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Dimensional (2D) Echocardiographic Predictors Of Renal Artery Stenosis In Patients With Coronary Artery Disease.

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ABSTRACT

Renal artery stenosis (RAS) and coronary artery disease (CAD) are disease of vessels due to similar etiologies with varying presentation. The present study focuses on finding 2D echocardiographic predictors of renal artery stenosis in patients with coronary artery disease. A total 167 patients with angiographically confirmed coronary artery disease and 33 patients with co-existing renal artery stenosis were included in the study. Relevant clinical examination was done and all patients underwent 2D echocardiography.2D echocardiographic predictors of RAS were identified in patients with renal artery stenosis on basis of comparison between two study groups. Results were analyzed based on four 2D echocardiographic parameters i.e. left ventricular ejection fraction (LVEF), wall hypokinesia, valvular lesions, diastolic dysfunction. Mean LVEF in patients with CAD was found to be 36.4% +- 9.6% in comparison to 28.6%+- 9.9% in patients with co-existing RAS. 46.7% patients with global left ventricular hypokinesia on 2D echocardiography had renal artery stenosis. 72.4% patients with grade 3 diastolic dysfunction had renal artery stenosis. Low LVEF and grade 3 diastolic dysfunction were found to be independent predictors of renal artery stenosis in patients with coronary artery disease. The present study showed that the prevalence of RAS increases in patients with reduced left ventricular ejection fraction and higher grades of diastolic dysfunction.

Keywords: Renal artery stenosis; coronary artery disease; 2-dimensional echocardiography.

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INTRODUCTION

Renal artery stenosis(RAS) is a possibly treatable cause of arterial hypertension and renal insufficiency [1]. Among all causes of renal artery stenosis, the maximum prevalence is of atherosclerotic type [2, 3]. Simultaneous atherosclerotic determinations in at least 2 major territories are common and managed as multisite artery disease [4]. Echocardiography is an important and resourceful imaging technique for the assessment of left ventricular systolic function, diastolic function, and even myocardial and coronary perfusion. ARVD is typically associated with extensive extra-renal atherosclerosis and significant cardiovascular comorbidities; 91% of ARVD patients have hypertension, 38% have clinical heart failure, and 67% have coronary artery disease [5, 6].

As a result of these overlapping cardiovascular risk factors, cardiac structural remodelling is almost ubiquitous in ARVD. At least three-quarters of ARVD patients have left ventricular hypertrophy and diastolic dysfunction on echocardiography [7]. Flash pulmonary oedema is however the presenting feature in only 12% of cases of ARVD. Meaning that the majority of patients with ARVD do not appear to suffer acute decompensation of heart failure despite underlying cardiac remodelling [8]. Patients with ARVD exhibit a high prevalence of cardiac morphologic and functional abnormalities at early stages of renal dysfunction. Such patients must be identified early in their disease course to allow risk factor modification. However, the present study focuses on finding 2D echocardiographic predictors of renal artery stenosis in patients of coronary artery disease.

MATERIAL AND METHODS

This observational cross-sectional study was conducted in the department of general medicine, at the tertiary care centre during a period of 18 months from November 2019 to April 2021. The study protocol was approved by the Institute Ethical committee and informed consent as obtained from patients. Patients of either sex, age>18 years, presented with history of CAD, ECG finding suggestive of CAD or patients presenting with severe/ resistant/ accelerated/ malignant hypertension and those willing to give informed consent were included in the study. Patient with age less than 18 years, patients not willing to give consent, patients with CKD with baseline with serum creatinine >1.4 mg/dl, eGFR < 30 ml/min, already on dopamine infusion, history of contrast allergy, pregnant women and RAS– post renal revascularization were excluded from the study. A total 200 patients were included in the study after applying inclusion and exclusion criteria and exclusion of drop out and subjects with protocol deviation. patients underwent coronary and renal angiography in single setting and categorized according to presence of coronary artery disease and presence of Renal artery stenosis along with CAD.

There were 167 patients with CAD and 33 patients had coexisting RAS. All patient underwent 2D Echocardiography and each subject analysed for left ventricular ejection fraction, presence of any hypokinesia, valvular lesion and diastolic dysfunction.

The collected data were analysed using SPSS (Statistical package for social science) version 27.0. Qualitative data variables were expressed by using frequency and percentage and quantitative data variables were expressed using mean and SD. Chi-square test was used to find the significance between outcome and various qualitative data variables. Tests were considered significant if the P-value was less than 0.05.

OBSERVATION AND RESULTS

Mean left ventricular ejection fraction in patients without RAS was found to be 36.4+-9.6% while in patients with coexisting RAS, it was found to be 28.6+- 9.9%. This comparative data was found to be significant with p-value<0.01, which indicates that LVEF in patients of CAD with coexisting RAS is significantly lower that patients without RAS.

Global left ventricular hypokinesia was found to be most commonly associated with Renal artery stenosis and 46.7% of patients with Global LV hypokinesia had Renal artery stenosis. Two patients with angiographically proven coronary artery disease had no hypokinesia in 2D echocardiography. This result was found to be statistically significant with p-value of <0.01.

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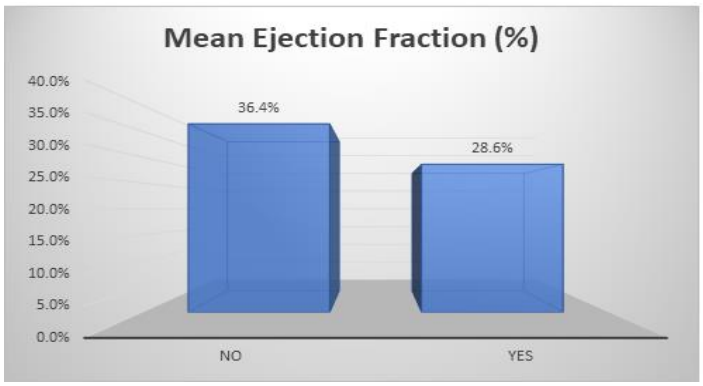


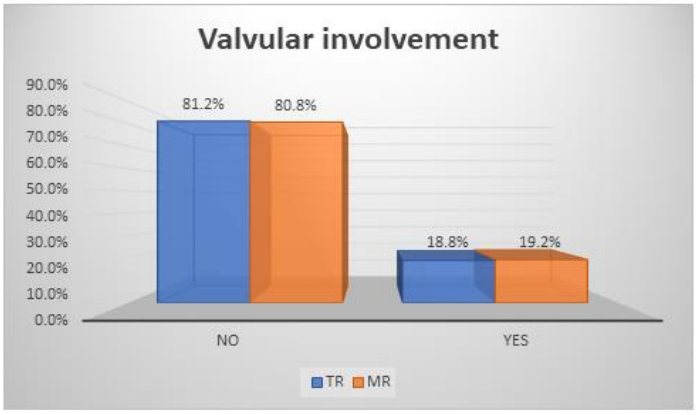
Figure 1: Showing comparative analysis between mean LVEF of patients of CAD with and without RAS.

Table 1: Prevalence of different types of regional wall motion abnormalities.

Echocardiographic Findings – Hypokinesia	RAS		Total	
	No	Yes		
Anterior Wall	113	14	127	
Anterior Wall (%)	89.0%	11.0%	100.0%	
Distal Apical	8	1	9	
Distal Apical (%)	88.9%	11.1%	100.0%	
Global LV	16	14	30	
Global LV (%)	53.3%	46.7%	100.0%	
Inferior Wall	26	2	28	**p- value <0.01**
Inferior Wall (%)	92.9%	7.1%	100.0%	
Lateral wall	2	0	2	
Lateral wall (%)	100.0%	0.0%	100.0%	
Septal wall	2	0	2	
Septal wall (%)	100.0%	0.0%	100.0%	
None	0	2	2	
None (%)	0.0%	100.0%	100.0%	
Total	167	33	200	
	83.5%	16.5%	100.0%	

A total of 104 patients had mitral regurgitation of some degree in study population and 19.2% patients with Mitral regurgitation had renal artery stenosis while Tricuspid regurgitation was found in 69 patients in study population, out of which 18.8% had renal artery stenosis. However, the correlation between valvular lesion and RAS was not found statistically significant.

Figure 2: comparison of valvular involvement in patients with and without Renal artery stenosis.



Grade 1 diastolic dysfunction was found in 66% patients in study population and none of the patients with grade 1 diastolic dysfunction had RAS. Grade 2 diastolic dysfunction was found in 19.5% of patients and 30.8% patients with grade 2 diastolic dysfunction had renal artery stenosis While 72.4% patients with grade 3 diastolic dysfunction had renal artery stenosis. Prevalence of renal artery stenosis increases with increase in grade of diastolic dysfunction. The correlation between presence of diastolic dysfunction and renal artery stenosis was found to be statistically significant with p-value <0.01.

Table 2: Prevalence of various grades of diastolic dysfunction in study population

Diastolic Dysfunction	RAS		Total	
	No	Yes		
Grade 1	132	0	132	**p- value <0.01**
Grade 1 (%)	100.0%	0.0%	100.0%	
Grade 2	27	12	39	
Grade 2 (%)	69.2%	30.8%	100.0%	
Grade 3	8	21	29	
Grade 3(%)	27.6%	72.4%	100.0%	
Total	167	33	200	
	83.5%	16.5%	100.0%	

On applying multivariate logistic regression analysis, it was found that reduced left ventricular ejection fraction and grade 3 diastolic dysfunction were independent predictors of Renal artery stenosis in patients with coronary artery disease.

Table 3: Showing logistic regression analysis and independent 2D echocardiographic predictors of renal artery stenosis

Logistic Regression: Significant Predictors for RAD								
Variables	**B**	**S.E.**	**Wald**	**Df**	**p- value**	**Odds Ratio**	**95% C.I. for EXP(B)**	
							Lower	**Upper**
Ejection Fraction	0.23	0.08	8.43	1	<0.01	1.26	1.08	1.48
Diastolic Dysfunction	4.88	1.40	12.22	1	<0.01	131.25	8.52	202.21

DISCUSSION

In the study by Kane GC et al, renal artery stenosis was associated with heart failure with preserved ejection fraction [9]. According to Wright et al Mean LVEF was 53 ± 12%.in contrast to our study where patients with RAS has significantly less ejection fraction, which may be because of coexisting coronary artery disease [7]. In the study by Emans et al presence of RAS does not correlate with worse LVEF [10].

In study by Wright et al, resting LV wall motion abnormalities were actually detected in 47 (59.5%) patients however, in their study coronary artery disease was not considered [7]. In our study, prevalence of global left ventricular hypokinesia was most common finding and out of patients with such finding 46.7% had renal artery stenosis.

In study by TH Marwick et al, Mitral regurgitation was found to be most common valvular heart disease in association to chronic renal disease [11]. However, most common valvular heart disease to be associated with coronary artery disease was found to be aortic stenosis followed aortic regurgitation followed by mitral regurgitation [12].

In study by Wright et al, 74.6% patient with renal artery stenosis had abnormal left ventricular diastolic function and there was significant correlation($p<0.001$) between left ventricular diastolic dysfunction and renal artery stenosis.In our study each patient had some degree of diastolic dysfunction, however, 72.4% patients with grade 3 diastolic dysfunction had Renal artery stenosis [7].

CONCLUSION

On 2D echocardiography, reduced left ventricular ejection fraction and grade 3 diastolic dysfunction are independent predictors of Renal artery stenosis.

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