

Association of CHA₂DS₂-VASc Score with Post Cardiac Surgery Atrial Fibrillation: A Single Centre Study

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ABSTRACT

Objective: To find out the association of CHA₂DS₂-VASc score with postoperative atrial fibrillation in cardiac surgery patients.

Study Design: Analytical Cross-Sectional study.

Place and Duration of Study: Cardiothoracic Anaesthesia and Adult Cardiac Critical Care department, Armed Forces Institute of Cardiology and National Institute of Heart Diseases (AFIC/NIHD), Rawalpindi Pakistan, from Feb 2022 to Apr 2022.

Methodology: After IERB approval, 186 adult patients of POAF with the prevalence of 9.7% undergoing CABG surgery were included in the study. Their demographic data and CHA₂DS₂-VASc score, originally used to find the risk of stroke in patients with atrial fibrillation, was calculated pre-operatively. They were followed for 48 hours postoperatively for any episode of post op atrial fibrillation (POAF). Data including pre op drugs, type of surgery, number of grafts, inotropic support and POAF timing after surgery was recorded and analysed by SPSS v 21.0.

Results: Incidence of POAF in our study patients was 17.2% (n=32). Mean time of onset of POAF was 24.75±16.05 hours. Patients who developed POAF had higher CHA₂DS₂-VASc score 3.06±1.21 compared with those who did not develop POAF 2.61±0.97. This association was statistically significant (*p*-value=0.023). Among the variables of CHA₂DS₂-VASc score, age had significant association with POAF (*p*-value= 0.001). No difference was found between on pump vs off pump surgery in terms of POAF (*p*-value=0.539).

Conclusion: This study found that CHA₂DS₂-VASc score has significant association with POAF after CABG surgery. It is a simple and easy scoring system which can be calculated in preoperative period. Patients at increased risk of POAF can be identified and given prophylactic treatment to reduce morbidity and mortality.

Keywords: Atrial fibrillation, CABG, cardiac surgery, CHA₂DS₂-VASc score, POAF.

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INTRODUCTION

One of the common complications of cardiac surgery is postoperative atrial fibrillation (POAF), which is associated with the increased risk of stroke, prolonged ICU and hospital stay, and increased mortality.¹ It is considered as second most costly complication after cardiac surgery due to its high incidence.² The incidence of POAF after cardiac surgery is reported around 10% to 35%.³ A local study conducted in a tertiary care hospital showed 9.7% prevalence of POAF after cardiac surgery.⁴ It is higher in valve surgeries than coronary artery bypass grafting (CABG) surgery. Surgical traumas, inflammatory response of cardiopulmonary bypass, oxidative stress due to reperfusion and electrolyte imbalances have been involved in the occurrence of POAF. The risk of development is highest immediately after surgery to 18 hours postoperatively and then between 36 to 48 hours after surgery.⁵ Preoperative risk factors which are associated with POAF include male gender, advanced

age, hypertension, congestive heart failure, left atrial enlargement, diabetes, COPD, chronic kidney disease and thyroid dysfunction.⁶

Some scoring systems have been utilized to predict the new onset of atrial fibrillation, such as FHS (Framingham Heart Study) score, the ARIC (Atherosclerosis Risk in Communities Study) score, and the CHARGE-AF (Cohorts for Heart and Aging Research in Genomic Epidemiology–Atrial Fibrillation) score but these have not been utilized for prediction of POAF. CHA₂DS₂-VASc score as shown in Table-I, combines cardiovascular and non-cardiovascular characteristics to determine a patient's risk of stroke. Parameters included in this score are congestive heart failure or LV dysfunction, hypertension, age, diabetes, stroke, vascular disease and female gender. This score is originally used to predict risk of stroke in patients with atrial fibrillation. It is suggested that this scoring system can be used to predict the risk of atrial fibrillation after cardiac surgery.⁷ A score of more than 3 is considered to be associated with a higher risk of

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atrial fibrillation.⁸ This study aims to find out the association of CHA₂DS₂-VASc score with POAF in our patients so that we can start prophylactic treatment in high-risk patients to reduce morbidity, mortality and cost of treatment.

METHODOLOGY

This Cross-Sectional study was conducted in Cardiothoracic Anaesthesia and Adult Cardiac Critical care department, Armed Forces Institute of Cardiology and National Institute of Heart Diseases from February 2022 to April 2022.

Sample Size: The calculated sample size by taking 9.7% prevalence of POAF after cardiac surgery in a local study was 135 but we included 186 patients.⁴

Inclusion Criteria: All consecutive patients undergoing cardiac surgery including on pump & off-pump CABGs were included in the study.

Exclusion Criteria: Patients with preoperative and intraoperative arrhythmias, pacemakers, on antiarrhythmic agents (verapamil, diltiazem, amiodarone, and digoxin), hyperthyroid, valve surgeries, combined CABG and valve surgeries, and re-openings were excluded from the study. Non-probability Consecutive sampling technique was used.

The data was collected after the official approval from ethical board of research AFIC-NIHD(IERB# 9/2/R&D/2022/170). Preoperative evaluation was done one day before surgery including a detailed history and physical examination of each patient. The CHA₂DS₂-VASc score was calculated during Preoperative evaluation. Echocardiography finding of left ventricular function and ejection fraction were noted. Medications including beta-blockers, angiotensin-converting enzyme inhibitor (ACEI)/angiotensin receptor blockers (ARB), and statins were noted. β-Blockers and statins were continued till the day of surgery. Type of surgery, on-pump or off-pump, cardiopulmonary bypass time, cross-clamp time, number of grafts and perioperative inotropic supports were noted. Patients were followed for two days postoperatively and new-onset POAF (an episode of Atrial Fibrillation that sustained for 30 seconds) was recorded with the time of onset after surgery.

All the data was analysed by SPSS v 21.0. Categorical variables are presented as frequencies (percent) while continuous variables are presented as mean±SD. Statistical tests such as chi square and t-test were applied for comparison and to measure the significance. *p*-value less than 0.05 was considered signi-

ficant by taking 95% confidence interval and 5% margin of error.

RESULTS

In this study 186 patients undergoing CABG surgery were included. They were followed for 48 hours postoperatively for atrial fibrillation to find its association with CHA₂DS₂-VASc score (Table-I).

Table-I: CHA₂DS₂ -VASc Score

Congestive cardiac failure/LV dysfunction(LVEF<45%)	Yes : 1 No: 0
Hypertension	Yes: 1 No: 0
Age	≥75 years :2 65-74 years : 1 < 65 years: 0
Diabetes mellitus	Yes: 1 No: 0
Stroke/transient ischemic attack	Yes: 2 No: 0
Vascular disease (prior MI/carotid or peripheral vascular arterial disease)	Yes: 1 No: 0
Female Gender	Yes: 1 No: 0

Incidence of POAF in these patients was 17.2% (n=32). Mean time of onset of POAF was 24.75±16.05 hours. Minimum time of onset after surgery was two hours. Patients who developed atrial fibrillation had higher CHA₂DS₂-VASc scores and this association was statistically significant (*p*-value=0.023). Patients' characteristics and medical history in POAF group and non-POAF group is shown in Table-II.

Table II. Patients Characteristics and Medical history

Parameter	Total (n=186)	POAF (n=32)	Non-POAF (n=154)	<i>p</i> -value	
Age (years) (Mean±SD)	58.54±9.31	63.62±7.12	57.49±9.39	0.001	
Gender	Male	168(90.3%)	30(17.9%)	138(82.1%)	0.368
	Female	18(9.7)	2(11.1%)	16(88.9%)	
EF(%)	50.39±8.83	51.25±9.05	50.22±8.8	0.55	
LV Dysfunction n(%)	46(24.7)	8(17.4)	38(82.6)	0.564	
Hypertension n(%)	112(60.2)	22(19.6)	90(80.4)	0.189	
Diabetes n(%)	80(43)	16(20)	64(80)	0.247	
Stroke n(%)	6(3.2)	-	6(100)	0.42	
Beta Blockers n(%)	128(68)	20(15.6)	108(84.4)	0.259	
ACE/ARB n(%)	58(31.2)	8(13.8)	50(86.2)	0.272	
Statins n(%)	102(54.8)	14(13.7)	88(86.3)	0.117	

Intraoperative findings and inotropic support between groups is compared in Table-III. In On pump

cases mean CPB time was 123±39.65 minutes and mean cross clamp time was 77.6±31.7 minutes.

Table-III: Intraoperative findings and Inotropic Support

Parameter	Total (n=186)	POAF (n=32)	Non-POAF (n=154)	p-value
CABG ON Pump n(%)	106(57)	18(17)	88(83)	0.539
Off Pump n(%)	80(43)	14(17.5)	66(82.5)	
Number of Grafts (Mean±SD)	3.24±0.75	3.18±0.53	3.25±0.79	0.626
IABP n(%)	24(12.9)	4(16.7)	20(83.3)	0.603
Adrenaline n(%)	136(73.1)	26(19.1)	110(80.9)	0.179
Noradrenaline n(%)	120(64.5)	28(23.3)	92(76.7)	0.002
Dobutamine n(%)	86(46.2)	18(20.9)	68(79.1%)	0.146
CHA ₂ DS ₂ -VASc Score (Mean±SD)	2.68±1.02	3.06±1.21	2.61±0.97	0.023

Mean CHA₂DS₂-VASc Score for all 186 patients was 2.68±1.02. POAF group had higher CHA₂DS₂-VASc Score of 3.06±1.21 as compared to non POAF group 2.61±0.97. Association of higher CHA₂DS₂-VASc Score with development of POAF was found significant with p-value of 0.023. Figure illustrates distribution of number of cases with CHA₂DS₂-VASc Score.

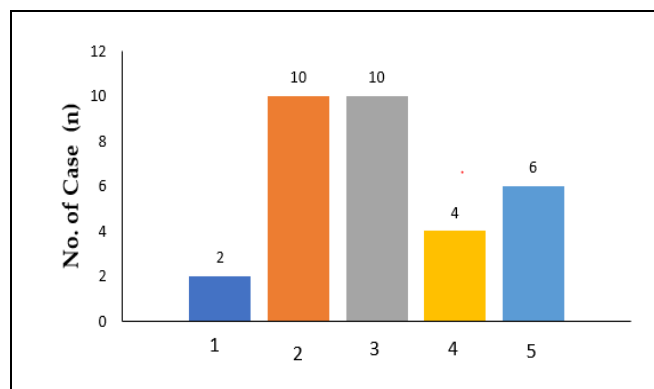


Figure: Association of CHA₂DS₂-VASc Score with POAF

DISCUSSION

Main finding of this study is the statistically significant association of CHA₂DS₂-VASc score with POAF after CABG surgery. Group of patients who developed atrial fibrillation had higher mean score (3.06±1.21) as compared to the group who had no episode of AF (2.68±1.02). Similar results were found by Krishna VR *et al.* who showed that CHA₂DS₂-VASc score of 3 had positive predictive value of 50% (95% CI: 32.92–67.08) and negative predictive value of 96.63% (95% CI: 89%–99.61%) for POAF.⁷ In their study Mortazavi *et al.* concluded that CHA₂DS₂-VASc score of ≥2 (OR: 1.813, 95% CI: 1.220-2.694) was associated with POAF.⁹ Sareh *et al.* and Chua *et al.* also found that

patients having score of two or more are at increased risk of atrial fibrillation after cardiac surgery.^{10,11} In another study after valve surgeries a score of 4 was considered significant to predict atrial fibrillation.¹²

Among the variables of CHA₂DS₂-VASc score age, hypertension and low ejection fraction are considered as most consistent factors associated with post op atrial fibrillation after cardiac surgery.¹³⁻¹⁵ But in our study we found only age as significant factor (p-value= 0.001) associated with POAF after CABG surgery. Other factors including hypertension and left ventricular dysfunction did not show any significant association. Benjamin *et al.* also found age as strong predictor of post cardiac surgery atrial fibrillation.¹⁶

Our study did not find any significant reduction in POAF with the use of beta blockers, statins and ACE inhibitors. Similar to our study preoperative statins, ACE inhibitors and ARBs did not show reduction of atrial fibrillation after cardiac surgery in other studies.^{17,18} Contrary to our study a metaanalysis showed beta blockers were associated with fewer episodes of atrial fibrillation after surgery.¹⁹ Off pump CABG surgery is considered to be associated with fewer episodes of atrial fibrillation than on pump CABG surgery.^{20,21} In contrast we did not find any significant difference between on pump and off pump CABG surgery in terms of POAF. Similar to our study it is found that number of grafts is not associated with increased risk of atrial fibrillation after CABG surgery. Even type of grafts did not show any association.²²

In our study the incidence of POAF after CABG surgery was 17.2% which is consistent with the incidence quoted in international studies.³ Mechanism of POAF is not clearly understood but it is proposed that surgical trauma, ischemic stress during CPB, pro-inflammatory markers during reperfusion and electrolyte imbalance result in generation of atrial fibrillation. Development of atrial fibrillation after cardiac surgery increases morbidity and mortality. ICU stay and hospital admission gets prolonged which result in higher cost of treatment and use of extra resources. It has been shown that prophylactic use of beta blockers and amiodarone are associated with lesser episodes of atrial fibrillation after cardiac surgery.^{19,23} Antiarrhythmic drugs like amiodarone have their own side effects so these drugs should be used in selected high risk patients. As our study and other similar studies showed that patients with high CHA₂DS₂-VASc score (score of 3 or more) are at increased risk of atrial fibrillation so we can start preoperative beta blockers

in these patients and give prophylactic perioperative amiodarone to prevent episodes of atrial fibrillation.

LIMITATIONS OF STUDY

The limitations of our study included just 48 hours follow up of patients, small sample size and single centre study. To increase the scope of study it can be done in multiple institutes, increase the the number of patients and follow up for seven to thirty days so that results may be more authentic and further complications associated with atrial fibrillation can be recorded.

CONCLUSION

This study found that CHA₂DS₂-VASc score is a good tool to predict post op atrial fibrillation after CABG surgery. It is a simple and easy scoring system which can be calculated in preoperative period. Patients at increased risk of POAF can be identified and given prophylactic treatment to reduce morbidity and mortality.

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Conflict of Interest: None.

Author's Contribution

Following authors have made substantial contributions to the manuscript as under:

WA: Concept, Literature review, Manuscript writing

SAH: Concept, Manuscript review, intellectual contribution,

RM: Data analysis, intellectual contribution, formatting

SMHK: Manuscript review, critical review, Proof read

MA: Data collection, data management, formatting

FUR: Data collection, referencing, study design

RJ: Data analysis, interpretation, editing

HK: Data analysis, interpretation, editing

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated & resolved.

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