Original Research Article Journal of National Heart & Lung Society Nepal

Vol-5. No. 1, Jan-Jun 2026 DOI:10.3126/jnhls.v5i1.96213 ISSN: 2091-0657 (Online & Print)

Prevalence of Renal Artery Stenosis in Patients Undergoing Coronary Angiography and its predictors

Krishna Prasad Adhikari[1], **Rabi Malla**[2]

[1]Department of Cardiology, National Academy of Medical Sciences, Bir Hospital, Kathmandu, [2]Department of Cardiology, Shahid Gangalal National Heart Centre, Bansbari, Kathmandu, Nepal

Received: 17th May, 2026 Accepted: 28th June, 2026 Published: 28th June, 2026

ABSTRACT

Background: Renal artery stenosis (RAS) causes secondary hypertension, progressive renal insufficiency and flash pulmonary edema. This study evaluates the prevalence of renal artery stenosis in patients undergoing coronary angiography and to assess its predictors.

Methods: It was a prospective observational study involving 207 patients who underwent coronary angiography and screened for the presence of renal artery stenosis in Shahid Gangalal National Heart Centre (SGNHC) from September 2014 to June 2015. Demographic, clinical, angiographic and lab parameters were statistically analyzed using SPSS 16..

Results: Among the 207 patients, 135(65.21%) were male and 72(34.78) were female. Mean age was 57.12 ±10.01 years. Among conventional risk factors, hypertension was most prevalent (58.93%) followed by hypercholesterolemia (53.43%), smoking (38.64), family history of ischemic heart disease (27.53%) and diabetes (19.81%). Coronary artery disease (CAD) was present in 54.10% (n=112) with left main disease, triple vessel disease, double vessel disease and single vessel disease in 4,22,37,49 patients respectively. RAS was present in 18.35% (n=38); thirty in patients with CAD and eight in patients without CAD. Thirty four (16.42%) patients had unilateral RAS and 17 (8.21%) patients had significant RAS defined as more than 50% stenosis. Among patients with CAD, significant RAS was associated with age > 65 years (p=0.001), hypertension (p=0.001), extent score >4 of coronary artery disease (0.037) and triple vessel disease (p=0.05).

Conclusion: The prevalence of total cases of RAS in patients undergoing CAG was 18.35 % out of which 8.21% had significant RAS. The high risk subsets of RAS in patients with CAD can be predicted from coronary angiography and demographic features. Patients of advancing age, multivessel CAD, high extent score>4, hypertension and positive family history of IHD were the high risk subsets for probable RAS.

Keywords: Anemia; Acute coronary syndrome; Outcomes; Prevalence; Severity

Correspondence: Dr. Krishna Prasad Adhikari, Department of Cardiology, National Academy of Medical Sciences, Bir Hospital, Kathmandu, Email:kpadhi01@yahoo.com, Phone: 977-9812140797.

INTRODUCTION

Renal artery stenosis (RAS) is an important but frequently unrecognized clinical condition. Its etiopathogenesis is similar to other atherosclerotic diseases like coronary artery disease (CAD), cerebrovascular disease (CVD) or peripheral arterial disease (PAD).[1] The detection of significant RAS is clinically important as it can perpetuate the progression of associated cardiovascular disease due to renovascular hypertension and lead to heart failure due to cardiorenal syndrome with renin angiotensin aldosterone system (RAAS) activation.[2] Among patients with suspected CAD undergoing diagnostic coronary angiography, presence of RAS carries important prognostic implications. It was independently associated with a 2-fold increased risk of all cause mortality.[3] Four year survival among patients undergoing catheterization was 21% lower among patients with established RAS compared those without RAS.[4] Reported RAS prevalence varies greatly because of different study populations and selection criteria (hypertension, ischemic heart disease, peripheral arterial disease, chronic kidney desease).[5] In a systematic review and metaanalysis of 31 studies, 13.4% of patients undergoing coronary angiography had significant RAS out of which 6.5% had severe RAS (more than 70% stenosis) and 3.7% had bilateral RAS.[6] The objective of the study is to examine the prevalence and predictors of atherosclerotic RAS in patients with coronary artery disease.

METHODS

This is a hospital based prospective observational study. It was carried out at a single interventional unit of the Shahid Gangalal National Heart Centre (SGNHC), Kathmandu, Nepal, during the period of September 2014 to June 2015. We enrolled 211 consecutive patients who underwent coronary angiogram for known or suspected CAD. They were then screened for the presence of renal artery stenosis through the use of aortography at first lumbar vertebral level with the 5F pigtail catheter using power injector or selective renal angiography using JR catheter by hand injection from either radial or femoral access after taking informed written consent. Patients with known renal artery stenosis, renal impairment, below 30 years of age, peripheral artery disease and those undergoing percutaneous coronary intervention in the same setting were excluded from the study. Significant coronary artery stenosis was defined as>50% stenosis. Less than 50% stenosis are non-critical coronaries. Multivessel disease is defined as either double vessel disease or triple vessel disease. Extent score is calculated by summing up score of 1, 2or 3 for <10%,10 to 50% or >50% respectively of length of 15 segments of coronary arteries. Significant RAS was defined as >50% narrowing in one or both of the main renal arteries. Ethics committee approved the study protocol. Demographic and clinical parameters of patients were recorded. Collected data were edited and coded manually. Then it was statistically analysed using computer based SPSS 16 version programme. Demographic and clinical characteristics were given as mean + SD and percentage. Bivariate analysis was used to determine the predictors of RAS. A p-value <0.05 was considered statistically significant.

RESULTS

The study consisted of 207 patients, of which 135 were male and 72 were female (male female ratio of 1.87:1). The mean age of the population was 57.12+9.98 years

Table 1. Coronary angiogram (CAD) And Renal angiogram (RAG) profile

Variables	n(%)
Coronary angiogram (CAD) profile	
Normal	95(45.89)
Coronary artery disease present	112(54.11)
Single vessel disease	49(43.75)
Double vessel disease	37(33.04)
Triple vessel disease	22(19.64)
Left main disease	4(3.57)
Renal angiogram (RAG) profile	
Normal	169 (81.64)
Renal artery stenosis	38 (18.35)
Insignificant	21 (10.14)
Significant	17 (8.21)

with a range of 31-82 years. Among the CAD risk factors, hypertension was the commonest (58.93%) followed by hypercholesterolemia (53.43%), smoking (38.64%), family history of ischemic heart disease (27.53%) and diabetes mellitus (19.81%). History of myocardial infarction was present in 69 (33.33%), unstable angina in 25 (12.07%), stable angina pectoris in 102(49.27%) and left ventricular systolic dysfunction in 11(5.31%) of patients. Coronary angiogram was normal in 45.89% (n=95) cases and lesion was present in 54.10 % (n=112) cases. Among the patients with CAD, 23.67% (n=49) had single vessel disease, 17.87 % (n=37) had double vessel disease, 10.62 percent (n=22) had triple vessel disease and 1.93% (n=4) had left main disease (Table 1). Table 3 shows significant association of hypertension and family history of ischemic heart disease with renal artery stenosis in patients with coronary artery disease. There was no significant association of diabetes, smoking and serum cholesterol with renal artery stenosis. RAS was present in 34.92 percent (n=22) patients with multivessel disease as compared to 16.32 percent (n=8) patients with SVD (p=0.027). There was significant association of CAD extent score >3 with RAS (p=0.026). Fifty percent of patients with CAD extent score >3 had RAS as compared to 14.86 percent patients with CAD extent score <3. Table 4 shows the bivariate test with 11 variables analyzed for association with significant RAS. The most important predictor of significant renal artery stenosis was age >65years followed by hypertension, CAD extent score >4 and triple vessel disease. Family history of ischemic heart disease was found to predict total RAS,

Table 2. Distribution of renal artery stenosis (RAS) by risk factors of CAD in patients with coronary artery disease (CAD) (n=112)

Variables	RAS		P value
	Absent n(%)	Present (n(%)	
Hypertension			
Absent(n=49)	41 (83.67%)	8 (16.32%)	
Present (n=63)	41 (65.07%)	22 (34.92%)	0.027
Diabetes mellitus			
Absent (n=83)	62 (74.69%)	21 (25.30%)	0.548
Present (n=29)	20 (68.96%)	9 (31.03%)	
Family history of IHD			
Absent (n=66)	54 (81.81%)	12 (18.18%)	0.013
Present (n=46)	28 (60.86%)	18 (39.13%)	
Smoker			
Absent (n=51)	38 (74.50%)	13 (25.49%)	0.777
Present (n=61)	44 (72.13%)	17 (27.86%)	
Serum Cholesterol(mg/dl)			
≤200 (n=76)	56(73.68%)	20(26.31%)	0.52
≥200 (n=36)	26(72.22%)	10(27.77%)	

Table 3. Variables analyzed by bivariate analysis to identify predictors of significant renal artery stenosis (n=16) in patients with coronary artery disease (n=112)

Variables	χ^2	P value
Age >65 years	12.14	0.001
Hypertension	10.571	0.001
Extent score≥4	4.348	0.037
Triple vessel disease	3.771	0.05
Diabetes mellitus	1.291	0.254
Family history of IHD	0.615	0.433
Hypercholesterolemia	0.433	0.511
Body mass index (BMI)	0.162	0.689
Smoking	0.024	0.877
Sex	0.008	0.928
Ejection fraction <50%	0.007	0.934

but was not found to predict significant RAS. The advancing age >65 years, hypertension and severity of coronary artery in terms of extent score were found to predict both significant and total RAS. Multivessel coronary artery disease was predicting total RAS but only TVD was predicting significant RAS.

DISCUSSION

Atherosclerosis is the primary cause of RAS.7 As atherosclerosis is diffuse in nature, patients with coronary artery disease are expected to have increased risk of renal artery disease.[8,9] The incidence of RAS in patients undergoing coronary angiogram in different studies varies from 3% to 30% and the incidence of severe RAS varies from 4% to 15 percent.[10] These differences may have occurred due to different patient selection and diagnostic approach. In our study, all lesions found were focal and were occurring within proximal third of the renal arteries hence were identified as atherosclerotic in etiology. This study has shown that the prevalence of RAS is 18.35% in patients undergoing coronary angiography. Significant RAS defined as more than 50% stenosis was present in 8.21% of patients. Unilateral RAS was present in 89.47 %(n=34) whereas 10.52% (n=4) had bilateral RAS. Predominant Unilateral affliction is in agreement with most other studies. Advancing age (> 65 years), hypertension and severe coronary artery disease like triple vessel disease and CAD extent score more than 4 are the risk factors for RAS. Performing renal angiography after cardiac catheterization seems to be appropriate in patients with these risk factors. Marcantoni[5] et al have found the significant RAS prevalence of 5.4% in their study. The presence of peripheral vascular disease, eGFR<67 ml/min/1.73m^2, age>66 years, dyslipidemia, CAD severity and pulse pressure> 52 mmHg were independent clinical predictors of significant RAS. Significant RAS prevalence in our study was little higher than this study. Age more than 65 years, hypertension and CAD severity were predictors of significant RAS in our study. Peripheral vascular disease was not evaluated in our study whereas patients with renal impairment were excluded from our study. Dyslipidemia was not the predictor of significant RAS in our study. In another study, Buller et al.11 performed renal angiography after cardiac catheterization in 851 patients who had at least one major risk factor such as severe hypertension, unexplained renal dysfunction, acute pulmonary edema due to hypertension and severe atherosclerosis. Total renal artery stenosis was present in 39% of the patients, but >50% stenosis was observed in 14.3%. In our study, the reason for the relatively low prevalence of RAS may be due to selection of patients regardless of RAS risk factors and our patients were younger with mean age of 57 years compared to mean age of 65 years in study by Buller et al. In a study performed by Kobo et al.12, total RAS prevalence was 36.9%, whereas significant RAS defined as narrowing more than 70% was prevalent in 9.1% in 450 patients undergoing coronary angiography and had risk factors like peripheral arterial disease, resistant hypertension, renal failure and pulmonary edema. This prevalence is higher than ours because of selection criteria with more risk factors. A study in China, by Shen et al. showed that RAS is frequent finding in patients of CAD, especially with triple vessel disease patients and hypertension being closely related with RAS.13 In another study, by Gross et al. concluded that RAS of any grade of severity was strongly associated with triple vessel disease.[14] Inclusion of renal angiography added no incremental risk to coronary angiography in our study. No episode of contrast induced nephropathy was observed. The cost of contrast agent and image interpretation are small. According to Richard Stack, routine performance of an aortogram on the way out is not an unreasonable option.[15,16] In 2003, Khosla and Kanjummen suggested that both the putative risk of progressive disease and benefits of endovascular intervention justify routine screening with renal angiography while doing cardiac catheterization in such patients, with the prospect of stent revascularization when such lesion is identified.[17] There are no other studies of this type in Nepal. Several studies world over have established the potential of this screening for knowing long term vascular disease progression. The patients with high

grade RAS will benefit from vascular intervention. Having information about the presence, severity, and bilaterality of renovascular disease obtained during angiography for other reasons, such as coronary angiography, offers a promising method for further investigating this disease.

CONCLUSIONS

Renal angiography should be performed in patients undergoing coronary angiography especially with patients of advancing age, hypertension and severe coronary artery disease. Further studies designed with a higher number of patients who have specific risk factors for RAS are needed.

Limitations

The limitations of our study was relatively lower number of patients, and including patients regardless of the specific risk factors.

Conflict of interest: None

Funding: None

Availability of data and materials

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

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Citation: Adhikari KP, Malla R. Prevalence of Renal Artery Stenosis in Patients Undergoing Coronary Angiography and its predictors. JNHLS. 2026; 5(1):11-16.