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Reconstruction for Renal Artery Aneurysm and its Effect on Hypertension

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Objectives: *many renal artery aneurysms (RAA) are diagnosed incidentally in the course of investigations for hypertension and their management is controversial.*
Aim: *to review the results of renal artery reconstruction for RAA.*
Methods: *between January 1978 and December 1998 111 RAR were performed in 81 kidneys in 71 patients.*
Results: *fifty-nine patients were hypertensive, three had a creatinine >2.0 mg/dl and one was on dialysis. The principal underlying pathology was fibromuscular dysplasia (39) and atherosclerosis (17). The mean RAA diameter was 2.2 (range 1–15) cm overall and 3.5 (range 2–10) cm in four patients who presented with rupture. Fifty-one patients had renal artery stenosis. Autogenous material was used in 105 RAR. There was no 30-day mortality and the morbidity rate was 16%. The 5-year cumulative patency rate was 69%. Hypertension was cured in 25% and improved in 39%.*
Conclusions: *RAR tested for RAA treats hypertension and reduces the risk of rupture and distal embolisation.*

Introduction

Renal artery aneurysms (RAA) are usually diagnosed incidentally in the course of investigations for hypertension and their management is controversial. The risks of rupture and embolisation must be weighed against the risks of repair. The aim of this study was to analyse the long-term patency of RAR and its influence on hypertension.

Table 1. Preoperative localisation of RAA in 71 patients, 81 kidneys and 111 arteries.

Side: right 40, left 21, both 10		
Kidneys *n*	81	
Arteries *n*	111	
Mainstem		66
Segmental		42 (17 pat.)
Accessory		3 (3 pat.)

Table 2. Underlying disease in 71 patients with RAA.

	n	%
FMD	39	55
Atherosclerosis	17	24
Aortic coarctation	5	
Arteritis	4	
Dissection (unknown aetiol.)	4	
Marfan's syndrome	1	
Trauma	1	

Table 3. Methods of renal artery reconstruction in $n = 111$ diseased arteries.

	n	%
Autogenous RAR	105	95
Saphenous vein interpos.	49	
Bridging bypass	9	
Aneurysmorrhaphy	27	
Resection and reanastomosis	19	
Hypogastric artery	1	
Dacron/PTFE bypass	5	
Homologous vein	1	

Materials and Methods

Between 1978 and 1998, 71 patients underwent RAR for RAA. The indications for surgery depended upon maximal diameter, morphology, and the clinical symptoms. Eighty-three per cent of patients presented with hypertension, presumably due to occlusive disease and/or embolisation. In such patients it was considered reasonable to operate, even if the aneurysm was <2 cm in diameter. On the basis of preoperative CT and/or angiography the mean RAA diameter was 2.2 (range 1.0–15) cm. In four patients presenting with rupture the mean diameter was 2 (range 2–10) cm.

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(a)

(b)

Fig. 1. Intra-arterial angiography before and after RAR for RAA of the right renal artery. In this case the technique of aneurysmorrhaphy was applied. (a) Aneurysm of the right renal artery in a 57-year-old hypertensive male patient. The aneurysm was located at the distal end of the renal artery. Three major branches originated from the aneurysm. (b) Post-operative angiography 10 days after aneurysmectomy. The wall of the aneurysm was resected and the orifices of the three renal artery branches were attached to each other by single stitches leading to a restoration of normal anatomy.

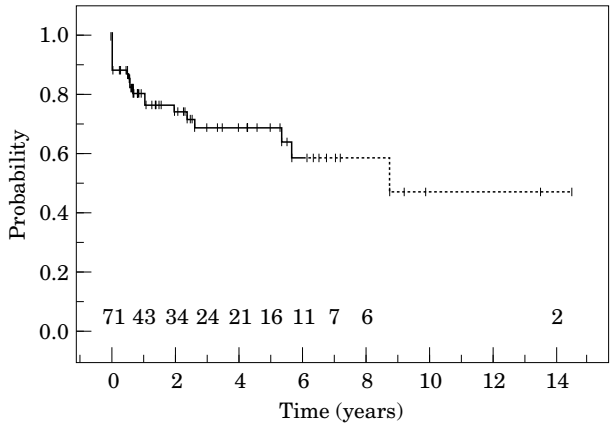

Fig. 2. Primary patency after RAR for RAA. Numbers below graph are patients at risk. Note patency curve beyond 6 years is unreliable due to low numbers of patients under observation (dotted line).

Postoperatively, patients underwent clinical examination, assessment of kidney function, and renal duplex. Renal artery stenosis (RAS) was defined by a maximum systolic velocity >150 cm/s. Where renal artery occlusion was suspected on duplex, angiography was performed. Graft patency rate was calculated according to Kaplan–Meier. Hypertension was stated to be "cured" if diastolic blood pressure was <91 mmHg without the need for antihypertensive medication. "Improvement" was defined as reduction of the diastolic blood pressure <91 mmHg with the same or fewer antihypertensive drugs.

Results

There were 44 women and 27 men with a mean age of 47, ranging from 16 to 78 years. Hypertension was found in 59 (83%) patients. In eight cases RAA was incidentally found during angiography performed for aorto-arterial occlusive disease. There were four cases of renal artery dissection of unknown aetiology. Altogether 111 arteries in 81 kidneys had at least one aneurysm. The right kidney was affected twice as often as the left, and many segmental arteries were diseased (Table 1). Concomitant renal artery stenosis was present in 72% of patients and dissection in 11 cases.

Three patients had a creatinine >2 mg/100 ml and one patient was on dialysis. Fibromuscular dysplasia was found to be the most frequent pathology (Table 2).

Various techniques were used to perform RAR (Table 3). Autogenous material was used in almost 95% of the cases, usually the long saphenous vein. In one patient the hypogastric artery was used. Aneurysmorrhaphy was only performed for segmental

secular aneurysms (Fig. 1). *Ex situ* repair was necessary in four cases.

Early Results

There was no 30-day mortality. Eleven patients suffered the following complications: graft occlusion ($n=2$), bleeding ($n=3$), deep venous thrombosis ($n=2$), or pancreatitis ($n=1$). Transient postoperative dialysis was necessary in three patients.

Postoperative angiography was performed in 64 patients, of whom 55 had patent renal arteries.

At a mean of 58 (range 3–143) months, two patients had undergone nephrectomy for uncontrollable hypertension after late occlusion of the repaired renal arteries, six patients had died and seven patients were lost for follow-up. In 56 patients re-examination was performed with duplexsonography (51) or angiography (five). There were 44 patients with patent renal arteries (79%), five with a mainstem occlusion, three with segmental artery occlusion, and four with renal artery stenosis. These four patients meanwhile have been reoperated successfully but have not yet been re-examined. The primary patency of all 71 patients after five years is 69% (Fig. 2). No graft aneurysms were identified. Hypertension was "cured" or "improved" in 14 (25%) and 22 (39%) patients respectively. The mean creatinine level at follow-up was 1.1 ± 0.3 mg/100 ml, only one patient had a creatinine >2 mg/100 ml, and no patient was on dialysis.

Discussion

A rupture, worsening of hypertension, and loss of renal function due to stenosis, thrombosis or embolisation are the main risks of RAA.[1–7]

Although the risk of rupture is related to diameter of RAA,[8] we believe that RAA should be operated in all patients with arterial hypertension and women of childbearing age. Like previous authors,[9–11] we have found good long-term results for autologous renal artery repair, and therefore we see a relative indication for operation in younger patients without hypertension and concomitant renal artery stenosis at a diameter of RAA of 1 cm or more.

About 80% of patients with RAA had arterial hypertension,[12,13] which could be confirmed in our material. If RAA is accompanied by a renal artery stenosis on the same or the contralateral side, it is reasonable to repair both with the intention to cure hypertension and to avoid rupture of the aneurysm. However, an ipsilateral stenosis may be missed by angiography due to overprojection from the aneurysm. Furthermore, aneurysmal disease includes not only dilatation of vessels but also their elongation, that might cause a kinking with a relevant stenosis.[14]

Surgical reconstruction of renal arteries for RAA is a safe procedure with good long-term results preventing aneurysm rupture and healing or improving arterial hypertension. Therefore, there should be a liberal indication for surgical repair in hypertensive patients and in younger individuals without hypertension presenting aneurysms with a diameter of $\geqslant 2$ cm.

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