PREVALENCE AND PREDICTORS OF CORONARY ARTERY DISEASE IN SEVERE AORTIC STENOSIS PATIENTS UNDERGOING SURGERY

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ABSTRACT

BACKGROUND

The present study is to find out the prevalence of CAD in severe Aortic Stenosis (AS) patients undergoing aortic valve replacement and the relation between the conventional risk factors and CAD in them. Calcific aortic stenosis is associated with the same risk factors as coronary artery disease. Studies on calcific aortic stenosis and CAD are rarely reported from India.

The aim of the study is to find out the predictive value of angina for presence of CAD in severe aortic stenosis.

MATERIALS AND METHODS

All cases of isolated severe aortic stenosis undergoing CAG before aortic valve replacement were included in the study. Data regarding various risk factors, symptoms, echocardiographic parameters and angiographic profile were collected.

RESULTS

Among a total of 94 patients who have undergone aortic valve replacement for severe AS 40 (42.6%) had CAD. Risk factors like advanced age, hypertension, diabetes and smoking were more in patients with CAD compared to isolate AS. Mean gradient was more in the AS + CAD group compared with AS group. Presence of angina had a sensitivity of 82.5% and specificity of 51.85% for predicting coexisting CAD.

CONCLUSION

Among severe aortic stenosis, patients undergoing AVR 42.6% of patients had significant obstructive CAD. The conventional risk factors predict presence of coronary artery disease. Angina has got a fairly good sensitivity, but moderate specificity for CAD.

KEYWORDS

Aortic Stenosis, Coronary Artery Disease, Risk Factors, Angina.

BACKGROUND

The prevalence of coronary artery disease in patients undergoing valve surgery is different in various subsets of valve diseases. Untreated CAD has poor perioperative and long-term postoperative outcomes in those undergoing cardiac surgery, which makes preoperative identification of CAD mandatory.[1,2] Two studies from India have reported prevalence of CAD to be around 12% in patients with Rheumatic Heart Disease (RHD) undergoing valve replacement.[3,4] Calcific aortic stenosis is the most frequent acquired valvular disease. Calcific aortic stenosis and CAD share many similarities.[5,6] Aortic stenosis and coronary artery disease often coexist, so an association of cardiovascular risk factors with aortic stenosis might be confounded by this association. Subsequent angiographic studies have shown that the prevalence of significant coronary disease in patients with aortic stenosis varies from 20% to 60%.[7-10] Only few data are available from India on the prevalence of CAD in calcific AS and the prevalence was less compared to western data.[11] The present study is to find out the prevalence of CAD in isolated severe aortic stenosis patients undergoing Aortic Valve Replacement (AVR) and the relation between the conventional risk factors and CAD in them. We also aim to study the statistical value of angina in predicting CAD.

MATERIALS AND METHODS

It was a retrospective study done in the Department of Cardiology, Government Medical College, Kottayam, Kerala, State of India. All consecutive patients with severe aortic stenosis undergoing preoperative coronary angiography from 2010 to 2016 were included in the study. The exclusion criteria included double or multiple valve surgeries, aortic root surgery, severe aortic regurgitation or prior history of acute coronary syndrome. The hospital

records of these patients were reviewed and the clinical, ECG and echocardiographic data were collected from the records. The presence of conventional risk factors and presence of angina were recorded by reviewing hospital records or by telephonic interview. Risk factors included hypertension (systolic arterial pressure ≥140 mmHg or diastolic arterial pressure ≥90 mmHg or use of antihypertensive medication), diabetes mellitus (fasting glucose ≥126 mg/dL, postprandial glucose ≥200 mg/dL or on medications for diabetes mellitus), smoking, dyslipidaemia (total cholesterol ≥200 mg/dL, triglycerides ≥150 mg/dL and/or LDL ≥130 mg/dL), history of CVA, etc. Aortic stenosis severity was determined by the mean pressure gradient (mean PG) and peak velocity and peak pressure gradient (max PG). The prevalence of coronary artery disease in the study population was analysed by reviewing the coronary angiogram. Significant coronary artery stenosis was defined as ≥50% luminal narrowing. Severity of CAD was assessed by classifying to single vessel, double vessel, triple vessel and LMCA involvement.

Data were entered in MS Excel and analysed using SPSS statistical software. Prevalence of CAD is expressed in percentage. Continuous variables are expressed as mean ± standard deviation. The Student's t-test is used to compare quantitative data and Chi-square test is used to compare qualitative data. P value <0.05 is considered statistical significant.

RESULTS

A total of 94 patients who underwent preoperative coronary angiography before aortic valve replacement were included in the study. Among them, 40 (42.6%) had aortic stenosis with significant coronary artery disease (AS + CAD group). There was no significant CAD in 54 (57.4%) (AS group). All the patients with significant coronary artery disease underwent CABG along with AVR.

Demographic Features and Risk Factors- Baseline characteristics of the study group and prevalence of various risk factors are given in Table 1. Among them, mean age of AS + CAD group was significantly greater than that of AS group (62.675 vs. 58.222, P value 0.006). Maximum number of the patients were in 50 to 60 years age group in the AS group were as maximum number of patients were in 60 to 70 years age in AS + CAD group. Number and percentages of the male-female patients in

the AS and AS + CAD were not statistically different. Risk factors like diabetes mellitus and hypertension were significantly more in the AS + CAD group compared with AS group. There was a significant association between smoking and presence of CAD. Smoking of patients was present in 67.5% in the AS + CAD group, whereas only 22.2% of the AS group were smokers. Contradictory to the expectation, dyslipidaemia was not significantly different among the groups. Past history of CVA was also not significantly different.

Parameter	AS + CAD (n=40)	AS (n=54)	P value
Age (Mean)	62.675	58.222	0.006
Male:Female	2.63:1	2.6:1	0.975
Diabetes, n (%)	23 (57.5)	11 (20.4)	0.000
Hypertension, n (%)	21 (52.5)	16 (29.6)	0.025
Smoking, n (%)	27 (67.5)	12 (22.2)	0.000
Dyslipidaemia	26 (65)	32 (59.3)	0.06
Previous CVA	2 (5)	2 (3.7)	0.095
Table 1. Demographic Features and Risk Factors			

AS- Aortic Stenosis, CAD- Coronary Artery Disease, n- Number, %- Percentage.

Symptoms and ECG Abnormalities of AS and Presence of CAD- Among the study group, 59 patients (62.8%) had angina, 35 patients (37.5%) had dyspnoea and 41 (43.6%) had syncope. Proportion of patients with angina and syncope were more in the AS + CAD group compared to the AS group. In the AS + CAD group, 33 (82.5%) patients complained angina compared to 26 (48.1%) in the AS group. In the AS + CAD group, 29 (72.5%) had syncope, whereas only 12 (22.2%) had syncope in the AS group. Occurrence of dyspnoea was similar in both groups (35% vs. 38.9%). Prevalence of ECG abnormalities were similar among the two groups. The various ECG abnormalities were left ventricular hypertrophy, strain pattern, atrial fibrillation and ventricular ectopic.

Coronary Angiogram Findings- In aortic stenosis with coronary artery disease group, 57.5% had Single-Vessel Disease (SVD), 22.5% had Double-Vessel Disease (DVD), 17.5% had Triple Vessel Disease (TVD) and 2.5% had Left Main + Triple Vessel Disease (LM + TVD). Minor CAD (<50% stenosis) was present in 24% of AS group.

Groups	Normal	Minor CAD	SVD	DVD	LM + TVD	TVD
AS, n (%)	39 (70.4)	13 (24.1)	0	0	0	0
AS + CAD, n (%)	0	0	23 (57.5)	9 (22.5)	1 (2.5)	7 (17.5)
Total, n (%)	39 (41.4)	13 (13.8)	24 (25.5)	9 (9.6)	1 (1.1)	7 (7.4)
Table 2. Coronary Angiogram Findings						

Echocardiographic Parameters and Presence of CAD
Aortic max PG and aortic mean PG were compared between the two groups using T test. The results are given in Table 3.

	Group	Number	Mean	Std. Deviation	t	P value
Aortic max PG	AS	54	84.79	14.77	0.426	0.671
	AS + CAD	40	86.22	17.73		
Aortic mean PG	AS	54	47.703	5.78	3.71	0.001
	AS + CAD	40	51.800	6.69		
Table 3. Echocardiographic Parameters						

Aortic max PG was not different between the two groups, whereas mean PG was more in the AS + CAD group compared to AS group and the result was statistically significant.

Predictive Value of Angina for the Presence of CAD
The various statistical values for the presence of angina in predicting presence of CAD are given Table 4.

Observed		CAD		Total
		Yes	No	
Angina	Yes	33	26	59
	No	7	28	35
Sensitivity		82.50% (95%, CI-67.22% to 92.66%		
Specificity		51.85% (95%, CI-37.84% to 65.66%)		
Positive predictive value		55.93% (95%, CI-48.18% to 63.41%)		
Negative predictive value		80.00% (95%, CI-66.06% to 89.15%)		
Positive likelihood ratio		1.71 (95%, CI-1.25 to 2.34)		
Negative likelihood ratio		0.34 (95%, CI-0.16 to 0.69)		
Table 4. Statistical Value of Angina				

CI- Confidence Interval.

Above table shows that angina has 82.5% sensitivity and 51.85% specificity to predict presence of CAD in patients with severe AS.

DISCUSSION
Historically, RHD was the most frequent aetiology of valvular heart disease in India. The prevalence of degenerative valvular heart disease is increasing with increase in age of the population. Parallel to the change in the epidemiology of valvular heart disease, prevalence of CAD among patients with valvular heart disease has been increasing. Calcific aortic stenosis is the most common valvular heart disease associated with CAD. In our study, out of 94 patients with severe AS undergoing AVR, 40 had coronary artery disease with a prevalence of 42.6%. In a previous study done by N Exadactylos et al out of 88 patients, 22 (34%) had coronary artery disease.[12]

Male sex, age, hypertension, dyslipidaemia, smoking, diabetes mellitus and family history of CAD are established risk factors for coronary artery disease. In our study, the mean age was significantly high in AS + CAD group. We compared our study with the larger risk factor study done by J R Ortlepp et al.[13] In that study, age was not significantly different among the two groups. In our study, mean age was 58.22 and 62.6 in AS and AS + CAD groups

and was statistically significant. Diabetes, hypertension and smoking are common atherosclerotic risk factors. In our analysis, there was definite association of diabetes in AS + CAD group (57.5%) compared to the AS group (20.4%). In our study, there was a good association between hypertension in AS + CAD group (52.5%) when compared to the AS group. Similar association was found between smoking and the presence of CAD in AS + CAD group (67.5%) compared to AS group. Dyslipidaemia is the one of the risk factor associated with accelerated atherosclerosis and there is a strong association with coronary artery disease. But, in our study, there was no significant association of dyslipidaemia in AS + CAD group. Even though, the presence of CVA has some relationship with coronary artery disease in our study, it was not statistically significant among both groups. In the study by J R Ortlepp et al, male sex, hypercholesterolaemia, smoking, diabetes mellitus and a family history of coronary artery disease were significantly associated with the presence of additional CAD in patients with AS.

Major symptoms of AS are angina, dyspnoea and syncope. We analysed each symptom and found that angina and syncope were more common in aortic stenosis with coexisting coronary artery disease when compared to the AS group alone and it was statistically significant. We analysed the coronary angiograms of all patients and found that 57.5% of AS + CAD group patients have single-vessel disease, 22.5% double-vessel disease, 17.5% triple vessel disease and 2.5% have LM + triple vessel disease. Aortic stenosis group had shown only minor coronary artery disease in 24% of patients. The relationship between presence of CAD and echocardiographic parameters of aortic stenosis were studied. Aortic mean PG was significantly more in the CAD + AS group. But, aortic max PG was not significantly different between the groups. Relation between presence of CAD and severity of AS could not be compared as we have not included any patients with mild or moderate AS.

The reported prevalence of angina in patients with aortic stenosis has varied from 40% to 70%. Overall, we analysed the predictive value of angina for the presence of CAD and found that it has got the sensitivity of 82.5% and specificity 51.85% for predicting the presence of coronary artery disease. Goncalves et al studied the diagnostic value of angina in AS patients above 50 years.[14] In that study, the diagnostic sensitivity of angina to detect CAD was 73.1%, specificity was 39.7%, positive predictive value was 54.8%, negative predictive value was 59.6% and the likelihood ratio of a positive test result was 1.6. Our study had a higher diagnostic value compared to that study in

patients above 40 years though the specificity was 51.85%.

Limitations of the Study

1. We have included only those aortic stenosis patients who are undergoing surgery. Conservatively managed patients were not studied. This may lead to selection bias.
2. Only severe AS patients were selected.
3. We have not compared the study population with normal controls. Risk factor profile of AS ideally requires comparison with normal controls.

CONCLUSION

Among severe aortic stenosis, patients undergoing AVR 42.6% of patients have significant obstructive CAD. There is significant association between conventional risk factors like advanced age, diabetes, hypertension and smoking and presence of coronary artery disease. Angina has got a fairly good sensitivity and negative predictive value for CAD, but specificity and positive predictive value are less.

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