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Preoperative Coronary Screening in Rheumatic Valvular Surgery: Is Age Just Number?

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Abstract

Background: Our aim of this study was to find the prevalence of CAD and various CAD risk factors in RHD patients < 50 years. *Materials and Method:* It was a single center observational retrospective study of 6324 rheumatic heart disease patients, who underwent Coronary Angiography (CAG) prior to surgical valvular replacement from January 2011 to December 2017. Among them 3920 patients were < 50 years of age, they were included in this study. Patients with age > 50 years (2404) were excluded. Among them significant CAD group patients (stenosis ≥50% -Group A), were compared with similar age group matched patients of RHD without CAD (Group B). *Results:* The overall prevalence of CAD in the patients undergoing valvular intervention was 5.68% (61.88% males, 38.12% female). The CAD incidence in patients with mitral, aortic and both valve replacement were 8.20%, 62.5% and 29.3% respectively. The prevalence of smoking (41.7% *vs*. 27.48%), diabetes (18.83% *vs*. 3.62%), hypertension (69.05% *vs*. 13.52%), family history of CAD (78.02% *vs*. 3.8%) and aortic valve disease (62.5%) was significantly higher in group A as compared to group B. *Conclusion:* Prevalence of CAD in patients with Rheumatic valvular heart disease in western population of Asian Indians with age < 50 years is 5.68%. Thus Coronary angiography should be performed in such patients only when there are associated CAD risk factors. No need of doing prophylactic angiography for those rheumatic heart disease patients who do not having any CAD risk factors in young patients age < 50 years.

Keywords: Rheumatic Heart Disease; Coronary Angiography; Coronary Artery Disease; Incidence; Risk factors.

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Introduction

Rheumatic Heart Disease (RHD)- A consequence of rheumatic fever persuaded degenerative changes in the cardiac valve tissue, causes permanent damage to the heart valves.[1] Globally, RHD is affecting around 70 million people whereas the Indian burden of the disease ranges from 0.2 to 1.1/1000.[2,3] Contrary to the burden of RHD on developed countries, which has come down gradually, it still remains prominent cause of morbidity and mortality in the developing countries of the world.[3]

Many patients with valvular and nonvalvular heart disease have concomitant Coronary Artery Disease (CAD), but there are only limited data regarding optimal strategies for diagnosis and timings for Coronary angiography.[6] According

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to ACC/AHA guidelines routine preoperative coronary angiography (CAG) in patients with valvular heart disease before valve surgery in men aged ≥35 years, in premenopausal women aged ≥35 years who have coronary risk factors, and in postmenopausal women is advocated.[7,8]

The primary aim of this study was to estimate the prevalence of CAD and various CAD risk factors in RHD patients below 50 years in western state of Gujarat in Asian Indian RHD patients, whereas our secondary aim was to compare the demographic and atherosclerotic risk factor profile of patients having valvular disease with CAD and without CAD and identify risk factors for CAD in RHD patients below 50 years.

Materials and Methods

This was a retro prospective observational study of 6324 valvular patients from Western Indian region, who underwent CAG prior to valvular intervention to confirm the presence of clinically significant lesions. Among them 3920 patients were less than 50 years of age, they were included in the study. Patients with age more than 50 years (N-2404) were excluded. All surgical interventions i.e.; percutaneous balloon valvulotomy, surgical valvular repair or replacement were taken inthe study from January 2011 to December 2017, a period of 7 years.

Coronary angiography was performed via femoral or radial approach with appropriate catheters. The degree of coronary artery stenosis was estimated by Quantitative CAG as the obstructed proportion of each vessel, expressed as a percentage of the vessel diameter (if the stenosis was >50% it is significant CAD). The patients with CAD (Group A), were compared with patients of RHD without CAD (Group B). None of the patients underwent PCI in view of scheduled valvular open heart surgery and all critical lesions were tackled with grafting simultaneously during valvular surgery. RHD was diagnozed by routine 2D echocardiographic evaluation. Apart from age, history of rheumatic fever and echocardiographic features life subvalvar pathology and multiple valve involvement were considered to confirm diagnosis of rheumatic etiology.

The study protocol was approved by the Institutional Ethics Committee (CARDIO/UNMICRC/32/2017). Patients having inflammatory disorders, associated congenital heart disease, constrictive pericarditis, ischemic mitral regurgitation, bicuspid aortic valve and degenerative aortic valve disease were excluded from the study.

Demographic characteristics were recorded by reviewing the patient medical record file. Family history of CAD was considered as risk factor if 1st degree relative had CAD (<55 years in males and <65 years in females). Typical angina was defined as "the presence of substernal chest pain or discomfort that was provoked by exertion or emotional stress which was relieved by rest where as in atypical angina one may not experience typical symptoms of angina and instead may feel a vague chest discomfort, shortness of breath, fatigue, nausea, back or neck pain or burning indigestion. Hypertension (HTN) and diabetes (DM) were diagnozed by history, investigations and on the basis of established guidelines.[9,10] History of smoking also recorded on basis of pack years. History of AF and Ejection Fraction (EF) on 2D echocardiography was also recorded. A low hemoglobin count is generally defined as less than 14 grams of hemoglobin per deciliter of blood for men and less than 12 grams perdeciliter for women. A raised creatinine was defined as greater than 1.2 milligrams per deciliter.

Statistical Analysis: Statistical analysis was done using software SPSS *vs*. 20. Continuous variables were expressed as Mean ± SD, whereas categorical variables were defined as percentage. The *chi*-square test was used for the comparison of proportions and the Student's t-test was used for the analysis of the continuous variables. Statistical significance was accepted at the level of $p<0.05$.

Results

The study cohort consisted of 1693 (43.2%) males and 2227 (56.8%) females with age less than 50 years. Out of 3920 RHD patients, 223 (5.68%) patients had significant CAD i.e., Group A (males 61.88%, and females 38.12%) whereas 3697 patients had normal coronaries i.e., group B (males 42.06%, females 57.94%). The overall prevalence of CAD in the patients undergoing valvular intervention was 5.68%. Baseline demographic and clinical data of the study groups are presented in Table 1. Results revealed that patients of group A (RHD with CAD) were predominantly males (61.88% *vs* 38.12%) as compared to group B (RHD without CAD). Increased prevalence of family history of CAD (78.02% *vs* 3.8%), BMI (25.13 ± 4.2 *vs* 21.9 ± 3.8), HTN (69.05% *vs* 13.52%), DM (18.83% *vs* 3.62%) were observed in patients with CAD as compared

to patients without CAD. Clinical symptoms such as angina (57.4%) were significantly higher in patients with CAD. The greater incidence ofatrial fibrillation (49.33% *vs* 29.77%), anemia (78.92% *vs* 46.01%) and lower EF (51.5±9.8% *vs* 54.3±8.3%) was observed in patients of group A as compared to Group B.

Coronary angiography parameters showed that in RHD with CAD group Single Vessel Disease (SVD), Double Vessel Disease (DVD) and Triple Vessel Disease (TVD) was seen in 46.64%, 39.91% and 9.86% respectively while LMCA (left main coronary artery) was involved in 3.59% cases. (Table 2)

The involvement of various valves in both the groups is indicated in Table 3, showing dominance of Aortic valve disease in patients with CAD (62.5%) in comparison to patients without CAD (47.1%), however the involvement of both valve defect was comparable in both groups. The associations of specific coronary artery involvement - lesion at LAD, RCA or LCx with valvular disease are tabulated in Table 2.

Table 1: Demographic and clinical characteristics of the total population.

Sr No	Variable	Total Patients N (%)	Group A N (%)	Group B N (%)	P value
1	Male	1693 (43.2)	138 (61.88)	55 (42.06)	0.0005
2	Female	2227 (56.8)	85 (38.12)	2142 (57.94)	
3	BMI	23.78 ± 3.3	25.13 ± 4.2	21.9 ± 3.8	<0.0001
4	Family History Of CAD	315 (8.03)	174 (78.02%)	141 (3.8)	<0.0001
5	Chest pain				
	Typical Angina	224 (5.7)	128 (57.4)	96 (2.6)	<0.0001
	Atypical Angina	208 (5.3)	165 (74.01)	43 (1.16)	<0.0001
6	Smoking	1109 (28.3)	93 (41.7)	1016 (27.48)	0.0093
7	Dyspnea	3081 (78.6)	203 (91.03)	2878 (77.85)	
	NYHA Class I	86 (2.19)	12 (5.38)	89 (2.40)	0.782
	NYHA Class II	1139 (29)	91 (40.80)	1261 (34.10)	0.22
	NYHA Class III	1775 (45.28)	89 (39.91)	1452 (39.28)	0.9886
	NYHA Class IV	83 (2.12)	11 (4.93)	76 (2.06)	0.8515
8	Diabetes	176 (4.49)	42 (18.83)	134 (3.62)	<0.0001
9	Hypertension	654 (16.68)	154 (69.05)	500 (13.52)	<0.0001
10	Low Hemoglobin	1877 (47.88)	176 (78.92)	1701 (46.01)	<0.0001
11	Raised creatine	579 (14.77)	84 (37.66)	495 (13.39)	<0.0001
12	EF % on ECHO	54.6 ± 7.6	51.5±9.8	54.3±8.3	<0.0001
13	Atrial fibrillation	1218 (31.07)	110 (49.33)	1108 (29.97)	<0.0001

Table 2: Involvements of various coronaries according to valvular heart disease

Sr No	Coronaries	Mitral Valve N(%)	Aortic Valve N(%)	Both Valve N(%)
1	Single Vessel Disease (N-104; 46.64%)			
	LAD	4 (22.2)	45 (32.4)	21 (31.8)
	LCX	1 (5.5)	16 (11.5)	4 (6.1)
	RCA	1 (5.5)	9 (6.4)	3 (4.6)
2	Double Vessel Disease (N-89; 39.91%)			
	LAD + LCX	6 (33.3)	31 (22.3)	16 (24.2)
	LAD + RCA	3 (16.8)	15 (10.8)	13 (19.7)
	LCX + RCA	0 (0)	4 (2.9)	1 (1.5)
3	Tripple vessel disease (N-22; 9.86%)	2 (11.2)	15 (10.8)	5 (7.5)
4	LMCA (N-08; 3.59%)	1 (5.5)	4 (2.9)	3 (4.6)
5	Total (223) (5.68%)	18 (8.2)	139 (62.5%)	66 (29.3)

Table 3: Association of Rheumatic heart disease with CAD

Valve affected	Sex	Total N(%)	Group A N(%)	Group B N(%)
Mitral Valve	Male	417 (38.1)	11 (4.93)	406 (10.98)
	Female	681 (61.9)	07 (3.13)	674 (18.23)
	Total	1098 (28)	18 (8.20)	1080 (29.2)
Aortic Valve	Male	799 (42.5)	81 (36.33)	718 (19.42)
	Female	1082 (57.5)	58 (26.00)	1024 (27.70)
	Total	1881 (48)	139 (62.5)	1742 (47.1)
Both Valves	Male	477 (50.7)	46 (20.63)	431 (11.66)
	Female	464 (49.3)	20 (8.98)	444 (12.01)
	Total	941 (24)	66 (29.3)	875 (23.7)

Discussion

The data evaluating prevalence of angiographically apparent coronary stenosis in RHD patients shows great degree of variation, from 8-50%.[11-14] In western countries the prevalence was reported to range from 16–50%, whereas in South East Asian countries the reported incidence was ranging from 8%–31.3% respectively.[15,16] From India, Jose et al., had shown overall prevalence of CAD with RHD as 12.2% which documented much lower prevalence than the earlier noted western reports.[17] Although the incidence of CAD is higher among south East Asians and are afflicted at an early age as compared to the western population, the prevalence of CAD in RHD is patients is comparatively low.[18–20] In our study also the current study also shows only 5.68% incidence of arterial stenosis in valvular patients of western India. This may be due to higher age group in the western countries and partly due to the demographic, clinical and environmental characteristics of the different population like race, dietary habits and physical activity.

Regarding the etiology, we observed a low prevalence of severe CAD among the rheumatic patients; it was initially thought that this etiology could confer some degree of protection against the development of coronary atherosclerosis, as observed by other investigators.[18] This was based on the fact that, in general, these patients receive the prophylaxis for rheumatic fever with the use of intramuscular antibiotics every 21 days for many years and this could have a protective antibacterial and anti-inflammatory effect on the genesis of coronary atherosclerosis. However, our findings do not corroborate the idea. A review of the clinical history showed that most of the patients had never received prophylaxis for rheumatic fever, which seems to make sense, as if this had really been adequately performed, certainly their cardiac valves would not have reached such state of damage as commonly found in these patients. The data showed an alternative explanation: that the low prevalence could be due to the demographic and clinical characteristics of this population.

The ratio of male to female (1.62:1) obtained by us was comparable with others showing the ratios from 1.6:1 to 2.6:1.[21] One study from China conveyed the ratio of 3:1, further suggesting the higher susceptibility of male gender.[15,21,22] The average age of patient having RHD with CAD was around 55-60 years in western and Chinese population which was comparable to Indian and Pakistani studies also.[14,21,23] Rangel et al. and Li BL et also found that LAD was the most commonly involved artery followed by RCA and LCX.[15]

Coronary artery disease with RHD is a multifactorial condition involving several risk factors namely smoking, DM, family history of CAD and obesity contributing to its pathophysiology. A prospective study, conducted by Jose et al.[17] had also reported the higher predictivity of CAD risk factors in rheumatic valve patients using multimarker strategy. Atalar et al., assessed predictors of CAD in RHD patients on large cohort of 1075 patients and found that HTN, smoking, DM and dyslipidemia are significantly higher in RHD patients with CAD as compared to patients without CAD.[24] The prevalence of CAD in the two models described by Lin et al. and Lim et al., was 19.3% and 36% respectively.[19,25] It indicates that in patients with RHD, the incidence of CAD was low and thus the strength of prediction and respective relationship between predictors derived in previous analyses might be lost. Presence of angina was significantly more common in the RHD with CAD group than the RHD patients without CAD (p=0.0001). Other studies also found that presence of angina is a good predictor of the CAD in RHD patients.[12,22,23] In our study, a low prevalence of significant CAD of 5.68% in the rheumatic patients was present, as observed by other investigators.[17,22,26] Single Vessel

disease was more commonly seen in the other studies also.[27] The reason cannot be the rheumatic-fever preventing intramuscular antibiotics which could have a protective anti-inflammatory effect on the genesis of coronary atherosclerosis because the patients in our study seldom received such prophylaxis. Kruczan et al. inferred that the low prevalence could be due to the demographic and clinical characteristics.[22] So the above discussion states that, occurrence of CAD may be partly attributed to the presence of multiple risk factors, which holds therapeutic and prognostic significance of diagnozing CAD incidence in valvular patients. Thus its always necessary to look for CAD risk factors as they are strong predictors of CAD in these group of patients.

Conclusion

Prevalence of CAD in patients undergoing intervention for valvular heart disease in Indians with the age less than 50 years is 5.68%. Presence of typical angina was predictive of CAD unlike many other studies in patients of RHD.

Although the diagnostic coronary angiography is a low-mortality method, it has an incidence of complications that vary from less than 1% to close to 5%. However, when such complications occur, they can have a quite significant adverse effect. Among other complications, it is important to mention the occurrence of brain injuries due to gaseous and solid micro embolisms that can result in the cognitive impairment of patients, particularly the predisposed ones.[28] In our opinion, the routine indication of preoperative coronary angiography based solely on the age criterion must be reconsidered and should be done in younger patients (Age 55 - 60 years) only when its associated with more than 2 coronary risk factors.

Conflict of interest: The authors declare that there is no conflict of interest exists.

List of Abbreviations

BMI: Body Mass Index;

CAD: Coronary Artery Disease;

NYHA: New York Heart Association;

AF: Atrial Fibrillation;

LVDD: Left Ventricular End diastolic dimension;

LVDS: Left Ventricular End systolic dimension;

ECHO: Echocardiography;

EF: Ejection Fraction;

ESR: Erythrocyte Sedimentation Rate;

* expressed as mean ± standard deviation,

RHD: Rheumatic Heart Disease;

CAD: Coronary Artery Disease;

LAD: Left Anterior Descending;

LCx: Left Circumflex;

RCA: Right Coronary Artery.

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