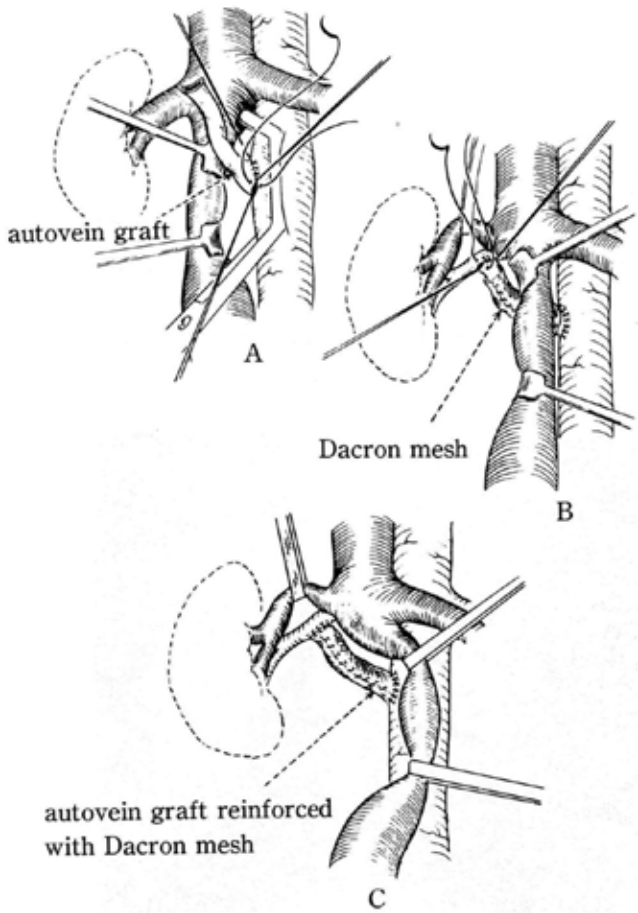


Fig. 5 The operative technique of aorto-renal autovein bypass graft. The proximal anastomosis of the graft to the abdominal aorta (A), distal anatomosis to the right renal artery (B). The vein graft is reinforced with Dacron mesh wrapping(C).

the graft to the antero-caudal wall of the renal artery was made in an end-to-side fashion, using 6-0 polypropylene interrupted simple sutures. Renal ischemia for vascular anastomosis was 15 minutes. The vein graft was reinforced with a wrapping technique using a Dacron mesh to prevent aneurysmal dilatation of the graft. The Dacron mesh was fixed to the suture lines with 6-0 polypropylene interrupted simple sutures (Fig. 5-C). The electromagnetically determined mean flow rate of the implanted vein graft was 260 ml/min. The flow rate of the left renal artery measured simultaneously revealed 240 ml/min.

Postopertaive course:

Postoperative course of the patient was uneventful. A postoperative aortogram revealed good function of the graft without any stenotic lesion at the anastomoses (Fig. 6).

Blood pressure reverted from 200/140 mmHg preoperatively to 140/90 mmHg postoperatively within 7 days after surgery. The plasma renin activity decerased to normal level (Table 2), and the radio-active renogram was normalized postoperatively (Fig. 7).

The patient has been doing well with normal blood pressure, 140/80 mmHg, without medication, 13 months after surgery.

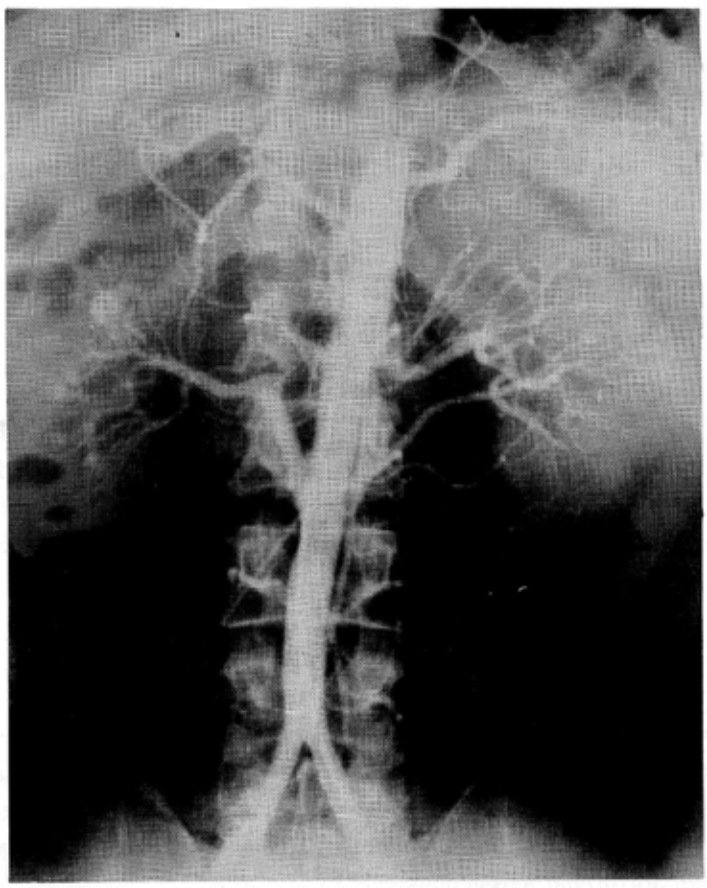

Fig. 6 Post-operative aortogram, demonstrating acceptable patency of the bypass graft.

Table 2 Preoperative and postopsrative plasma renin activity

| | Preoperative (ng/ml/hr) | Postoperative (ng/ml/hr) |
|---|---|---|
| right renal vein | 15.04 | 4.05 |
| left renal vein | 13.55 | 3.53 |
| vena cava | | |
| supra-renal | 14.11 | 3.41 |
| infra-renal | 13.58 | 3.31 |
| periphral vein | 11.76 | 2.97 |

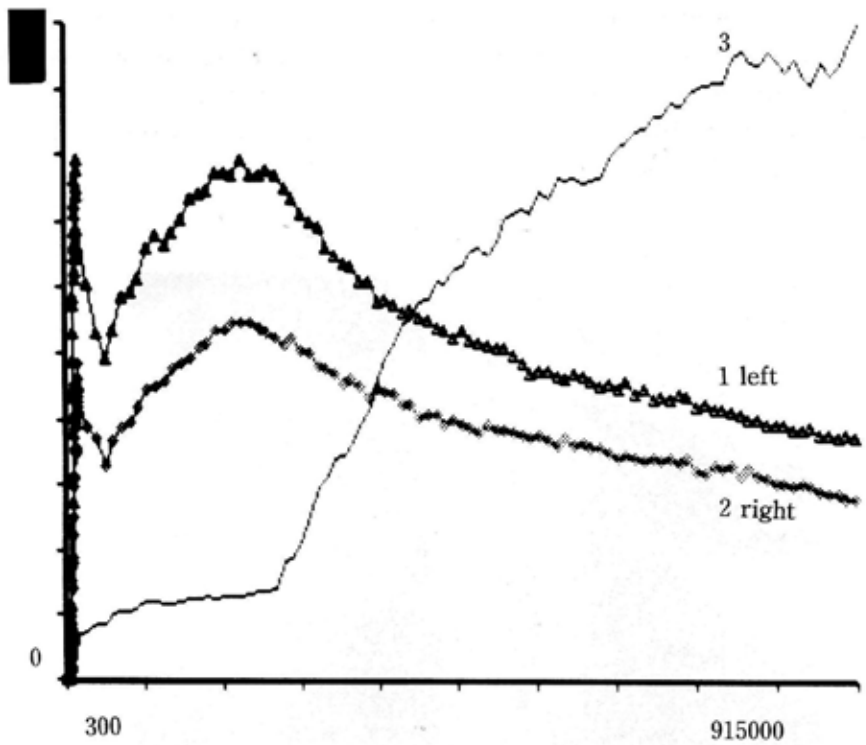


Fig. 7 Postoperative radio-active renogram. Secretory phase and peak time is within normal.

## Discussion

The patient reported herein had been having diastolic hypertension with severe headache and a hemorrhage in his bilateral eye-grounds due to a severe stenosis of the right renal artery. The patient underwent PTA for a stenotic lesion of the right renal artery, however it failed due to the recurrence of hypertension 9 months later. Thereby, the diseased right renal artery was reconstructed by an aortorenal autogenous vein bypass graft.

The diagnosis of renovascular hypertension is based on number of factors, and they are as

follows: 1) evident localized or multiple stenotic lesion of the main renal artery in arteriography, 2) unilateral delay in appearance of the contrast medium, decrease in the length of the kidney more than 1.5 cm as compared with the contralateral kidney in rapid sequence excretory pyelography, 3) reduced and delayed excretion in radio-active renography, and 4) high plasma renin activity of renal venous blood smaples.

In our case, a severe stenosis over 90% in diameter, localized at the orifice of the right renal artery was demonstrated in aortography. Shortening of the length of the right kidney, 1.5 cm shorter as compared with the left kidney, and delayed appearance of contrast medium were evident in rapid sequence excretory pyelography. The plasma renin activity of the right renal venous blood was remarkably elevated to 15.04 ng/ml. These data satisfied the factors in the diagnosis of renovascular hypertension.

Split renal function tests, e.g. Howard test, Rapaport test and Stamey test are based on characteristics that the ischemic kidney resorbs water and sodium excessively, and fixed solutes appear in the urine in increased concentration. However these tests are now rarely used because of the disadvantages such as the patient's discomfort, and the occasional complications secondary to the test, e.g. urinary tract infection, ureteral colic and transient ureteral edema which are seen in about 10% of the patients.

In the treatment of the renovascular hypertension, the repair of the stenotic or occlusive lesions of the renal artery with the revascularization is emphasized, since the long-term results of the medical therapy have been inferior to those of the revascularization. As a reliable indicator in selection of candidates for surgery, the validity of ischemic renal renin hypersecretion and contralateral renin suppression in discriminating between cured and noncured responses to surgery receives support from the investigations. Ernst et al stated that a renal vein renin ratio, represented by ischemic kidney renin activity / contralateral kidney renin activity, was greater than 1.4 in cured patients [15] and Michelakis et al indicated that a ratio of 1.5 was significant.[18] Stanley et al reported that a renal systemic renin incidence (RSRI) defined as (individual renal renin activety − systemic renin activity) / systemic renin activity was useful as a indicator and that RSRI less than 0.48 was significant.[16,17] However, subsequent studies demonstrated that many individuals with a successful operative result had high plasma renin activity, but 5-20% of patients who had no response to surgery showed also high plasma renin activity. In other reports, 4-41% of patients, in which hypertension was cured or improved by revascularization, showed normal or low plasma renin activity.[15,19,20] Ernst et[15] al and Stanley and collaborators[17] pointed out that development of collateral circulation may be associated with reversion of renin ratio toward unity; therfore, renin ratio is not reliable as a diagnostic indicator on curability of surgery in patients with obvious collaterals. The assumption that the renal vein renin ratio greater than 1.5 reflects curability of the disease with revascularization is somewhat arbitrary, so that renovascular hypertension must be treated by revascularization, once the stenotic lesion of the renal artery is evident and is proved to be functionally significant.

In recent years, as the method of revascularization in the treatment of renovascular hypertension, a percutaneous transluminal angioplasty (PTA) is often used. PTA initially achieved results equal to those in reconstructive surgery without prolonged hospitalization and

there is no need for general anesthesia.[8,9] In the report of Sos et al,[8] 89 patients with renovascular hypertension were treated with PTA, and the result showed that they were technically successful in 87% of fibromuscular dysplasia and in 57% of atherosclerotic lesions. Although PTA appeared technically promising for the treatment of fibromuscular dysplastic lesion, it was less encouraging in patients with atherosclerotic lesions.[9] Besides, many of the patients treated with PTA failed due to the recurrence of the lesion, the incomplete technique and the complications related to technique, e.g. perforation of the artery or obstruction due to dissection of the arterial wall.[9~11] When PTA failed with recurrence or incompleteness, reconstructive surgery, i.e. aorto-renal bypass, patch angioplasty or renal artery endarterectomy etc. must be employed. As the reconstructive surgery for the localized stenotic lesion in the proximal third of the renal artery, an autogenous vein bypass has been preferably employed with high long-term success.[6,7,16,21] However, long-term follow-up of venous grafts used as a renal artery substitute developed degenerative changes leading to aneurysmal dilation.[6,16] Stanley et al[16] demonstrated aneurysmal dilatation of the grafts in 60% in the follow up of 1 to 12 years. Dean et al[6] also reported a 50% increase in diameter and aneurysmal formation. Such degenerative changes of vein grafts used in renal artery bypass is considered to be highly related with high flow rate of the renal artery. The results of the flowmetric studies of the aorto-coronary artery bypasses and femoral artery bypasses which did not show any aneurysmal dilatation, were on the average 70-90 ml/min and 100-200 ml/min, respectively, whereas aorto-renal bypasses averaged 250-400 ml/min. A wrapping technique with Dacron mesh is a recommendable technique in prevention of aneurysmal dilatation of the implanted aorto-renal vein graft.

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