

Original Research Article

Incidence of coronary artery disease before valvular replacement in isolated severe aortic stenosis patients in Western Rajasthan

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ABSTRACT

Background: The aim of the study was to evaluate the incidence of Coronary artery disease (CAD) and predictors of CAD in patients with severe AS in western Rajasthan population.

Methods: Data from all consecutive patients with severe AS undergoing AVR at a major tertiary cardiac and vascular center in Udaipur were entered in a prospective registry beginning in 2015. Significant CAD was defined as one or more major coronary arteries having an estimated narrowing of $\geq 70\%$ and left main coronary arteries having an estimated narrowing of $\geq 50\%$ on coronary angiography. We excluded patients with multiple valve disease, significant aortic regurgitation, or prior CAD or valve surgery.

Results: Mean age of 55 enrolled patients was 52.64 ± 15.5 years. Diabetes mellitus and hypertension were present in 3.64% and 5.45% of patients, respectively. Moderate and severe Left ventricular ejection fraction (LVEF) was found in 16.36% and 10.91% patients, respectively. Only 5.45% patient had severe CAD and thus underwent AVR and coronary artery bypass grafting, and rest 94.55% patients underwent AVR. Mean age of patients who underwent AVR was 51.75 ± 15.36 years and who underwent AVR and CABG was 68 ± 11.14 years with no significant association ($p=0.078$). Proportion of patients requiring AVR and CABG was significantly higher in moderate (22.22%) and severe LVEF (16.67%) as compared to normal or mild ($p=0.034$).

Conclusions: Coronary angiography before AVR will be considered in patients with multiple risk factors for cardiovascular disease or in patients above 68 years of age without risk factors for cardiovascular disease. However, larger studies on heterogeneous population are required to prove our findings.

Keywords: Severe aortic stenosis, Coronary artery disease, Coronary angiography, Aortic valve replacement

INTRODUCTION

Incidence of Aortic stenosis (AS) increases with age and is common valvular heart disease. AS patient when become symptomatic outcomes are poor, guidelines recommend Aortic valve replacement (AVR) in severe, symptomatic AS.^{1,2}

Angina pectoris is principal symptoms of severe AS, even in patients without significant Coronary artery disease (CAD). However, the incidence of angina pectoris and

related CAD in patients with AS is not clear, especially in Asian countries.^{3,4} Therefore, there is continuing debate whether angiography is needed in symptomatic severe AS patient undergoing AVR. Some previous studies suggest that coronary angiography is needed only in patients with symptoms consistent with CAD, some believe that it should be carried out only in those over 40 or even 50 years of age, while others still conclude that coronary angiography should be performed in all patients before surgery.⁴⁻⁹ The aim of the study was to evaluate the incidence of CAD and predictors of CAD in patients with severe AS in western Rajasthan population.

METHODS

This was a single-center, prospective registry which included 55 consecutive patients with severe AS undergoing AVR at a major tertiary cardiac and vascular center in Udaipur from January 2014 to December 2020. The study was approved by institutional ethics committee and all the patients provided written informed consent before being enrolled into the study. Exclusion criteria included presence of other concomitant valvular disease of moderate/higher severity, coronary artery bypass graft, and prior valve surgery.

Integrated echocardiographic evaluation was used to diagnose the severity of AS using the following measurements: aortic valve area $<1 \text{ cm}^2$, peak aortic velocity ($AV V_{\max}$) $>4 \text{ m/sec}$, or a mean transaortic pressure gradient ($AV_{\text{mean}} \text{ PG}$) $>40 \text{ mmHg}$. Patients included in this study were those who met one of these criteria. We defined CAD as $\geq 70\%$ narrowing in at least one coronary artery and $\geq 50\%$ narrowing in left main artery on coronary angiography, because there is a general consensus that a luminal diameter reduction of 70% is needed to cause a hemodynamically significant reduction in flow in the coronary circulation.¹⁰

Echocardiographic evaluation

Comprehensive transthoracic echocardiography (M-mode, 2D, and Doppler) was performed using commercially available equipment. We recorded maximal aortic jet velocity from the apical window that yielded the highest velocity signal. End diastole was defined as the frame with the largest cavity area immediately before the onset of the QRS and end systole as the frame with the smallest cavity area. Left ventricular ejection fraction (LVEF) were calculated from 2D recordings using the modified biplane Simpson's method.

Coronary angiography

Coronary angiography was performed using standard interventional techniques with appropriate antiplatelet therapy and heparin use. All baseline coronary

angiograms were reviewed and analyzed quantitatively at the angiographic core laboratory. CAD was considered hemodynamically significant if left main coronary arteries were estimated to have $\geq 50\%$ narrowing of the lumen diameter and one or more major coronary arteries except for left main were estimated to have $\geq 70\%$ narrowing of the lumen diameter from at least two views.

Statistical analysis

All the data were analyzed using SPSS version 21.0. The quantitative data were presented as mean with standard deviation (SD) and analyzed using independent t-test. The qualitative data were presented as frequency (percentage) and analyzed using Fisher's exact test. A p value <0.05 was considered as statistically significant.

RESULTS

Mean age of 55 enrolled patients was 52.64 ± 15.5 years and around 69.1% patients were male. Diabetes mellitus and hypertension were present in 3.64% and 5.45% of patients, respectively. In majority (67.27%) of patients, LVEF was normal followed by moderate dysfunction in 16.36% and severe dysfunction in 10.91% patients. Coronary angiogram was normal in 90.91% patients, and only 5.45% patient had severe CAD. In present study AVR and CABG was required in only 3 (5.45%) patients, and in 94.55% patients only AVR procedure was. The baseline and procedural details are outlined in Table 1.

Mean age of patients who underwent AVR was 51.75 ± 15.36 years and who underwent AVR and CABG was 68 ± 11.14 years with no significant association ($p=0.078$). Distribution of AVR and CABG was comparable in gender, diabetes mellitus and hypertension. Proportion of patients requiring AVR and CABG was significantly higher in moderate (22.22%) and severe left ventricular dysfunction (16.67%) as compared to normal (0%), mild ventricular dysfunction (0%) ($p=0.034$). Table 2 depicts the comparison of baseline and procedural parameters among patients who underwent only AVR and AVR and CABG.

Table 1: Baseline and procedural characteristics of all patients.

Patients characteristics	N=55	
Age (years)		
Mean \pm SD	52.64 \pm 15.5	
Median (25 th -75 th percentile)	52 (45-64)	
Range	15-78	
Gender	N	%
Female	17	30.91
Male	38	69.09
Risk factors		
Diabetes mellitus	2	3.64
Hypertension	3	5.45

Continued.

Patients characteristics	N=55	
Coronary angiography		
Normal	50	90.91
Mild CAD	2	3.64
Severe CAD	3	5.45
Left ventricular ejection fraction		
Normal	37	67.27
Mild dysfunction	3	5.45
Moderate dysfunction	9	16.36
Severe dysfunction	6	10.91
Procedure		
Aortic valve replacement	52	94.55
Aortic valve replacement and CABG	3	5.45

Note: CAD- Coronary artery disease, CABG- Coronary artery bypass grafting.

Table 2: Comparison of baseline and procedural characteristics between both groups.

Patients characteristics	AVR (N=52)		AVR and CABG (N=3)		P value
Age (years (mean±SD))	51.75 ± 15.36		68 ± 11.14		0.078
Gender	N		%		
Female	16	94.12	1	5.88	1
Male	36	94.74	2	5.26	
Risk factors					
Diabetes mellitus	1	50	1	50	0.107
Hypertension	2	66.67	1	33.33	0.158
Left ventricular ejection fraction					
Normal	37	100	0	0	0.035
Mild dysfunction	3	100	0	0	
Moderate dysfunction	7	77.78	2	22.22	
Severe dysfunction	5	83.33	1	16.67	

Note: AVR- Aortic valve replacement, CABG- coronary artery bypass grafting.

DISCUSSION

The main findings of our study in Western Rajasthan patients with severe AS undergoing AVR are as follows: (1) the incidence of significant CAD was low, (2) age was found as an independent predictor of CAD and the incidence of significant CAD increases after 68 years of age, and (3) patients having a minimum of two risk factors for cardiovascular disease were more likely to have significant CAD.

Presence of CAD in patients with severe AS undergoing AVR

The evaluation for the presence of significant CAD before AVR is necessary. Current updated guidelines suggest coronary angiography before valve intervention in patients with symptoms of angina, objective evidence of ischemia, decreased left ventricular systolic function, history of CAD, or coronary risk factors (including men age >40 years and postmenopausal women (Class I, level of evidence C)).¹¹ Computed tomographic (CT) coronary angiography is reasonable to exclude the presence of significant obstructive CAD in selected patients with a low/intermediate pretest probability (Class IIa, level of evidence B).

However, coronary angiography should still be carried out in all patients before AVR regardless of pretest probability of CAD due to the poor predictive value of angina pectoris and the lack of accuracy of available non-invasive tests.

The incidence of associated CAD in patients with severe AS has been reported to range from 21% to 56%.¹² However, in our study the overall incidence of angiographically significant CAD was 5.45% which was very low compared to Western population. So, age suggested coronary angiography before valve intervention in current updated guidelines could be higher in Asia than in Western countries.

The cause of severe AS in significant CAD patients

Severe AS is generally caused by either degenerative or rheumatic causes or infective endocarditis.

In our study, 100% patients with significant CAD had a degenerative etiology for their severe AS. The high incidence of AS was associated with elderly population in our study. These results support the recent hypothesis that calcification in AS is a presentation of

atherosclerosis, with the process of valve fibrosis and calcification resembling different phases of arterial plaque formation and progression.^{13,14}

Thus, the pathophysiology of degenerative aortic valve disease is similar to that of atherosclerosis, which may be responsible for the relationship between AS and increased incidence of coronary artery stenosis.¹⁵

Predictors of the presence of CAD in severe AS patients undergoing AVR

Symptoms of angina pectoris have a low positive predictive value of CAD in patients with AS.¹⁶ Hence, the incidence of CAD in patients with AS is difficult to discern from patient symptoms alone. Thus, coronary angiography should be carried out in all patients before AVR in clinical practice.

The extent of CAD involvement in patients with severe AS predicts morbidity and mortality associated with AVR and is also important for the assessment of long-term prognosis.¹⁷ Thus, patients with severe AS scheduled for AVR should routinely undergo coronary angiography. The incidence of significant CAD with severe AS was low in this study. Therefore, in patients with a low/intermediate pretest probability of CAD such as in Asian countries, CT-coronary angiography is reasonable to exclude the presence of significant obstructive CAD in patients who are young or have few risk factors.

Limitations

Patients included in this study were consecutively enrolled at a single center, thus we cannot assume that these results represent other hospital patient populations. We excluded patients with multiple valve disease and significant aortic regurgitation. However, in a previous study, it has been reported that patients with severe AS were associated with aortic regurgitation. So, we might have underestimated the incidence of patients with severe AS. However, we believe that the incidence of significant CAD in the general population and in patients with severe AS is quite similar in other Asian countries. Large-scale, multicenter studies will be needed to confirm these results.

CONCLUSION

The incidence of significant CAD in patients with severe AS was low in our study population (5.45%). Therefore, coronary angiography before AVR will be considered in patients with multiple risk factors for cardiovascular disease or in patients above 68 years of age without risk factors for cardiovascular disease. However, larger studies on heterogeneous population are required to prove our findings.

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