

Surgical Treatment of Renovascular Hypertension^{*)}

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ABSTRACT

nine hypertensive patients were operated by revascularization procedure, in our institute, from January 1963 to August 1984. The revascularization procedure were aorto-renal artery bypass in 2 cases, resection with end to end renal artery anastomosis in one case, resection with end to end left colic-renal artery reanastomosis in one case, resection with end to side aorto-renal artery reanastomosis in one case, renal angioplasty with patch graft in one case, percutaneous transluminal angioplasty (PTA) of renal artery in one case, renal autotransplantation with renal angioplasty in 2 cases.

Although early one case was lost by acute renal failure, the other cases of renovascular hypertension (RVHT) were healthy free from hypertension after follow-up from 2 months to 16 years.

The Choice of operative methods for RVHT should be based on the type and severity lesions present, and should be based on the general condition. In addition to the choice of operative methods, preparations of protection to ischemic damages of Kidney during operation should be done. From 1981, hypertensive patients due to renal artery stenosis were administered of vitamin E (Vit. E) and coenzyme Q₁₀ (CoQ₁₀) as protective agents for ischemic damages of kidney. We performed operation for RVHT with good results without severe renal failure in pretreatment group.

INTRODUCTION

Renovascular hypertension (RVHT) is the most common cause of secondary hypertension, with reports of its incidence varying from less than 1% to 6%, of the hypertensive population¹⁶⁾. Despite the relatively small numbers of patients, RVHT continues to elicit considerable clinical interest.

There are no protective randomized trials of medical versus surgical therapy.

The choice of medical therapy has traditionally been a combination of diuretic, beta blocker, and vasodilator. Recently a new class of drug

has been available, the angiotensin-converting enzyme inhibitor, available orally as Captopril^{1, 17)}.

Although Captopril is effective in reducing mean arterial pressure in patients with RVHT, there are several caveats regarding its use. Most of the renal toxicity reported with Captopril's use occurred in patients with renal insufficiency, possibly because of toxic accumulation¹⁶⁾. Dean et al appropriately stresses the importance of careful follow-up of renal function in patients treated medically³⁾.

As the long-term results with medical therapy seem to be poorer than with surgical therapy,

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it is emphasized that once a lesion is found and proved to be functionally significant, it should be repaired if at all possible^{4,7,11}.

In this paper, our results of surgical treatment of RVHT have been studied and presented.

MATERIALS AND METHODS

Nine patients were operated by revascularization procedures, in our institute, in the period from January 1963 to August 1984. Of nine cases operated, 5 were male whose ages range from 19 to 46 (mean 31.6 years old), 4 were female whose ages range from 27 to 30 (mean 28.0 years old). The basic and disease included 3 cases of atherosclerotic lesion 6 cases of fibromuscular dysplasia (Table 1).

Systolic blood pressure in patients of our series preoperatively were from 164 to 240 mmHg (mean 197.2 mmHg), and diastolic blood pressure were from 100 to 150 mmHg (mean 126.4 mmHg).

Initial symptom of RVHT patients were headache in 7 cases, palpitation in 2 cases, nausea in one case, free from symptom in one case. The average interval from onset of symptom to admission in our series was 5.7 years, and only one case of them was admitted within one year after onset of symptom.

Minor complications were recognized in 7 cases, left ventricular hypertrophy in 5 cases, atherosclerotic changes on angiogram in 3 cases, sclerotic changes on ophthalmoscopic examination in 6 cases. Case 6 was complicated with

coronary insufficiency which did not need special treatment without medication.

All cases were administered of combination of diuretics, vasodilators, beta blockers, Captopril and other anti-hypertensive drugs.

From 1981, patients who will be operated for RVHT was daily administered orally with 300 mg of Vit. E and 60 mg of CoQ₁₀ for 7 days before operation, in order to prevent ischemic damages of kidney during revascularization procedure^{14,15}, shown in Table 3.

RESULTS

Table 1 presents the overall results of operative methods in nine RVHT patients. Of nine patients, 8 cases were classified as cured, and the other one with atherosclerotic lesion as failed due to operative death. The cause of death of case 1, was acute renal failure after operation.

Other cases were achieved follow-up study from 2 months to 16 years. All of them was free from hypertension and not administered of antihypertensive drugs.

Systolic blood pressure of 9 cases got down from 197.2 mmHg to 127.3 mmHg (mean decreased pressure 68.6 mmHg), and diastolic blood pressure got down from 126.4 mmHg to 84.9 mmHg (mean decrease pressure 41.6 mmHg) after operation. Plasma renin activity of 7 cases (in early 2 cases were not done plasma renin study) got down from 6.90 ng/ml/hr to 2.58 ng/ml/hr, postoperatively. Good correction of blood

Table 1. Cases of Renovascular Hypertension

Case	Sex	Age	Lesions	Blood pressure		Operation	Prognosis
				pre ope	post ope		
1	F	30	R AS ^a	164/100	150/80	A-R Bypass ^b	operative death,
2	M	20	L FMD ^c	185/108	120/80	R-C Anast ^d	16 y
3	F	27	L FMD	190/120	110/80	R-R Anast ^e	13 y
4	M	31	Bil AS	212/150	120/70	A-R Bypass	9 y
5	M	42	L FMD	180/140	150/100	Patchy Graft ^f	6 y
6	M	19	L FMD	180/120	130/84	R-T ^g	3 y
7	M	46	Bil FMD	220/130	138/100	A-R Anast	3 y
8	F	27	R FMD	204/150	120/90	PT A ^h	3 y
9	F	29	Bil FMD	240/120	108/80	PT A. R-T	2 m

AS^a: atherosclerotic lesion

A-R Bypass^b: aorto-renal bypass

FMD^c: fibromuscular lesion

R-C Anast^d: renal-right colic artery anastomosis

R-R Anast^e: resection with end-to-end reanastomosis

Patchy Graft^f: angioplasty with patch graft

R-T^g: renal auto-transplantation

PTA^h: percutaneous transluminal renal angioplasty

pressure and plasma renin activity was shown. These data was shown that revascularization procedure of our choice was effective in treatment for RVHT of our nine cases.

Results of pretreatment to prevent ischemic renal damages during revascularization are presented in Table 2. In all cases, without

PTA treated one, renal arteries were clamped for long time from 20 to 208 min. As ischemic damage is a major factor in prognosis of operation for RVHT, pretreatment of administration of Vit. E and GoQ₁₀, and cooling with perfusion technique have been achieved every case from 1981. In pretreatment series,

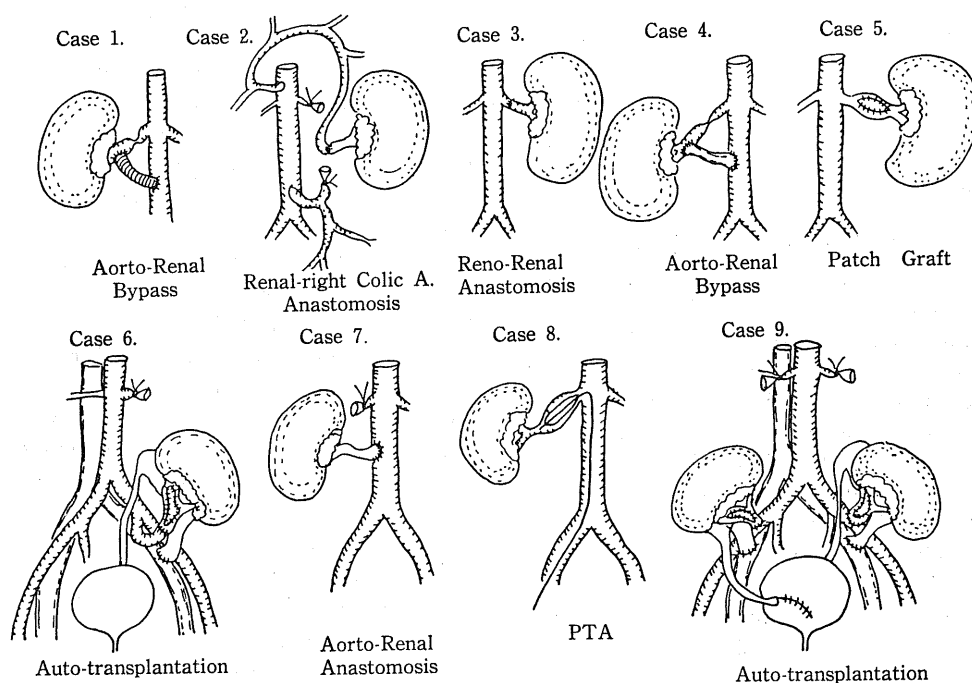


Fig. 1. Surgical Treatment of Renovascular Hypertension

Table 2. Results of Pretreatments to prevent Ischemic Renal Damages

Case	Operation	Ischemic Time (min)	Drugs ¹⁾	Perfusion	Prognosis
1	A-R Bypass ²⁾	70	(-)	(-)	ATN ³⁾
2	C-R Anast ⁴⁾	30	(-)	(-)	good
3	R-R Anast ⁵⁾	20	(-)	(-)	good
4	A-R Bypass	80	(-)	(-)	good
5	Patch graft ⁶⁾	50	(-)	(-)	good
6	R-T ⁷⁾	160	(+)	(+)	excellent
7	A-R Anast	40	(+)	(+)	good
8	PTA ⁸⁾	3	(+)	(-)	excellent
9	R-T	165 (10)	(+)	(+)	ATN (?)
	R-T	208 (2)	(+)	(+)	excellent

Drugs¹⁾: vit E (300 mg/d), Coenzyme Q₁₀ (60 mg/d), for 7 days

A-R Bypass²⁾: Aorto-renal bypass

ATN³⁾: Acute tubular necrosis

C-R Anast⁴⁾: right colic artery-renal artery anastomosis

R-R Anast⁵⁾: resection with reno-renal artery reanastomosis

Patchy graft⁶⁾: Angioplasty with patchy graft.

R-T⁷⁾: Renal auto-transplantation

PTA⁸⁾: Percutaneous transluminal angioplasty

Table 3. Pretreatments to prevent ischemic renal damage

1. All case
Administration of Coenzyme Q ₁₀ (60 mg/day), and Vitamin E (300 mg/day) for 7 days before operation.
2. In situ operation
Perfusion with chilled Lactate Ringer's solution (4°C) after canulation of renal artery.
3. Bench surgery
Simple cooling and perfusion with chilled Lactate Ringer's solution (4°C) after nephrectomy.

no operative death, no sever renal damage was complicated, although operations needed long ischemic time from 40 to 208 min.

Renal autotransplantation were performed in case 6 and 9, because of severe lesions extended to branches of renal arteries. These procedures needed long clamping time from 160 to 208 min. During these long ischemic time, kidneys will lost Viability due to severe damages without pretreatment of drugs and cooling with perfusion of chilled solution. Although low grade acute tubular necrosis which was diagnosed by the renogram without clinical symptom in left kidney of case 9, all other kidneys had excellent function for long time.

DISCUSSION

Many questions remain unanswered in the field of treatment for renovascular hypertension, medical therapy is still preferred in many institutes. However, recent experiences with operative management of RVHT is encouraging. And theoretical advantages of potential cure of hypertension and retrieval of renal function by revascularization are obvious^{9,11,16}.

Although early surgical series performed primarily nephrectomy, with greater experience and improved techniques a variety of revascularization are available and nephrectomy is limited¹⁶.

Grüntzig et al. repoted the first description about the effect of PTA on secondary RVHT at 1978⁶. PTA for RVHT is generally performed after radiographic studies have identified stenotic lesion and selective renal arteriography have been performed^{8,10}. Success of PTA may

be a direct reflection of specific type disease being treated. Solitary stenosis with fibromuscular dysplasia as shown in case 8, appear most amenable to these percutaneous procedures. In a recent report by Sos et al. of 89 patients with RVHT treated by PTA, the technically successful in 87% of fibromuscular lesions, 57% atherosclerotic lesions, and only 10% of bilateral lesions¹³. Long-term follow-up studies are limited but most authors report good patency following angioplasty in patients with fibromuscular dysplasia. Although PTA appears very promissing for the treatment of RVHT due to fibromuscular dysplasia, results are less encouraging in patients with atheromatous disease⁸.

When PTA procedure is incomplete, other revascularization procedure should be employed. Revascularization technidues include endarterectomy, resection with end to end renal artery reanastomosis, aorto-renal bypass, angioplasty with patch graft, etc. More recently, ex situ angioplasty and autotransplantation with cooling and after perfusion of chilled solution was used for the treatment for RVHT^{2,12}. This method makes the time for repair of severe degree of lesion, so it can be performed to revascularization of branch stenosis of renal artery.

Discussions regarding the choice of appropriate therapy for patients with RVHT must be individualized and should take into account the type of lesion as demonstrated angiographically¹⁶. For patients with segmental stenotic lesions of renal arteries, PTA appears ideal for most types and usually achieves results equal to those obtained surgically without the prolonged hospitalization and the need for general anesthesia^{8,9,10,13}. In patients with difficulty of PTA, surgical revascularization should be performed after preparation to renal ischemic damage. In patients with severe stenotic lesions of branches of renal artery, we emphasize renal autotransplantation with renal angioplasty should be done after cooling with perfusion technique, as shown in Fig. 1.

The choice of operative methods is done according to Table 4 in our institute.

The results of the cooperative study published in 1975 demonstrated a 5.9% operative mortality rate⁵. Of the primary causes of death, 80% were related to uremia, hemorrhagic complications, or myocardial infarction. For the

Table 4. Surgical Treatment of Renovascular Hypertension

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- I. Segmental stenotic lesion of renal artery
 - 1. Percutaneous transluminal angioplasty
 - 2. Surgical revascularization
 - ① Endarterectomy
 - ② Resection with end to end to end renal reanastomosis
 - ③ Aorto-renal bypass
 - ④ Angioplasty with patch graft
 - II. Severe stenotic lesion of branches of renal artery
 - 1. Renal auto-transplantation with renal angioplasty
 - 2. (Nephrectomy)
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purpose of reduction of mortality rate and improvement of operative result, new trial of premedication for ischemic damages of kidney, was performed as shown in Table 3.

Although our series is small one, these data have shown a considerably reduced mortality rate, and an improved operative result with combinations of premedication of Vit. E and CoQ₁₀, and cooling after perfusion technique.

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