PREVALENCE OF RENAL ARTERY STENOSIS IN PATIENTS UNDERGOING CORONARY ANGIOGRAPHY

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ABSTRACT

BACKGROUND

Renal Artery Stenosis (RAS) is an independent risk factor for cardiovascular diseases. The present study was designed to assess the prevalence of renal artery stenosis in patients with Coronary Artery Disease (CAD) who underwent Coronary Angiography (CAG).

MATERIALS AND METHODS

The consecutive CAD patients undergoing CAG and renal angiography were studied from November 2000 to July 2004. The presence of risk factors such as age, hypertension, diabetes, left ventricular function and myocardial infarction were assessed. The degree of arterial stenosis was categorised into mild, moderate and severe and at least 50% narrowing of the arterial lumen was considered as arterial stenosis. Data was analysed by using SPSS 20.0 software.

RESULTS

Out of 878 patients, the prevalence of RAS was calculated as 33 (3.8%) patients, the majority of them were male (75.9%). Out of 33 patients, 19 (57.6%), 6 (18.2%) and 8 (24.2%) patients were classified as mild, moderate and severe RAS, respectively. Using multiple variables including age, sex, hypertension, diabetes mellitus, multivessel disease and left ventricular dysfunction patients were considered as predictors of RAS. The significant number of a patient had unilateral 18 (54.5%) and 11 (33.3%) bilateral RAS observed from renal angiography.

CONCLUSION

The present study suggests that the renal angiography in combination with coronary artery angiography in CAD patients provides the opportunity for identification of RAS.

KEYWORDS

Coronary Artery Disease; Renal Angiography; Renal Artery Stenosis.

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BACKGROUND

Renal Artery Stenosis (RAS) was defined as any vascular lesion causing narrowing of the renal artery thereby impairing blood flow to the kidney. RAS is often present without any clinical signs or symptoms and is one of the aetiological factors for renal insufficiency and hypertension and atherosclerosis.[1] Progression of Atherosclerotic Renal Artery Stenosis (ARAS) disease leads to renal atrophy over a period and chronic kidney disease despite the control of hypertension. Angioplasty of ARAS with renal artery stenting is a beneficial treatment strategy to restore and preserve renal function and to control blood pressure.[2]

The mortality rate in patients with cardiovascular disease increases in the presence of RAS. The occurrence of RAS ranges from 3-30% in CAD patients with varying severity who underwent Coronary Angiography (CAG). There is a linear relationship between RAS and severity of CAD, but act as an independent predictor of mortality in CAD patients. The treatment of RAS would act as a remedy for severe hypertension and ischaemic nephropathy. However, RAS remains carefully observed, because most patients with RAS have no signs or symptoms.[3,4] The presence of ARAS exacerbates the CAD and course of the medical condition. There was a strong relation between systemic hypertension and RAS because of pathophysiologic stimulus, including activation of the renin-angiotensin system by RAS, hypertension triggered by ischaemic nephropathy and aggravation of renal atherosclerosis by hypertension.[5,6]

Hence, performing the renal angiography reduced the progression of RAS during Coronary Angiography (CAG) as it can be safe and cost-effective diagnostic approach in patients with CAD.[3] However, regular assessment of RAS in asymptomatic patients suffering from CAD is difficult to endorse, because of the lack of experience for clinical benefits related to renal artery intervention in patients with RAS.

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Aims and Objectives- The aim of this study was to evaluate the prevalence of RAS in patients with CAD who were admitted for CAG.

MATERIALS AND METHODS

From November 2000 to July 2004, renal angiography was performed in patients undergoing coronary angiography at Department of Cardiology, Government Medical College, Kozhikode, Kerala, India.

Patient Selection- This study included male or non-pregnant female patients ≥18 years of age with a diagnosis of angina equivalents of class III or IV severity, angina of less severity, but having positive treadmill exercise stress test at low workloads or delayed recovery of depressed ST segments, atypical chest pain syndromes. Additional eligibility criteria were the presence of post myocardial infarction patients who are positive for inducible ischaemia on exercise stress test.

Procedure- All patients were subjected to a pre-procedure clinical evaluation, which included a thorough history and physical examination pertaining to the cardiovascular system. ECGs were taken for all eligible patients and were subjected to a treadmill exercise stress test on the standard Bruce or modified Bruce protocol. Echocardiographic evaluation was done for all to assess regional wall motion abnormality and Left Ventricular Function (LF). Informed consent from all participants was obtained before the procedure. Coronary angiography was performed preferably with Judkins left and right coronary catheters of appropriate size. After completion of coronary angiography, the Judkins right catheter was withdrawn into the abdominal aorta and renal arteries were selectively cannulated. Diameter stenosis in percentage was recorded. Less than 50% stenosis was classified as mild; 50-75% as moderate and >75% as severe. The incidence of renal artery stenosis and its relation to gender, prevalence of hypertension and CAD were determined. In addition, the incidence of a positive treadmill exercise stress test population was estimated.

RESULTS

A total of 1101 patients with CAD proven by CAG and consecutive CAG conducted over a period from November 2000 to July 2004 were studied. Renal angiograms were done in 878 patients. Most of the patients were males (666; 75.9%). The disposition of patients who underwent renal angiogram to detect RAS is outlined in Figure 1.

Renal artery stenosis was detected in 33 (3.8%) patients (Table 1). There were 10 (30.3%) women and 23 (69.7%) men. The RAS was further graded as mild (<50%), moderate (50-70%) and severe (>75%). Among 33 patients, 19 (57.6%), 6 (18.2%), 8 (24.2%) subjects have having mild, moderate and severe RAS, respectively. Out of 33 patients, 9 (27.3%) cases were diabetic and 24 (72.7%) were non-diabetic patients. Whereas, 13 (39.4%) were hypertensive and 20 (60.6%) were non-hypertensive patients. Among 13 hypertensive patients, 9.1% had moderate RAS and 15.2% had severe RAS. Among 33 patients, only 3 had normal coronary arteries. The prevalence of RAS for Single Vessel Disease (SVD), Left Main Coronary Artery (LMCA), Double Vessel Disease (DVD) and Triple-Vessel Disease (TVD) were in 1, 2, 13 and 14, respectively. Approximately, one-quarter of 9 (27.3%) patients had an incidence of LF dysfunction and 19 (57.6%) had a prior myocardial infarction. Of 33 patients, 18 (54.5%) individual had unilateral RAS followed by 11 (33.3%) patients suffering from bilateral RAS. Furthermore, positive treadmill exercise stress test (20; 60.6%) was represented notably higher in patients suffering from RAS (Figure 2). Out of 33 RAS participants, 30 (91%) cases illustrated the lesion was ostial (Figure 3). Amongst those with mild stenosis, 5 (15.2%) had involvement of left renal artery, 11 (33.3%) had involvement of right renal artery and 3 (9.1%) had bilateral involvement. Moderate stenosis was observed only in 3 patients on either side of the kidney.

Variables	Renal Stenosis (n=33)		
	Mild (<50%)	**Moderate (50-75%)**	**Severe (<75%)**
Male	12 (36.3%)	5 (15.2%)	6 (18.2%)
Female	7 (21.2%)	1 (3.0%)	2 (6.1%)
Age			
<50	6 (18.2%)	1 (3.0%)	3 (9.1%)
51-60	6 (18.2%)	2 (6.1%)	1 (3.0%)
>60	7 (21.2%)	3 (9.1%)	4 (12.1%)
Disease Condition			
Diabetic	7 (21.2%)	1 (3.0%)	1 (3.0%)
Non-diabetic	12 (36.3%)	5 (15.2%)	7 (21.2%)
Hypertensive	5 (15.2%)	3 (9.1%)	5 (15.2%)
Non-hypertensive	14 (42.4%)	3 (9.1%)	3 (9.1%)
CAD			
LMCA	1 (3.0%)	1 (3.0%)	0 (0%)
SVD	1 (3.0%)	0 (0%)	0 (0%)
DVD	9 (27.2%)	1 (3.0%)	3 (9.1%)
TVD	7 (21.2%)	5 (15.2%)	2 (6.1%)
Mild	2 (6.1%)	0 (0%)	1 (3.0%)
Normal	0 (0%)	1 (3.0%)	2 (6.1%)
LV Function			
Normal	15 (45.5%)	5 (15.2%)	4 (12.1%)
Dysfunction	4 (12.1%)	1 (3.0%)	4 (12.1%)
Myocardial Infarction			
IWMI	4 (12.1%)	2 (6.1%)	2 (6.1%)
AWMI	7 (21.2%)	1 (3.0%)	3 (9.1%)
Type of Stenosis			
Unilateral	15 (45.5%)	3 (9.1%)	0 (0%)
Bilateral	3 (9.1%)	4 (12.1%)	4 (12.1%)
Branch	1 (3.0%)	1 (3.0%)	2 (6.1%)
Site of Involvement			
Left renal artery	5 (15.2%)	3 (9.1%)	2 (6.1%)
Right renal artery	11 (33.3%)	3 (9.1%)	3 (9.1%)
Bilateral	3 (9.1%)	0 (0%)	3 (9.1%)

Table 1. Baseline and Frequency Distribution of Prevalence of Renal Artery Stenosis among Patients Undergoing Coronary Angiography

IWMI- Inferior Wall Myocardial Infarction; AWMI- Anterior Wall Myocardial Infraction.

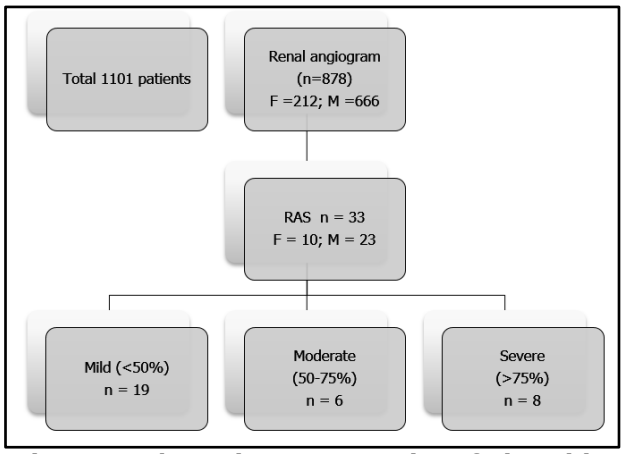

Figure 1. Schematic Representation of Disposition of Subjects who Underwent Renal Angiogram to Detect Renal Artery Stenosis

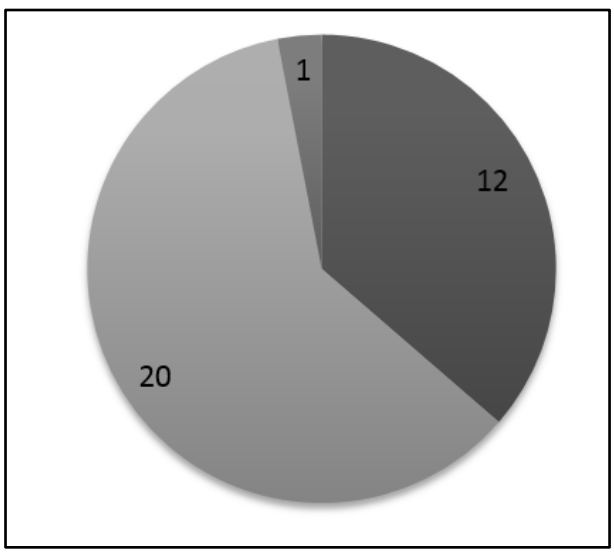

Figure 2. Association of Positive Stress Test in Renal Artery Stenosis Patients

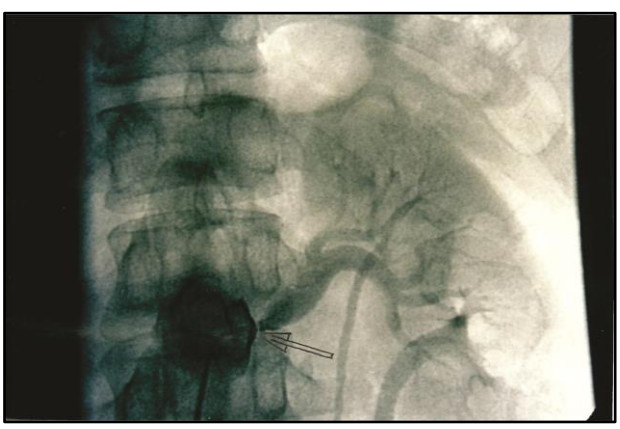

Figure 3. Angiogram of Left Renal Artery Showing Ostial Stenosis (Arrows)

DISCUSSION

Coronary artery disease is hardening and narrowing arteries that supply blood to heart muscle. It is commonly associated with atherosclerosis of cerebrovascular, peripheral and renal arteries. Some of the patients suffering from CAD may also have presence of RAS. Hence, there is need of a cardiologist to undertake a more global approach to patients with CAD.

The present study was conducted to determine the prevalence of RAS in patient population referred for diagnostic CAG suffering from CAD and its multiple variables were based on number of diseased coronary arteries, age, sex, history of systemic hypertension and diabetes mellitus, LV functions, type of myocardial infarction, type of stenosis and site of involvement. In this study, we have investigated 878 CAD patients who underwent renal angiography and found that the prevalence of RAS in this population was 33 (3.76%), which was relatively low as reported elsewhere.[6,7] The reported prevalence was usually between 14% and 20% depending on the study inclusion criteria, sample size and severity of renal stenosis criteria, presence or absence of peripheral arterial disease, serum creatinine concentration and presence of triple-vessel CAD or history of coronary artery bypass graft surgery.[6,8,9] The present findings suggest that males were more commonly affected by ARAS.

A majority of the study population had unilateral 18 (54.5%) RAS, while 11 (33.3%) of them suffered from bilateral RAS and only 4 (12.1%) had branch RAS. On the other hand, previously published prospective study revealed that 30% of patients diagnosed with RAS underwent coronary angiography of which 15% demonstrated that significant stenosis (11% unilateral and 4% bilateral).[10] The unilateral RAS was associated with increased renin and aldosterone levels that leads to vasoconstriction and increased peripheral vascular resistance. Furthermore, in bilateral RAS, both the kidneys activated renin and aldosterone flow causing retention of water and sodium to restore the volume and maintain hypertension.[11]

Diabetes and hypertension, common risk factors for atherosclerosis were not mainly related with significant RAS, because they were already reflected by other variables, specifically significant old age, CAD and LV dysfunction. The high predominance of hypertension in patients experiencing CAG also presented significant association between RAS and hypertension (39.4%). While in previously published literature, Rimoldi et al reported lower percentage of RAS (8%) in hypertensive patients.[12] On the contrary, prevalence of ARAS was estimated 13% as reported by Yamashita et al.[13] Accordingly, this discrepancy between published literatures partially correlated with the ethnic, regional and lifestyle pattern differences.

The prevalence of RAS in males was more commonly affected by atherosclerotic RAS and it was found to be significantly high in the patients with diabetes mellitus. Our study confirmed that age >60 years, male sex, multivessel disease and LV dysfunction patients were predictors of RAS.[6,14] The vast majority of patients with RAS had a positive exercise stress tests and incidence of LV dysfunction was more with increase in severity of RAS. These results are in agreement with study by Tumelero et al in which they concluded the presence of a strong relationship between LV dysfunction and RAS.[15]

For clinical investigation of CAD patients, it is difficult to perform renal angiography in all selected patients because

of the lack of evidence of benefit and low prevalence of RAS. Hence, a proper differentiation should be made in patient with considerable RAS who are at higher risk of cardiovascular events and need close surveillance. As in CAD patients, RAS is an independent predictor of mortality.[7,16] So, from the observations of cardiologist, it advisable to perform renal angiography at the time of CAG in selected patients undergoing CAG.

CONCLUSION

The present finding demonstrated that prevalence of renal artery stenosis observed in patients with coronary artery disease who underwent coronary angiography.

Limitations of the Study

The limitations of our study were small sample size and it is a single-center observational study. The study was done in selected patients with high probability of atherosclerotic vascular disease. Hence, other causes of RAS could not be assessed. As this is not a longitudinal study, the natural course of the disease could not be determined.

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