FREQUENCY AND PREDICTORS OF RENAL ARTERY STENOSIS IN PATIENTS WITH CORONARY ARTERY DISEASE

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Background: Renal artery stenosis (RAS) is a common finding in patients undergoing coronary angiography. We designed this study to look for the frequency and any predictors of renal artery stenosis in patients with coronary artery disease (CAD). **Methods:** A total of 201 consecutive patients with CAD confirmed by coronary angiography underwent an abdominal aortogram in the same sitting to screen for RAS. Patient demographics and co-morbidities were analysed for any association with RAS. **Results:** Forty-one of the patients were female (20.4%); ninety patients were hypertensive (44.8%); 49 patients (24.4%) were smokers; 19 patients (9.5%) had renal insufficiency; 88 patients (43.8%) had high cholesterol levels; 44 patients (21.9%) were diabetic. Thirty-two patients (15.9%) had single coronary artery disease, 59 patients (29.4%) had two vessel disease, and 110 patients (54.7%) had three vessel disease. Significant renal artery stenosis (≥50% stenosis) was present in 26 patients (12.9%). Among the variables studied, only female gender was found to be associated with a higher frequency of renal artery stenosis (24.39% vs 10.0%, p=0.01). **Conclusions:** The frequency of renal artery stenosis in patients with coronary artery disease is 12.9%. Female gender is associated with a higher frequency of renal artery stenosis in patients with CAD.

Keywords: Renal Artery Stenosis, Coronary Artery Disease, Atherosclerosis

INTRODUCTION

Renal artery stenosis (RAS) is one of the most common causes of secondary hypertension. More recently, attention has been focused on renal artery stenosis as a cause of chronic renal insufficiency, and end stage renal disease.[1,2] Both hypertension and chronic renal failure secondary to renal artery stenosis are potentially reversible disorders.[3-6] However, due to low prevalence and invasive nature of investigations, many of the patients, who could be benefited from revascularization procedure, could not be diagnosed.[3] For the same reasons, no true study of prevalence of RAS has been performed in an unselected population.[1,7]

Recently, some studies have been performed to look for some subsets of population, in which it is feasible to investigate for renal artery stenosis. This being an atherosclerotic process in the majority of cases, theoretically it would be associated with atherosclerotic disease elsewhere. Thus, many studies for its diagnosis have been carried out in patients with documented vascular diseases elsewhere in the body like Coronary Artery Disease and Peripheral Vascular Disease.[8-15]

We have designed this study to determine the frequency of renal artery stenosis in patients having coronary artery disease and look for any predictors of RAS in this patient population

MATERIAL AND METHODS

Data for this study was collected from October 2007 to April 2008 at the Department of Cardiology of Hayatabad Medical Complex, Peshawar and Lady Reading Hospital, Peshawar.

All those patients who underwent for coronary angiography and were found to have significant coronary artery disease were included into this study. Those patients who had undergone nephrectomy in the past, or were known cases of renal artery stenosis were excluded. Coronary angiography was performed in the Catheterization Laboratory of Lady Reading Hospital, Peshawar. Angiography was done using Judkins technique via right femoral artery. If the patient was found to have significant coronary artery disease, the pigtail catheter used for left ventriculogram, was pulled down into the abdominal aorta with its tip at the level of the body of L1 vertebra. An aortogram at this level was taken using digital subtraction, visualizing the renal arteries. The films so obtained were reviewed by two cardiologists and reported.

Two hundred and seven consecutive patients with CAD on coronary angiography underwent abdominal aortography to visualise the renal arteries. CAD was defined as more than 50% reduction in diameter of at least one major epicardial artery. RAS with more than 50% stenosis in diameter was considered as significant.

The relationship between RAS and age, gender, smoking, diabetes mellitus, hyperlipidemia, impaired renal function and hypertension was also studied. Written informed consent was obtained from each patient prior to the study. The data were analysed using SPSS 10. Having described the variables, we explored their associations with Chi-square test and p values below 0.05 were considered as statistically significant.

RESULTS

A total of 207 patients were included initially. Six patients were later excluded from the results. Four patients did not have significant coronary artery disease, and renal arteries were not properly visualized due to overlying mesenteric vessels in two patients

The final results included 201 patients. Mean age of the patients was 53.15±9.33 years (Range 29–74 years). There were 21 (10.44%) patients in the age group below 40 years, 68 patients (33.83%) between 41 and 50 years, 68 patients (33.83%) in the age group between 51 and 60 years, and 44 patients (21.89%) 61 years and older. Table-1 shows the baseline clinical characteristics of these 201 patients.

Renal artery stenosis was present in 47 patients (23.4%). However, significant stenosis (≥ 50% stenosis) was present in 26 patients (12.9%). The RAS was bilateral in 8 patients with five patients having at least one significant lesion. There were a total of 55 lesions (one of the patients had stenosis of all the three renal arteries), of which 33 lesions were significant (≥50% stenosis). Of these 33 lesions, 19 were osteal, 13 were proximal and only one lesion was in the mid segment of the main renal artery. No distal segment or branch lesions were seen in these patients.

Of the total number of 26 patients with RAS (≥50%), 13 (14.44 %) were in the hypertensive group and 13 (11.72%) were in the normotensive group (p=0.21) (Table 2). There were 44 patients (21.89%) older than 60 years of age, while 157 patients (78.11%) were 60 years or younger. Nine of the 44 patients (20.45%) older than 60 years had RAS, while 17 of the 157 patients (10.82%) 60 years or younger had RAS (p=0.08). Ten of the 41 females (24.39%) and 16 of the 160 male patients (10.0%) had renal artery stenosis (p=0.01). Six of the 44 diabetic patients (13.63%) had RAS while 20 of the 137 non diabetic patients (14.59%) had RAS (p = 0.17). Six of the 49 smokers (12.24%) and 20 of the 152 nonsmokers (13.15%) had RAS (p=0.54). Two of the 19 patients (10.52%) with renal insufficiency had RAS. On the other hand 24 of the 182 patients (13.18%) with normal renal function had RAS (p=0.53). Eighty-eight patients had high total cholesterol levels (>240 mg.). Eleven (12.5%) of these had RAS while 15 of the 113 patients (13.27%) with normal cholesterol levels had RAS (p=0.50).

When looking at extent of coronary artery disease, we divided the patients on the basis of number of vessels involved and disease in the left main coronary artery (Figure-1). There were 32 patients (15.9%) with single vessel disease, 59 patients (29.4%) had double vessel disease, and 110 patients (54.7%) had three-vessel disease. Two patients (6.25%), 11 patients (18.64%), and 13 patients (11.82%) had renal artery stenosis among these groups respectively (p=0.20). Left main stem disease was present in only 15 of the total 201 patients. Four of them had renal artery stenosis (p=0.14).

Thus, these results show that only female sex is associated with higher frequency of renal artery stenosis in patients with Coronary artery disease. Although there is a trend towards higher frequency of RAS in patients older than 60 years, the higher frequency is statistically not significant (p=0.08).

Table-1: Clinical characteristics of selected patients with coronary artery disease

Characteristics	Results
Number of patients	201
Male/Female	160/41
Age (mean±SD)	53.15±9.33 years.
Hypertension	90 (44.7%)
Renal insufficiency	19 (9.45%)
Hypercholesterolemia	88 (43.78%)
Diabetes Mellitus	44 (21.89%)
Smoking	49 (24.37%)
RAS	47 (23.38%)
Significant RAS	26 (12.9%)

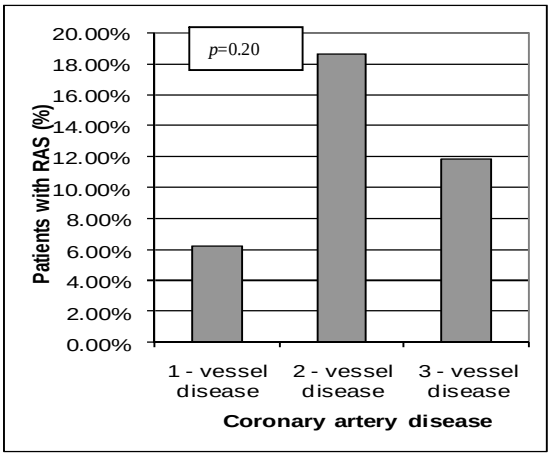

Figure-1: Frequency of RAS distributed according to the number of coronary arteries involved

Table-2: Frequency of RAS according to presence or absence of variables in patients with CAD

Variables		RAS	No RAS	p
Age (Years)	≤60	17 (10.82%)	140 (89.18%)	0.08
	>60	9 (20.45%)	35 (79.55%)	
Gender	Male	16 (10.0%)	144 (90.0%)	0.01
	Female	10 (24.39%)	31 (75.61%)	
Hypertension	Yes	13 (14.44%)	77 (85.56%)	0.21
	No	13 (11.72%)	98 (88.28%)	
Hyperlipidemia	Yes	11 (12.5%)	77 (87.5%)	0.50
	No	15 (13.27%)	9 (86.73%)	
Renal Insufficiency	Yes	2 (10.52%)	17 (89.48%)	0.53
	No	24 (13.18%)	158 (86.82%)	
Smoking	Yes	6 (12.24%)	43 (87.76%)	0.54
	No	20 (13.15%)	132 (86.85%)	
Diabetes Mellitus	Yes	6 (13.63%)	58 (86.37%)	0.17
	No	20 (14.59%)	137 (85.41%)	

Fig 2: A 58 years old male having tight stenosis of right renal artery in the proximal segment

DISCUSSION

Renal artery stenosis has long been associated with hypertension. More recently, chronic renal failure has also been identified as an important complication of RAS. Both these conditions are potentially reversible with revascularization techniques. However, identifying renal artery stenosis may be difficult as there are no definite clinical clues for suspecting RAS and the investigations used are comparatively invasive and expensive. That is why, in most cases, the diagnosis of renal artery stenosis is established during the course of evaluation for systemic hypertension.

Our study was designed to determine the frequency of renal artery stenosis in patients who had significant CAD. Association between renal artery stenosis and other clinical variables was then observed. This included, sex, age, hypertension, history of smoking, renal insufficiency, cholesterol levels, extent of CAD, and diabetes mellitus.

The standard renal angiography involves injecting the dye selectively in renal arteries.[16,17] This allows clear visualization of renal arteries from the osteum to the intra renal branches. To make our study less time consuming and more cost effective, instead of selective renal arteriography, we have used abdominal aortography at the level of renal arteries. The pigtail catheter that is used for left ventriculography is also used for visualizing the renal arteries. This reduces the time consumed in changing the catheter, the extra cost for renal artery catheters and trauma to the patient. Similar technique of flush aortography at the level of renal arteries has been used previously in similar studies.[9,18,19]

Our finding of a 12.9% prevalence of significant renal artery stenosis in patients with coronary artery disease is consistent with findings from previous studies (12-23%).[9,18-21] A number of studies done in the past to look for prevalence of renal artery stenosis in patients with CAD or undergoing cardiac catheterization, have also tried to look for predictive value of hypertension for RAS in their selected populations. Several studies have shown that hypertension is a good predictor of RAS in patients with CAD or undergoing coronary angiography.[19,20] However, in some studies, hypertension failed to predict the presence of RAS.[9,13,18]

One of the reason why hypertension in our study is not associated with RAS may be the degree of stenosis considered as significant. This fact was accidently highlighted by comparison of two studies done on the same cohort of patients. Harding *et al*[9] while studying the prevalence of RAS in patients undergoing cardiac catheterization, used 50% stenosis as the cut off point for significant RAS. Conlon *et al*[22], studying the same patient population (although many more were added), for effect of severity of renal artery stenosis on survival in patients undergoing coronary angiography, used 75% stenosis as the cut-off point. Harding *et al* did not find any predictive role of hypertension in these patients, while Conlon *et al* found that hypertension was a good predictor of RAS. Thus it seems that hypertension becomes relevant only when the renal artery stenosis becomes more severe, and future studies should use ≥75% stenosis as the cut off point for severity.

Association of female gender with renal artery stenosis is of interest because women are commonly not thought to have a high association with atherosclerotic disease, and RAS in older patients is most commonly due to atherosclerosis. However, this is not a new finding as similar results have been reported in several studies.[9-11] This association has been left unexplained at present.

With increasing age, the frequency of RAS is bound to increase as has been observed in several previous studies.[9,19,20] In our study also, renal artery stenosis is more frequent in older patients (>60 years age). However, this difference is not statistically significant. Unfortunately, the number of patients in old age group in our study is comparatively small and the mean age is much lower than the previous studies (53 years vs 60-69 years).[9,20] This seems to be the reason that the difference in frequency of RAS in younger and older patients in our study is not significant.

CONCLUSION

The results of our study show that renal artery stenosis is quite frequent in patients with CAD. Hypertension, which is one of the main predictors in general population, has no association with RAS (≥50%

stenosis) in patients with CAD. Only female gender is associated with a higher frequency of RAS in patients with coronary artery disease. Keeping in view the adverse consequences of RAS and the good results obtained after revascularization of renal arteries, efforts should be made and larger studies conducted to identify predictors of RAS in patients with CAD.

REFERENCES

1. Chonchol M, Linas S. Diagnosis and Management of Ischemic Nephropathy. Clin J Am Soc Nephrol 2006;1:172–81.
2. Spiniwitz BS. Renal artery stenosis. Available at: www.emedicine.com/med/topic 2001.htm. emedicine specialities>Nephrology>Hypertension and kidney. Updated: Feb 01, 2007.
3. Bloch MJ, Basile J. The Diagnosis and Management of Renovascular Disease: A Primary Care Perspective. J Clin Hypertens 2003;5:210–8.
4. Guerrero M, Syed A, Khosla S. Survival following renal artery stent revascularization: Four-year follow-up. J Invas Cardiol 2004;16:368–71.
5. Vetrovec G. Commentary: Renal Artery Stenting: Continuing to Evaluate the Benefits. J Invasive Cardiol 2004;16:372.
6. Christopher J. White. Catheter-Based Therapy for Atherosclerotic Renal Artery Stenosis. Circulation 2006; 113:1464–73.
7. Zoccali C, Mallamaci F, Finocchiaro P. Atherosclerotic Renal Artery Stenosis: Epidemiology, Cardiovascular Outcomes, and Clinical Prediction Rules. J Am Soc Nephrol 2002;13:S179–83.
8. Buller CE, , Nogareda JG, Ramanathan K, Ricci DR, Djurdjev O, Tinckam KJ, *et al*. The profile of cardiac patients with renal artery stenosis. J Am Coll Cardiol 2004;43:1606–13
9. Harding MB, Smith LR, Himmelstein SI, Harrison K, Phillips HR, Schwab SJ, *et al*. Renal artery stenosis: Prevalence and associated risk factors in patients undergoing routine cardiac catheterization. J Am Soc Nephrol 1992;2:1608–16.
10. Masoomi M, Azimzadeh BS, Nosrati SN, Raissi A. Prevalence of renal artery stenosis in hypertensive patients undergoing coronary angiography. ARYA J 2006;2(1):23–6.
11. Tumelero RT, Duda NT, Tognon AP, Thiesen M. Prevalence of Renal Artery Stenosis in 1,656 Patients who Have Undergone Cardiac Catheterization. Arquivos Brasileiros de Cardiologia 2006;87:213–8.
12. Weber-Mzell D, Kotanko P, Schumacher M, Klein W, Skrabal F. Coronary anatomy predicts presence or absence of renal artery stenosis. A prospective study in patients undergoing cardiac catheterization for suspected coronary artery disease. Eur Heart J 2002;23**:**1684–91.
13. Wang Y, Ho DSW, Chen WH, Wang YQ, Lam WF, Shen ZJ, *et al.* Prevalence and predictors of renal artery stenosis in Chinese patients with coronary artery disease. Int Med J 2003;33(7):280–5.
14. Sathyamurthy I, Jayanthi K, Subramanyan K, Ramachandran P, Mao R. Incidence of Renal Artery Stenosis in Patients Undergoing Coronary Angiography. (Letter). J Assoc Physicians India 2007;55:381–2.
15. Leertouwer TC, Pattynama PMT, Berg-Huysmans AVD. Incidental renal artery stenosis in peripheral vascular disease: A case for treatment? Kidney Int 2001;59:1480–3.
16. Neville C, House AA, Nguan CY, Beasley KA, Peck K, Thain LMF, *et al*. Prospective comparison of magnetic resonance angiography with selective renal angiography for living kidney donor assessment. Urology 2008;71:385–9.
17. Aqel RA, Zoghbi GJ, Baldwin SA, Auda WS, Calhoun DA, Coffey CS, *et al*. Prevalence of renal artery stenosis in high-risk veterans referred to cardiac catheterization. J Hypertension 2003;21:1157–62.
18. Jean WJ, al-Bitar I, Zwicke DL, Port SC, Schmidt DH, Bajwa TK. High incidence of renal artery stenosis in patients with coronary artery disease. Cathet Cardiovasc Diagn 1994;32:8–10.
19. Gross CM, Krämer J, Waigand J, Luft FC, Dietz R. Relation between arteriosclerosis in the coronary and renal arteries. Am J Cardiol 1997;80:1478–81.
20. Uzu T, Inoue T, Fujii T, Nakamura S, Inenaga T, Yutani C, *et al.* Prevalence and predictors of renal artery stenosis in patients with myocardial infarction. Am J Kidney Dis 1997;29:733–8.
21. Akram Z, Abbas T. The prevalence of renal artery stenosis in ischemic heart disease patients undergoing coronary angiogram. Pak J Cardiol 2004;15(3):103–7.
22. Conlon PJ, Little MA, Pieper K, Daniel B. Mark. Severity of renal vascular disease predicts mortality in patients undergoing coronary angiography. Kidney Int 2001;60:1490–7.

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