

Renal Artery Aneurysms

Natural History and Prognosis

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Eighty-three patients out of 8,525 undergoing renal angiography during the years 1970–1979 were found to have renal artery aneurysm, which in six patients were bilateral and in 11 multiple. This corresponds to an incidence of almost 1% in this group of patients. Sixty-nine patients were treated conservatively and followed for a mean of 4.3 years. At that time nine patients had died. The cause of death was in no case related to the aneurysm. None of the 60 living patients had symptoms which could be related to the aneurysm. Reports of 36,656 autopsies, including most of the sudden deaths occurring in southern Sweden during a ten-year period, were analyzed. Nineteen cases of ruptured arterial aneurysms in the branches of abdominal aorta were found, but in no case were the renal arteries involved. It is concluded that the risk for rupture of a renal artery aneurysm is extremely small. The indications to operate renal artery aneurysms are discussed.

THE KNOWLEDGE on the occurrence, the natural history, and the prognosis of renal artery aneurysm is limited. At the time when most of the information on this disease came from autopsy studies, rather than angiography, it was considered to be extremely rare. Abeshouse¹ found in a retrospective study 12 cases among 100,421 autopsies. In that series he observed a total of 1340 aneurysms in various locations. In angiographic studies the incidence has, however, been found to be very much higher, varying between 0.3 and 0.7%.²⁻⁴ The reason for this difference between autopsy series and angiography series may be that the renal artery aneurysms often are quite small and sometimes intrarenal, and therefore not easily visualized at a routine autopsy. Since renal artery aneurysms are found relatively often at renal angiography, carried out on various indications,

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the question of the natural course and the risk for complications of this type of aneurysm is important.

This paper reviews the findings in 83 patients with renal artery aneurysms, including a follow-up of 69 not undergoing surgery, and reports on 36,656 autopsies with regard to the occurrence of ruptured renal artery aneurysms.

Material and Methods

Patient Series

Eighty-three patients with one or more renal artery aneurysm are included in the series. It includes all the renal artery aneurysms found at 8525 renal angiographies performed at the University Hospitals of Lund and Malmö during the years 1970–1979. Fourteen underwent surgery for their aneurysm. Sixty-nine were treated conservatively.

The indications for angiography varied: in 27 patients it was a suspicion of renovascular hypertension. In 31 patients angiography was made because of findings on intravenous pyelograms, such as calcifications or signs of renal tumor. The indications for the pyelography was in these cases usually urinary tract infection, hematuria, or suspicion of a tumor. In 15 patients the angiography was performed for other reasons, such as hematuria, flank pain, trauma, or for evaluation of a potential kidney donor.

The mean age of the patients was 60.6 years (4 to 85 years) (Fig. 1). Thirty-nine were women, 44 men. Fifty-one were located to the right side, 26 to the left, and six were bilateral. In 11 additional cases the aneurysms were multiple but on one side, in nine cases on the right side

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and in two on the left. In six cases the patient had only one kidney due to aplasia or to previous nephrectomy. The reasons for this nephrectomy were trauma or tuberculosis, but in no case an aneurysm.

The location of the aneurysms, in relation to the renal artery, was as follows, including the bilateral aneurysms: main renal artery 20, bifurcation of main artery 19, first branch or its bifurcation 29, peripheral branches 21.

Calcifications were found in 15 of the 83 patients.

The size of the aneurysms varied, as shown in Table 1, which also shows the size of the operated aneurysms.

Angiographic appearance of the aneurysms was as follows: about 80% of the aneurysms were of saccular type. The remaining were either fusiform, dissecting aneurysm, or, in one case, pseudoaneurysm after trauma. Multiple microaneurysms, as seen in fibrous dysplasia, are not included in the series, nor are cases of poststenotic dilatation.

The nonoperated patients were followed for one to nine (mean 4.3) years, the operated for one to nine (mean 4.4) years. The follow-up study included clinical examination but only in a few cases angiography. Nine patients died during the follow-up period. Hospital records and records from autopsy were evaluated in all these patients.

Autopsy Series

The reports of 36,656 postmortem examinations performed in Lund and Malmö during the years 1970–1979 were studied; 16,564 of the examinations were performed at the Institute for Forensic Medicine. These cases include, therefore, practically all unexpected sudden deaths occurring in southern Sweden during this period. The remaining autopsies came from the Institutions of Pathology at the University Hospitals in Lund and Malmö.

Results

Patient Series

Sixty-nine patients were treated conservatively. Sixty of these patients were alive at follow-up. None of them had any symptoms that could be ascribed to their renal artery aneurysm.

Nine patients died during the follow-up period at the age of 55 to 82 years (mean 69.1). The causes of death were in four cases myocardial infarct, one dissecting aortic aneurysm, one cancer of the kidney, one myeloma, one cancer of the urinary bladder, and one cancer of the lung.

Fourteen patients were operated. Data on the operations are given in Table 2. At follow-up all the operated patients were alive and well. Only three of the seven

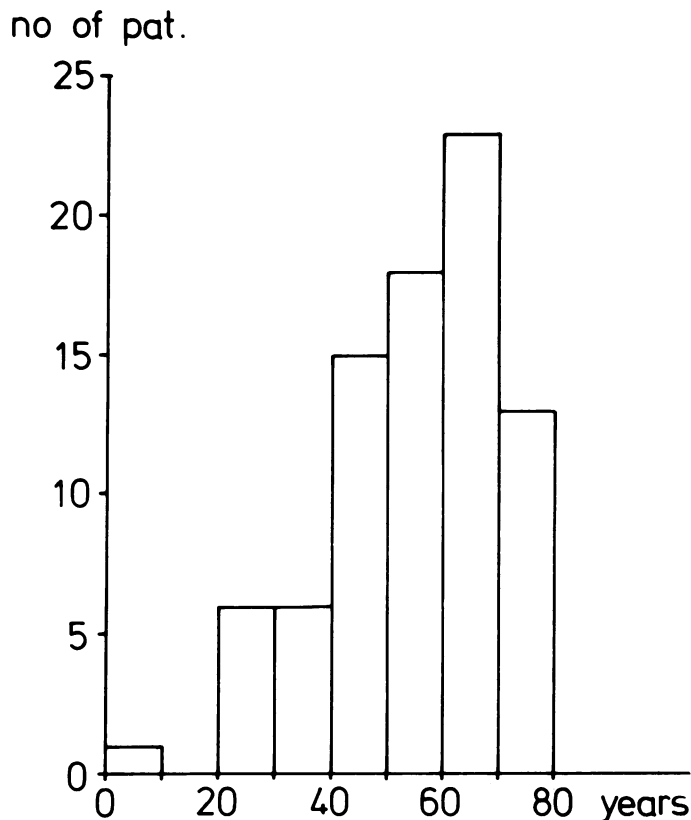


FIG. 1. Age distribution of the patients with renal artery aneurysms.

patients with hypertension before the operation were normotensive or significantly improved at follow-up.

Autopsy Series

In the analysis of 36,656 autopsies, a total of 19 ruptured arterial aneurysms in the branches of the abdominal aorta were found. Out of these, 12 were located to the iliac arteries, five to the splenic artery, and one to the hepatic artery, but none to the renal arteries.

Discussion

The occurrence of renal artery aneurysms in reported series of patients undergoing renal angiography varies between 0.3%,² and 0.7%.^{3,4} In this series the figure is slightly higher, almost 1%. These figures do not, however, necessarily reflect the true incidence of renal artery

TABLE 1. Size of the Aneurysm

	No. found	No. operated
<10 mm	60	6
10–15 mm	12	2
15–20 mm	4	2
>20 mm	7	4

TABLE 2. *Operated Patients*

Patient Age, Years	Symptoms	Type of Operation	Indication to Operate	Pathology
E.S. 50	Hemorrhage after major trauma	Partial nephrectomy	Hemorrhage + aneurysm in single kidney	Ruptured pseudoaneurysm
G.S. 35	Recurrent urinary tract infections	Removal of aneurysm + suture	Size of the aneurysm: 25 × 20 mm	Partly thrombosed aneurysm from fibrous dysplasia
V.O. 22	Hematuria	Nephrectomy	Hematuria + multiple peripheral aneurysms	Hemangiomatosis
M.P. 71	Hematuria	Ligation + extirpation	Hematuria + large size (40 × 40 mm)	Thrombosed atherosclerotic noncalcified aneurysm
E.N. 70	Hematuria + flank pain	Vascular reconstruction	Pain + large size (30 × 30 mm)	—
S.V. 53	None. Right-sided aneurysm detected accidentally when the tumor on the left kidney was found	Left-sided nephrectomy + ligation of aneurysm on the right side	Relatively large aneurysm (12 × 18 mm) + single kidney	—
M.J. 10	Hypertension	Resection of stenosis and aneurysm + reconstruction with vein graft	Renovascular hypertension	Congenital malformation
S.F. 48	Hypertension	Resection + suture	Hypertension (no arterial stenosis)	Fibrous dysplasia
A.N. 61	Hypertension after major trauma (15 years earlier)	Resection + reconstruction	Hypertension (no arterial stenosis)	Dissecting post-traumatic aneurysm
D.R. 60	Hypertension	Resection + vascular reconstruction	Renovascular hypertension + aneurysm in single kidney	Fibrous dysplasia
L.L. 46	Hypertension after angiography 2 years earlier	Resection + reconstruction with autologous artery	Renovascular hypertension	Post-traumatic dissecting aneurysm
C.B. 39	Flank pain	<i>Ex vivo</i> reconstruction	Large size (30 × 30 mm) + small aneurysm on contralateral side	Fibrous dysplasia
ML.B. 32	Hypertension	<i>Ex vivo</i> reconstruction	Renovascular hypertension	Fibrous dysplasia
E.P. 32	Hypertension	Reconstruction of stenosis with vein patch + resection of aneurysm	Renovascular hypertension	Fibrous dysplasia

aneurysms in normal individuals since several of the symptoms, which have been the reason to perform angiography, such as hypertension, hematuria, or flank pain, may be caused by an aneurysm. The incidence found angiographically is about 70 times higher than obtained from necropsy reports in retrospect. In a carefully performed prospective autopsy study, 22 renal artery aneurysms were found in 15 out of 154 nonselected cases, giving an over all prevalence of 9.7%.⁵ These findings suggest that the incidence may be quite high.

The knowledge on the natural course of renal artery aneurysms is also unsatisfactory. As in all aneurysms, there is a potential risk for rupture. The aneurysms may also thrombose, or be the source of distal emboli, occluding peripheral vascular branches. Renal artery aneurysms also have been reported to cause hypertension,

hematuria, and flank pain. On intravenous pyelogram they may simulate a tumor and, therefore, make angiography necessary.

Incidence of Rupture

Earlier reports give an extremely high risk for rupture of renal artery aneurysms. Ippolito⁶ reported that 24 out of 169 patients with noncalcified aneurysm ruptured, and Cerny⁷ claims that 30% of intrarenal aneurysms rupture. According to several case reports,^{8,9} pregnancy increases the risk for rupture of renal artery aneurysms as it does for splenic artery aneurysm. Rupture is reported to result in a mortality of about 80%.⁶ The risk for rupture is reported to be especially high in noncalcified saccular aneurysms.⁷ In a few recent reports, small

series of patients with renal artery aneurysms have, however, been followed without operative treatment.^{4,10} No ruptures have been reported in these studies.^{10,11}

McCarron reported that out of 19,600 autopsies at the New York hospital, no case of rupture of a renal artery aneurysm could be found.¹¹ In 180,000 pregnancies brought to term, no instance of rupture of a renal artery aneurysm was observed. The authors' series strongly indicates that rupture is a rare complication to renal artery aneurysm. The 14 operated cases in this series of 83 were not operated because of rupture or any signs of impending rupture. The indication was often fear of rupture, particularly in patients with single kidneys, sometimes an unusually large aneurysm, and a few times hematuria. The 69 conservatively treated patients are, therefore, only to a minor extent a selected group; most of them actually have been chosen randomly for conservative treatment. In spite of this, no patient developed symptoms, no rupture occurred, nor was any rupture seen among the nine patients who died.

The findings in the more than 36,000 autopsies are also of interest. Most cases of unexpected sudden deaths in a population of almost two million people during a decade is included in this series. Several deaths were due to rupture of aneurysms in the branches of abdominal aorta, but none of them were located in the renal artery. This finding confirms the impression that the risk for rupture of a renal artery aneurysm is extremely low. This is surprising in view of the fact that the renal artery aneurysms have great similarities with the berry aneurysms of the circle of Willis', which are known to have a high incidence⁵ of rupture.

Hypertension

One of the most common indications to perform renal angiography is suspicion of renovascular hypertension. It is, therefore, not surprising that a large number of patients with renal artery aneurysms have hypertension. It is important to separate patients with a combination of a significant renal artery stenosis, often caused by fibrous dysplasia, and an aneurysm, from those with aneurysm alone. It is obvious that the former group can be cured by surgery, but it is very doubtful if the latter group can. Theoretically, the aneurysm may change the hemodynamics in the kidney and thereby cause hypertension without the presence of stenosis.¹² In a careful study, Cummings and coworkers¹³ demonstrated that those patients who have renal artery aneurysm combined with a hemodynamically significant stenosis, as verified with renal venous renin studies, could be cured with surgery. Those without evidence of stenosis, and with negative renin studies remained, however, hypertensive even after a technically successful reconstruc-

tion. Also in the present series, most of the patients with renal artery aneurysm and hypertension remained hypertensive after surgery. Therefore, hypertension alone in a patient with a renal artery aneurysm is no indication to operate and probably cannot improve the blood pressure situation unless it is combined with a stenosis, which has been demonstrated to be hemodynamically significant. In that case the primary indication to operate is not the aneurysm but the stenosis.

Other Symptoms

Renal artery aneurysm may, like all aneurysms, thrombose, or serve as a source of emboli that may occlude the peripheral arteries in the kidney.¹⁴ In the present series, embolization has not been found to occur, but thrombotic material was occasionally seen in aneurysms at operation. It is probable that saccular aneurysm may thrombose completely or partially, without causing embolization, or occlusion of the renal artery. In a careful analysis of this series of 27 hypertensive patients with renal artery aneurysm, the authors could not angiographically demonstrate any cases of occlusion of the renal artery or its branches.

Renal artery aneurysm has been described to cause hematuria.⁷ In the present series this finding was on two occasions the main indication to operate. In one of these cases, with multiple peripheral aneurysms from hemangiomas, the hematuria was massive and disappeared completely following nephrectomy. It is not unlikely that renal artery aneurysms in certain cases may cause hematuria, but great care is, of course, needed to exclude other causes.

When Should Renal Artery Aneurysms Be Operated?

One of the main indications to operate on an aneurysm of any kind is the risk for rupture. This complication has been well documented in the literature.^{5,7} The few systematic studies that have been performed, either by studying conservatively treated series of patients with known aneurysms, or by analyzing autopsy series, has, however, failed to demonstrate any cases of rupture. Also, the two series reported here seem to indicate that the risk is smaller than generally thought. It can, therefore, not be justified to recommend surgery in a patient with an accidentally detected renal artery aneurysm only because of risk for rupture. The same statement can probably be made regarding the potential risk for thrombosis or embolization.

A patient with a confirmed renovascular hypertension with renal artery stenosis in the presence of renal artery aneurysm obviously should be operated, which usually means that also the aneurysm is excised. There is, however, no clear indication to operate a patient with com-

bination of renal artery aneurysm and hypertension unless it can be proven that the hypertension is renovascular.

Renal artery aneurysm has also been reported to cause flank pain and hematuria.^{6,7} This may be an indication to operate, but very often the symptoms may be coincidental with the aneurysm rather than caused by it.

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