Original Article

Prevalence of Renal Artery Stenosis in Hypertensive patients on Treatment Undergoing Coronary Angiography; In Multi Cardiac Centers

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ABSTRACT

Objective: To determine the prevalence of renal artery stenosis.
Study Design: The cross-sectional study
Place and Duration of Study: This study was conducted at the Iraqi Center of Heart Diseases and Baghdad Cardiac Center Iraq from 1st August 2023 to 30th June 2024.
Methods: Sixty hypertensive patients who experience elective coronary angiography were enrolled. They were divided into two groups, controlled and uncontrolled hypertension.
Results: The mean age was 61.4 years and 53.3% males. The majority of them had uncontrolled hypertension (70%), diabetes (60%), and dyslipidemia (65%). Abnormalities were observed in 41.7 percent of patients on coronary angiography and the severe coronary disease was present in 25 percent. RAS was identified in 15 per cent and had a strong correlation with the abnormal angiography coronary findings (P = 0.002) and ineffective control of hypertension (P = 0.033). There was no significant correlation with diabetes, dyslipidemia, smoking, and echocardiographic outcomes.
Conclusion: Renal artery stenosis is one of the frequent observations in hypertensive patients with coronary artery disease, which requires effective blood pressure management and multidisciplinary approach to minimize cardiovascular and kidney problems.
Key Words: Hypertension, Renal artery stenosis, Coronary artery disease, Atherosclerotic.

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INTRODUCTION

Renal artery stenosis (RAS) is a vascular disease that has a massive impact on cardiovascular health of patients with hypertension and coronary artery disease (CAD).[1] It is a constriction of the renal artery(s) or arteries, causing less blood access to the kidneys and resulting in permanent high blood pressure, and eventual kidney failure.[2]

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Uncontrolled hypertension is considered to be one of the predisposing factors and outcomes of RAS.[3] The World Health Organization says that uncontrolled hypertension occurs when the blood pressure is 140/90mmHg or higher regardless of treatment or no treatment. Hypertension is a significant cause of stroke, heart attack and kidney disease and affects over 21 percent of the world adult population.[4]

Dysfunction in renal perfusion initiates the renin-angiotensin-aldosterone system (RAAS) leading to the release of angiotensin II and aldosterone which elevates blood pressure by causing vasoconstriction and sodium reabsorption. This produces a vicious cycle whereby hypertension worsens the RAS and CAD.[5] Renal artery stenosis makes CAD more difficult by enhancing myocardial ischemia because decreased renal blood flow imposes additional hemodynamic load on the heart, and it may trigger cardiac events.[6] Furthermore, the treatment of hypertension among CAD patients with RAS is complicated due to the fact that the usual antihypertensive medications may deteriorate the renal hypoperfusion. Thus, the maintenance of renal perfusion and blood pressure should be carefully combined with the efforts of interventional radiologists, cardiologists, and nephrologists.[7,8]

Imaging methods that are commonly used in diagnosing RAS include Doppler ultrasound, magnetic resonance angiography (MRA), computed tomography angiography (CTA), or conventional angiography, which are able to determine the extent and location of stenosis.[9] Renal artery stenosis-based interventions are necessary in hypertensive CAD patients to restore the renal perfusion, blood pressure, and cardiovascular risk of hypertensive patients.[10] It can be treated with pharmacological therapy with RAAS inhibitors, calcium channel blockers, and diuretics and revascularization, like percutaneous transluminal angioplasty (PTA) with or without a stent or surgery in selected cases.[11]

Renal artery stenosis may be categorized according to its cause. The most widespread form is called atherosclerotic RAS, which is caused by the accumulation of the plaque reducing the lumen of the renal artery and reducing the perfusion of the kidneys.[12] Fibromuscular Dysplasia (FMD) is a non-atherosclerotic, non-inflammatory disease that is associated with unusual growth of cells of the arterial walls and results in localized or generalized stenosis, and may be common among women younger than 50.[13] The congenital RAS is the result of inherited structural defects in the form of fibrous bands or inappropriate patterns of branching.[14] Traumatic RAS is caused by renal or abdominal trauma of a blunt trauma, or surgery.[15] Inflammatory RAS can be a by-product of autoimmune or infectious vasculitis.[5] Iatrogenic RAS is acquired after medical interventions that lead to the scarring of arteries i.e. catheterization[16], whereas Radiation-Induced RAS develops after abdominal or pelvic radiotherapy of cancers.[17]

There are a number of risk factors that are linked to RAS. The biggest determinant is age and the disease is more common among people above 50 years.[18] Hypertension, diabetes, smoking, and dyslipidemia favor atherosclerosis and lead to the narrowing of the arteries.[19] Familial history of cardiovascular disease, chronic kidney disease (CKD) and obesity also make one more susceptible.[20] Besides, ethnicity and gender also play a role in prevalence African Americans are at more risk, and RAS associated with FMD is more prevalent in women younger than 50.[21]

METHODS

The study was carried out in the Iraqi Center of Heart Diseases and Baghdad Cardiac Center, Iraq from 1st August 2023 to 30th June 2024 vide letter No. 4545/QM/Approval/4JKJD8 dated January 9, 2023 and 60 hypertensive patients who attended elective coronary angiography based on a referral following the detection of the presence of chest pain or ischemic signs with the help of non-invasive tests were enrolled. The patients were divided into controlled and uncontrolled hypertension (blood pressure below 140/90 mmHg and above 140/90 mmHg, respectively). The inclusion criteria were a history of treated hypertension and a referral to coronary angiography with exclusion criteria being serum creatinine greater than 1.5 mg/dl and excessive use of contrast. The complete data were gathered that included demographics, medical and family history, laboratory tests (CBC, RBS, HbA1c, blood urea, serum creatinine, uric acid, lipid profile), ECG, echocardiography, and findings of coronary and renal angiography. All angiogram optimally assessed by a qualified interventional cardiologist and RAS was determined under the basis of significant stenosis. The statistical analysis was conducted and calculated using SPSS-26.0. The categorical data were tested with 2-tailed 125, p = -0.05 as the statistically significant p-value.

RESULTS

The mean age was 12.18±6.8 years. Most of the patients, 73.04% had poor control of hypertension, 36 (60%) patients had history of DM with an average of 11.53±6.04 years and 21 (35%) patients had history of IHD. None of the patients was chronic kidney disease (CKD). Another 39 (65%) patients and 27 (45%) patients were on statin therapy. Smoking was a common characteristic among the respondents with 33 (55%) patients being identified as smokers. Also, when analyzing premature coronary artery disease (CAD) 18 (30%) patients, a sedentary lifestyle was observed, 39 (65%) patients had a positive family history (Tables 1-2).

A strong and statistically significant association between renal and coronary angiography findings (P = 0.002). Among patients with abnormal renal angiography, 88.9% also had abnormal coronary results, while only 11.1% showed normal coronary findings. However, no significant relationship was found between the site of renal lesions (ostial or proximal) and coronary outcomes (P=0.134), nor between the severity of renal lesions (critical or intermediate) and coronary results (P=0.134) [Table 3].

The duration of hypertension showed no significant difference between patients with abnormal and normal renal findings (P = 0.780). However, hypertension control was the only factor significantly associated with renal results - patients with well-controlled blood pressure all had normal renal findings, while 21.4% of those with poorly controlled hypertension showed abnormalities (P = 0.033). Diabetes, dyslipidemia, and smoking showed no significant associations with renal angiography outcomes (P = 0.238, 0.103, and 0.445, respectively), though abnormal findings were slightly more frequent among diabetics, dyslipidemic patients, and smokers. Overall, poor hypertension control emerged as the main clinical factor linked to abnormal renal angiography results, emphasizing the importance of effective blood pressure management in preventing renal vascular complications (Table 4).

Table No. 1: Descriptive statistics of the patients

Variable	Mean±SD
Duration of hypertension	12.18±6.8
Systolic blood pressur	154.3±23.5
Diastolic blood pressure	90.9±16.3
Duration of diabetes mellitus	11.53±6.04

Table No. 2: Demographic features of the patients

Variable	Category	No.	%
Control of hypertension	Good	18	30.0
	Poor	42	70.0
Diabetes mellitus	No	24	40.0
	Yes	36	60.0
Control of diabetes mellitus	Good	11	18.3
	Poor	25	41.7
Ischemic heart disease	No	39	65.0
	Yes	21	35.0
Chronic kidney disease	No	60	100
	Yes	0	0.0
Dyslipidemia	Negative	21	35.0
	Positive	39	65.0
Use of statins	Negative	33	55.0
	Positive	27	45.0
Smoking status	Negative	27	45.0
	Positive	33	55.0
Sedantary life style	Negative	42	70.0
	Positive	18	30.0
Family history of premature Coronary artery disease	Negative	21	35.0
	Positive	39	65.0

Table No. 3: Distribution of renal artery stenosis, side and severity with coronary angiography findings

Variable for renal angiography		Coronary angiography				P value
		Abnormal		Normal		
		No.	%	No.	%	
Renal angio-graphy	Abnormal	8	88.9	1	11.1	0.002
	Normal	17	33.3	34	66.7	
Site	Ostiallesion	2	66.7	1	33.3	0.134
	Proximal lesion	6	100.0	-	-	
Severity	Critical	6	100.0	-	-	0.134
	Intermediate	2	66.7	1	33.3	

Table 5 shows no significant association between echocardiographic findings and renal angiography results (P=0.327). Among patients with normal echocardiograms, 10.5% had abnormal renal findings, while 9.5% of those with hypertensive heart disease and 27.8% with ischemic heart disease showed abnormal renal results. All patients with severe mitral regurgitation had normal renal findings. The mean ejection fraction was slightly lower in patients with abnormal renal findings (55.78±7.65%) compared to those with normal findings (59.94±7.60%), but the difference was not statistically significant (P=0.135). Overall, echocardiographic abnormalities did not significantly correlate with renal angiography outcomes.

Table No. 4: Analysis of variables associated with renal angiography findings

Variable		Coronary angiography				P value
		Abnormal		Normal		
		No.	%	No.	%	
Height duration		12.78±6.379		12.08±6.962		0.780
Control of hypertension	Good	-	-	18	100.0	0.033
	Poor	9	21.4	33	78.6	
Diabetes mellitus	No	2	8.3	22	91.7	0.238
	Yes	14	29.7	33	70.3	
Dyslipidemia	Negative	1	4.8%	20	95.2%	0.103
	Positive	16	24.3	50	75.7	
Smoking Status	Negative	3	11.1%	24	88.9%	0.445
	Positive	10	19.6	41	80.4	

Table No. 5: ECG and echocardiographic findings associated with renal angiography results

Variable		Coronary angiography				P value
		Abnormal		Normal		
		No.	%	No.	%	
Echocardiography finding	Normal	2	10.5	17	89.5	0.327
	HHD	2	9.5	19	90.5	
	IHD	5	27.8	13	72.2	
	Severe MR	-	-	2	100.0	
EF	Mean±SD	55.78±7.645		59.94±7.596		0.135

DISCUSSION

The incidence of renal artery stenosis (RAS) observed in hypertensive patients in the present study during coronary angiography is consistent with the available research on the world, which demonstrates a close relationship between hypertension, coronary artery disease (CAD), and renal artery stenosis. Renal artery stenosis was present in 22.5% of hypertensive patients who underwent coronary angiography[22], and 13% of hypertensive patients[23] had RAS, which was intensified by hypertension, multivessel CAD, and being a female. Mirbolouk et al[24] also emphasized RAS as a factor in the deterioration of the renal function and resistant hypertension in line with the existing evidence that underlines the necessity of RAS screening in hypertensive CAD patients. Kirishcheva et al[25] demonstrated that renal artery endovascular reconstruction enhanced blood pressure and cardiac values, which favor early intervention. Hypertension and low eGFR were also found to be strong predictors to RAS by Dong et al.[26]

The hypertensive patients in this study had mean age of 61.18±6.8 years, mean systolic blood pressure (SBP) of 154.3 mmHg and diastolic blood pressure (DBP) of 90.9 mmHg which showed that they had poor blood pressure control. Approximately 70 percent were uncontrolled hypertension, which is consistent with Ullah et al[27] who reported hypertension as one of the significant predictors of RAS. Sixty percent of the patients were diabetic (mean 11.53 years), and only 18.3% were well-regulated glycemically. According to Tofaha et al[28], cardiovascular risk is one of the major precipitants of uncontrolled diabetes.

The high CAD burden was seen in 35% of patients who had ischemic heart disease (IHD). All of them lacked chronic kidney disease (CKD), indicating that their renal function was intact despite being at high risk of cardiovascular disease, just like Kayed et al[23], who observed that multivessel CAD is associated with RAS despite the absence of an overt CKD. Lipid management was not at its best with 65% of the patients having dyslipidemia with only 25% on statins. Mirbolouk et al[24] emphasized the need to follow lipid-lowering therapy. There was also smoking (55%) and sedentary lifestyle (33) which were also considered risk factors to CAD and RAS. Omidi et al[29] proved that the sedentary behavior, smoking, and progression of CAD have a strong connection. Also, 65% had a family history of early CAD, which aligns with the report of Kayed et al[23], who suggested the family history as a significant CAD predeterminant.

Coronary angiography and RAS Correlation: 15% of the patients exhibited abnormal renal angiography, which proves the impressive RAS prevalence. Only 2.9% of hypertensive patients whose coronary angiography was normal exhibited RAS and 32% of hypertensive patients with abnormal coronary angiography exhibited RAS, and this indicates that there is strong correlation between coronary and renal artery disease. These results go hand in hand with Khalaf et al[3], who discovered that age, hypertension, diabetes, and renal impairment were important predictors of RAS.

The statistical significance of the correlation between abnormal renal and coronary angiography outcomes was statistically significant (P = 0.002), which confirms that atherosclerosis is a systemic disease that involves more than one vascular bed as Payami et al,[30]. Nevertheless, there were no significant differences regarding lesion location (ostial or proximal) and coronary outcomes (P=0.134), which proves Soliman et al[22] and Mirbolouk et al[24] showed no correlation between RAS and CAD severity.

Control of hypertension helps in the prevention of RAS; diabetes, dyslipidemia, smoking, and echocardiographic data did not play a significant role.[31]

CONCLUSION

The renal artery stenosis is common in hypertensive patients undergoing coronary angiography, strongly correlates with coronary artery disease, influenced by hypertension control, while diabetes, dyslipidemia, smoking, and echocardiography show no significant association.

Author's Contribution:

Concept & Design or acquisition of analysis or interpretation of data:	Murtada Ali Jassim, Ghazi Farhan Haji, Qassim Mudalal Ubaid
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Final Approval of version:	All the above authors
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