ASSOCIATION OF LEFT VENTRICULAR DIASTOLIC DYSFUNCTION WITH ATRIAL FIBRILLATION AFTER CORONARY ARTERY BYPASS GRAFT SURGERY

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ABSTRACT

Objective: To determine the association of Diastolic dysfunction in patients with atrial fibrillation after CABG surgery.

Methodology: This cross sectional study was conducted from 01st May, 2022 to 30th Nov, 2022 in department of Cardio-thoracic Anaesthesia and Adult Cardiac Critical care, AFIC/NIHD, Rawalpindi. 154 patients were assessed for preoperative diastolic dysfunction, and grade. After CABG, they were monitored for 24 hours in ICU for atrial fibrillation (AF). If there was AF, it was noted down.

Results: Most of our patients were male (81.2%). Mean age of patients was 58.69 ±8.25 years. Hypertension was present in 71.4% patients. Mean ejection fraction was 49.88±6.28%. Grade I diastolic dysfunction was present in 42.9% patients. Frequency of AF was 31.2%. Frequency of diastolic dysfunction (Grade 1 & 2) was higher in non-AFib group while Grade-3 dysfunction was higher in AFib group and the association was statistically significant ($p<0.01$). Mean difference of ejection fraction and hypertension status was also significantly associated with AFib status with p-values ($p=0.007$ and 0.034 respectively). All rest variables had insignificant findings with regard to AFib status ($p>0.05$).

Conclusion: Our study shows that grade III diastolic dysfunction is associated with increased frequency of post-operative atrial fibrillation.

Keywords: Atrial Fibrillation; CABG; Diastolic Dysfunction

INTRODUCTION

Diastolic dysfunction is a disorder of progressive nature resulting from impairment of left ventricular relaxation. Collagen deposition interstitially and modification of extracellular proteins result in stiffness of LV which causes poor relaxation during diastole. Old age, obesity, hypertension and diabetes are common risk factors for diastolic dysfunction.[1] Diastolic dysfunction prevalence in general population is reported around 11% to around 34%.[2] LV filling and stroke volume is dependent on left ventricular diastolic function. Abnormality of this function leads to increased morbidity and mortality.[3]

Coronary artery bypass grafting surgery (CBAG) is associated with many complications postoperatively such as bleeding, prolonged mechanical ventilation, atrial fibrillation and delirium. Atrial Fibrillation is the Second most common complication after CABG surgery and is associated with the greater risk of Cerebrovascular events, extended Intensive care unit and hospital stay, cost of treatment and escalated risk of death.[4,5] Recently it has been recognised that diastolic dysfunction increases the risk of AF. It causes pathological alterations in function and structure of left atrium.

We sought to determine through this study association of diastolic dysfunction with atrial fibrillation after CABG surgery. Our hypothesis was that high grade of diastolic dysfunction is associated with increased frequency of AF. To the best of our knowledge no such study has been published in our population.

METHODOLOGY

This descriptive cross sectional study was conducted from 1st May, 2022 to 30th Nov, 2022 in adult operation theatre, Cardiothoracic Anaesthesia and Adult Cardiac Critical care department, Armed Forces Institute of Cardiology and National Institute of Heart Diseases, Rawalpindi. Sample Size of 152 was calculated

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by taking 11.1% prevalence of diastolic dysfunction. However, we included 154 patients in this study.

All consecutive patients with diastolic dysfunction undergoing cardiac CABG Surgery, with LV ejection fraction more than 45% and good coronary targets were recruited into the study. Patients with arrhythmias after surgery, pacemakers, on antiarrhythmic agents, combined CABG and valve surgery, hyperthyroid and peri-op myocardial infarction were excluded from the study. In this study, Post-Operative AF was defined as an episode of Atrial Fibrillation after CABG surgery that lasted 30 seconds and observed on ECG.[6] Diastolic dysfunction was defined on the basis of E (early diastolic) and A(late diastolic) velocities on echocardiography. Diastolic dysfunction is grade 1 with E/A <0.8, grade 2 with E/A (0.8-1.5) and grade 3 with E/A >1.5.[7] Study was conducted after the approval from ethical review board of the institute. Non-probability Consecutive sampling was used in this study.

After informed consent, patients were included in the study after fulfilling inclusion criteria. Their demographic features were noted down. Surgical Echocardiography was done by senior consultant of the institute who did not take part in the study. Preoperative diastolic dysfunction and LV ejection fraction was noted down using pre-designed proforma by one of the member of research team. Patients were kept in surgical intensive care unit, and were monitored for 24 hours postoperative for atrial fibrillation. AF episode was noted down by duty nurse who did not take part in study, ECG recorded and then counter checked by anaesthetist on duty using same proforma. All data was analysed by IBM SPSS v 24.0. Frequencies and mean +/- SD were recorded for different variables. Significance was measured using chi-square test and T-test. 0.05 p-value was considered as significant. Confidence interval was taken 95% and error of margin 5%.

RESULTS

Descriptive analysis revealed that frequency of males was higher 125(81.2%) in study sample (n=154). 58.69 ±8.25 years was recorded as mean age of the patients. Maximum number of patients presented with TVCAD 135 (87.7) and least number of patients had additional valvular disease with TVCAD 2(1.3%). Majority were hypertensive 110(71.4%) and mean ejection fraction was 49.88±6.28%. Greater number of patients had Grade-1 (E(A <0.8) diastolic dysfunction 66 (42.9%). Prevalence of atrial fibrillation was 31.2% (Table 1).

Cross-tabulation findings presented in Table 2 showed minimal and insignificant variation in mean age among patients with AFib and without AFib (59.0±8.21 vs 58.56±8.31 respectively; p>0.05). Frequency of diastolic dysfunction (Grade 1 & 2) was higher in non-AFib group while Grade-3 dysfunction was higher in AFib group and the association was statistically significant (p<0.01). Mean difference of ejection fraction and hypertension status was also significantly associated with AFib status with p-values (p=0.007 and 0.034 respectively). All rest variables had insignificant findings with regard to AFib status (p>0.05).

DISCUSSION

To our knowledge, no study has been conducted in our population which has researched association of diastolic dysfunction with atrial fibrillation in post-operative CABG cases. Our study shows that frequency of diastolic dysfunction (Grade 1 & 2) was higher in non-AFib group while Grade-3 dysfunction was higher in AFib group and the association was significant statistically (p<0.01).

This topic has been of interest to researchers in other countries. Ashes and his colleagues researched this subject in 109 patients. Their study differed from ours in regards to the fact that they checked new or worsened diastolic dysfunction in post CABG cases. We did not take this into consideration. However, their finding is quite similar to our study. They concluded that if new diastolic dysfunction developed, or previous one worsened, frequency of post-operative atrial fibrillation increased.[8] Similar results

Table 1: Characteristics of study participants

Variable		n(%) Mean±SD
Age in years		58.69 ±8.25
Gender	Male	125(81.2)
	Female	29(18.8)
Disease	SVCAD	5(3.2)
	DVCAD	12(7.8)
	TVCAD	135(87.7)
	TVCAD+Valvular Disease	2(1.3)
Ejection Fraction (%)		49.88±6.28
Hypertension		110(71.4)
Diabetes		62(40.3)
COPD		4(2.6)
Diastolic Dysfunction	Grade 1 (E(A <0.8)	66(42.9)
	Grade 2 (E(A 0.8-1.5)	56(36.4)
	Grade 3 (E(A >0.15)	32(20.8)
Atrial Fibrillation		48(31.2)

Table 2: Association of Atrial Fibrillation with different variables among study cases

Variable		Atrial Fibrillation		p-value
		Yes (n=48)	No (n=106)	
Age (years)		59.0±8.21	58.56±8.31	0.758
Gender	Male	39(81.3)	86(81.1)	1.00
	Female	9(18.8)	20(18.9)	
Disease	SVCAD	42(87.5)	93 (87.7)	0.14
	DVCAD	2(4.2)	10(9.4)	
	TVCAD	2(4.2)	3(2.8)	
	TVCAD+Valvular Disease	2(4.2)	-	
Ejection Fraction (%)		47.85±3.52	50.8±7.02	0.007
Hypertension		40(83.3)	36(66.0)	0.034
Diabetes		20(41.7)	42(39.6)	0.860
COPD		-	4(3.8)	0.310
Diastolic Dysfunction	Grade 1 (E(A <0.8)	6(12.5)	60(56.6)	<0.001
	Grade 2 (E(A 0.8-1.5)	18(37.5)	38(35.8)	
	Grade 3 (E(A >0.15)	24(50.0)	8(7.5)	

were found by Melduni and his colleagues. They included 351 patients in their study, and they found an exponential increase in frequency of post-operative atrial fibrillation with increase in diastolic dysfunction.[9] Rong and his colleagues discovered similar finding. They studied 402 patients and concluded that baseline preoperative LV diastolic dysfunction is independent risk factor for post-operative atrial fibrillation.[10] Our study shares this conclusion with their study since we also considered baseline LV diastolic dysfunction.

A retrospective study was conducted by Değirmencioğlu and his colleagues. They included 650 patients in their study, and concluded that mild diastolic dysfunction is not associated with adverse outcomes after CABG surgery.[11] Their study showed that post-operative AF was 11.2 % in patients having diastolic dysfunction versus 10.1%. Statistically difference was insignificant. Apparently this retrospective study contradicts our study, however even our study demonstrated that in Grade I and II diastolic dysfunction, atrial fibrillation was not higher. The difference was found in Grade III diastolic dysfunction. Also, Kyle and his colleagues conducted a prospective observational study and found that all grades of diastolic dysfunctions were associated with increased morbidity.[12] In addition, frequency of post-operative atrial fibrillation was higher in those patient who had diastolic dysfunction.

Brown et al published his research article which mentioned that frequency of atrial fibrillation, increased duration of mechanical ventilation, acute kidney injury, requirement for red cell transfusion and length of stay increased in grade III diastolic dysfunction.[13] Though our study focused on post-operative atrial fibrillation, their finding regarding post-operative atrial fibrillation is similar to our study. All these studies highlight the fact that diastolic dysfunction is associated with post-operative atrial fibrillation in CABG patients. Though atrial fibrillation may often be benign and transient, these can lead to prolonged ventilation time, increase need for re-intubation, congestive cardiac failure, stroke and prolonged ICU stay in patients already having grade II or III diastolic dysfunction.[14-16]

There are studies which state that diastolic dysfunction is not associated with post-operative atrial fibrillation. For example, Barbara et al conducted a retrospective study and concluded that preoperative diastolic dysfunction did not predict post-operative atrial fibrillation.[17] However, other researchers have highlighted association of diastolic dysfunction with increased morbidity.[18,19]

LIMITATIONS

Our study did not take into consideration any worsening of diastolic dysfunction. Also, choice of ionotropic supports has influence on diastolic dysfunction, and we did not use similar ionotropes in patients. This is because ionotropes had to be tailored according to patient.

CONCLUSIONS

Our study has shown association between grade III diastolic dysfunction and post-operative atrial fibrillation. This is first of its kind study, and more studies are suggested to find more about diastolic dysfunction in our population.

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Author's Contribution

AM conceived the idea and designed the study. SAR, NA and WA helped in designing the study, performed data analysis and helped in the write up of the manuscript. IBM and SAH helped in the write up of the manuscript. All authors made substantial intellectual contributions to the study.

Conflict of Interest

Authors declared no conflict of interest

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None

Data Sharing Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.