

# Prevalence of renal artery stenosis in patients undergoing routine cardiac catheterization

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## ABSTRACT

**Objectives:** To determine the prevalence of renal artery stenosis (RAS) and associated risk factors in patients undergoing cardiac catheterization for suspected coronary artery disease.

**Methods:** Three hundred and fifty-four consecutive patients (71 female) were studied at the Cardiology Unit of King Abdullah University Teaching Hospital, Irbid, Jordan, between May 2002 and May 2003. Left-sided cardiac catheterization and abdominal aortography were performed to screen for coronary and renal artery disease.

**Results:** Of the 354 patients, 285 had coronary artery disease and 27 had RAS. Significant RAS was present in 11

patients. Patients with RAS were older ( $66 \pm 8$  versus  $59 \pm 10$ , mean  $\pm$  SD;  $p=0.004$ ), had higher incidence of systolic hypertension ( $156 \pm 14$  versus  $130 \pm 16$  mm Hg;  $p=0.005$ ), diabetes mellitus (72% versus 38%;  $p=0.004$ ), smoker (85% versus 55;  $p=0.005$ ), and had  $> 2$  coronary lesions.

**Conclusion:** The prevalence of significant and insignificant RAS is 3.1% and 4.5%. Diagnostic yield increase in elderly patient with  $>2$  coronary lesions, elevated systolic pressure, smoking, diabetes mellitus, and electrocardiogram criteria of left ventricular hypertrophy.

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Atherosclerosis is a diffuse arterial disease. It is a commonly recognized cause of renal artery stenosis (RAS).<sup>1</sup> The incidence of RAS in the general population is not known, but it was found to be from 22-44% in patients with peripheral vascular disease or abdominal aneurysm,<sup>2,3</sup> from 5-10% in hypertensive patients<sup>4</sup> and 17% in patients with hypertension and coexistent diabetes mellitus type 2.<sup>5</sup> The aim of this study is to determine the prevalence of RAS in patients undergoing cardiac catheterization for suspected coronary artery disease and to define variables that helps decide, which group of patients undergo renal artery visualization by abdominal aortography could be carried out.

**Methods.** A total of 354 patients who were referred for cardiac catheterization to exclude coronary

artery disease were studied at the Cardiology Unit of King Abdullah University Teaching Hospital, Irbid, Jordan, between May 2002 and March 2003. The reported blood pressure is the mean of at least 2 measurements taken the day before angiography. Blood and urine samples were taken before and after cardiac catheterization after an overnight fast. A 12-lead electrocardiogram (ECG) was carried out before cardiac catheterization for left ventricular hypertrophy using Sokolow-Lyon criteria. Under local anesthesia, percutaneous access was gained with Seldinger technique through the right femoral artery. Left and right coronary angiogram was performed followed by left ventriculography. Abdominal aortogram was performed in the anterior-posterior projection with Omnipaque 350 injected at a rate of 20 mL's to a total volume of 20 ml at a pressure of 700

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PSI. The injection was recorded at 30 frames per second. An angiographically significant coronary artery disease and RAS were defined by narrowing of the lumen of >50%. All patients were kept on intravenous fluid at a rate of 70 ml/hour during and 5 hours after the procedure. Urine out-put was observed for the first 6 hour.

**Statistical analysis.** Data were analyzed using the Statistical Package for Social Sciences. Continuous variables are presented as mean  $\pm$  SD. Continuous variables between the groups were compared by using the paired Student t-test and categorical variables were compared by Chi-square test.

**Results.** A total of 354 patients were studied, 87 females and 267 men. Significant coronary artery disease was identified in 27 (7.6%) of the patients. Renal artery stenosis was identified in 7.6% of the patients. Insignificant RAS was found in 16 (4.5%) and significant RAS was identified in 11 (3.1%) patients. Renal artery stenosis group was composed of 11 (3.1%) patients. The clinical characteristics of RAS and non-RAS groups are shown in **Table 1**. Patients with RAS were older ( $66 \pm 9$  versus  $59 \pm 10$  years; mean difference 7 years,  $p=0.004$ ). Diabetes mellitus (72% versus 38%;  $p=0.004$ ), hypertension (91% versus 62%;  $p=0.008$ ), and smoking (85% versus 55%;  $p=0.005$ ) were more frequent in the RAS group. Differences in sex and hyperlipidemias were not significant between the 2 groups. Systolic hypertension, pulse pressure, serum urea, and serum creatinine were higher in the RAS group (**Table 2**). Stenosis of the left anterior descending artery, circumflex artery, right coronary artery coronary artery were more frequent in patients with RAS. The frequency of RAS increased with the number of stenotic segments. The blood pressure, blood test, results, 52ECG, and coronary angiographic findings are shown in **Table 2**. The renal artery angiographic are shown in **Table 3**. Renal artery stenosis was identified in 27 (7.6%) of patients. Insignificant RAS was found in 16 (4.5%) and significant stenosis was found in 11 (3.1%). Significant unilateral disease was present in 2.3% and bilateral disease was present in 0.5%. Proximal third of renal artery was the main site in both significant and insignificant stenosis (90% and 81%).

**Discussion.** In this study, the prevalence of angiographically RAS was 7.6%. Significant RAS was 3.1% lower than previously reported values in the range of 11-23%.<sup>6-9</sup> Among patients with atherosclerotic RAS, progressive stenosis was reported in 51% after 5-years of diagnosis,<sup>10,11</sup> renal atrophy developed in 21%, and total occlusion in 3-16%.<sup>12</sup> Thus, atherosclerotic RAS is a progressive disease, particularly in patients with diabetes or other manifestations of atherosclerosis. ACE inhibitors and

**Table 1** - Clinical characteristics.

Characteristics	Without renal artery stenosis Mean $\pm$ SD	With renal artery stenosis Mean $\pm$ SD	p value
N	343	11	
Age	$59 \pm 10$	$66 \pm 9$	0.004
Gender			non-significant
Male	276	7	
Female	67	4	
Hypertension (%)	62	91	0.005
Diabetes mellitus (%)	38	72	0.004
Smoking (%)	55	85	0.005
Hyperlipidemia (%)	8	10	non-significant

**Table 2** - Blood pressure, blood tests, electrocardiogram, and angiographic results.

Characteristics	Without renal artery stenosis	With renal artery stenosis	p value
Systolic BP (mm Hg)	$135 \pm 18$	$152 \pm 14.3$	0.005
Diastolic BP (mm Hg)	$81 \pm 18.2$	$79 \pm 14.4$	NS
Pulse pressure (mm Hg)	$45 \pm 11$	$82 \pm 16.2$	<0.001
LAD stenosis (n)	114	10	<0.001
CX stenosis (n)	64	8	0.003
RT stenosis (n)	110	9	<0.001
First stenotic coronary segment (n)	90	0	NS
Second stenotic segments (n)	77	1	NS
Third stenotic segments (n)	89	6	<0.001
Fourth stenotic segments (n)	29	4	<0.001
Serum urea (mg/dl)	$38 \pm 10$	$48 \pm 16$	0.030
Serum creatinine (mg/dl)	$1.0 \pm 0.2$	$1.3 \pm 0.6$	0.045
Hemoglobin (g/dl)	$13.4 \pm 1.1$	$13.5 \pm 1.2$	NS
LDL (mg/dl)	$142 \pm 36$	$134 \pm 33$	NS
HDL (mg/dl)	$36 \pm 14$	$38 \pm 15$	NS
Sinus rhythm	238	10	NS
Left ventricular hypertroph (ECG)	65	8	0.003

BP - blood pressure, LAD - left anterior descending artery, CX - circumflex artery, RT - right coronary artery, LDL - low-density lipoprotein, HDL - high-density lipoprotein, ECG - electrocardiogram, RAS - renal artery stenosis, NS - non-significant

**Table 3** - Renal angiography result.

Characteristics	Significant renal artery stenosis >50% n (%)	Insignificant renal artery stenosis <50% n (%)
N	11 (3)	16 (4.5)
Unilateral renal artery stenosis	8 (2.3)	12 (3.4)
Bilateral renal artery stenosis	2 (0.5)	4 (1.1)
Total occlusion	1 (0.2)	0
Proximal third	10 (90)	13 (81)
Mid-third	1 (10)	3 (19)
Distal third	0	0

angiotensin-receptor blockers are effective in 86-92% of these patients as antihypertensive drugs,<sup>13</sup> but the loss of renal mass and a reduction in transcapillary filtration pressure can produce acute or chronic renal insufficiency, especially in bilateral stenosis.<sup>14</sup> Atherosclerotic RAS may be overlooked as a cause of renal insufficiency,<sup>15,16</sup> but it should be considered, since it is potentially reversible when treated early.<sup>17-19</sup> Contrast nephropathy has to be considered in diabetics, patients with renal insufficiency, and when high contrast dose (>100 ml) is used.<sup>20</sup> Adequate hydration prior to the contrast study is of paramount importance to prevent contrast nephropathy in high risk patients.<sup>21</sup>

In conclusion, RAS is present in a significant proportion of patients undergoing cardiac catheterization for suspected coronary artery disease. The probability of having significant RAS is increased in elderly patients with systolic hypertension, diabetes mellitus, smoking, renal impairments, and diffuse coronary artery disease. Abdominal aortogram is a safe procedure and associated with low morbidity. Abdominal aortogram should be considered in the above mentioned group of patients for detection and possibly reduce the progression of renal artery atherosclerosis with aggressive medical and surgical treatment.

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