

Hyperglycemia as a Risk Factor for Atrial Fibrillation after Coronary Artery Bypass Graft Surgery

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Abstract

Post-operative atrial fibrillation (POAF) is considered a common complication after coronary artery bypass surgery (CABG), which is associated with prolonged hospitalization, increased morbidity and even mortality [1]. We investigated the risk factors for POAF and analyzed the relationship between hyperglycemia and atrial fibrillation after CABG. This retrospective study was conducted on 100 patients who were admitted post CABG to critical care department at Benha University Hospital and National Heart Institute. Patients were divided into two groups: Group A included 50 patients who developed POAF and Group B included 50 patients who did not. In this study, we found that history of diabetes mellitus (DM), mean post-operative blood sugar (BS) and maximum post-operative BS were significant ($P < 0.05$) in group A. We also found that post-operative drainage volume was significant in group A. We concluded that post-operative mean BS, maximum BS and post-operative drainage volume were significant risk factors for occurrence of POAF. We should control intensively blood sugar and also decreasing bleeding risks.

Keywords: CABG, POAF, Blood sugar, DM, Drainage volume.

1. Introduction

Atrial fibrillation (AF) is the most common cardiac arrhythmia in adults and is characterized by chaotic atrial electrical activity leading to irregular heart rhythm [1].

Postoperative atrial fibrillation (POAF) is defined as new-onset atrial fibrillation (AF) in the initial period after surgery and is considered the most important type of secondary AF (AF resulting from an identifiable, primary, acute condition) [2].

POAF is a complication in approximately one-third of patients undergoing cardiac surgery, causing substantial increases in hospital costs; intensive care unit time and hospital stay [3].

Diabetes mellitus is a group of metabolic disorders where there are high blood sugar levels over time. Prolonged elevations in sugar levels lead to a number of health complications including cardiovascular disease and kidney disease [4,5].

In a comprehensive meta-analysis, diabetic patients were found to have an 40% greater risk for developing atrial fibrillation compared to non-diabetic patients [5] and a more recent meta-analysis identified a 20% increase in the risk of developing atrial fibrillation for prediabetic patients whereas in patients with diabetes, this number was elevated to 28% greater change of atrial fibrillation development [6].

AF is clinically managed through pharmacologic heart rate control with beta-blockers, calcium-channel blockers, and other antiarrhythmic medications [7]. A rhythm control strategy can be attempted to return the patient to sinus rhythm via pharmacologic or electrical cardioversion, or increasingly by intracardiac catheter ablation [8].

Intensive care unit (ICU) protocols currently use bedside glucometers to check glucose levels every

30-60 minutes in the immediate post-operative period and adjust insulin titrations accordingly [9].

The aims of the present study were to identify predictors of postoperative AF after CABG, and to show the relationship between postoperative blood sugar concentration (BS) and postoperative AF.

2. Patients and methods

A 100 Patients post CABG admitted to critical care department at Benha University Hospital were divided into two groups:

❖ **Group [A]** included 50 patients: Patients who developed POAF.

❖ **Group [B]** included 50 patients: Patients who did not develop POAF.

Patients were monitored postoperatively and arrhythmias were recorded using a 12 leads ECG and blood sugar levels were also recorded every 2 hours in the ICU in the first 6 hours after operation and subsequently every 6 hours. Other post-operative routine labs were also recorded. Both groups were compared according to the preoperative and post-operative data.

3. Results

The collected data were tabulated and statistically analyzed using SPSS program software version 18.0. Quantitative data presented as minimum and maximum of the range and the mean \pm SD while Qualitative data presented as number and percentage. P values less than 0.05 were considered significant.

There were no significant differences (p -value > 0.05) between both groups as regard age, sex, pre-operative heart rate and blood pressure (systolic and diastolic), medical history as regard to smoking and hypertension but history of DM was significant in group A (P -value < 0.001) as shown in Table (1)

Table (1) Comparison between the two groups as regard age, sex, risk factors [Medical history] and vital data.

	Group A (n=50)		Group B (n=50)		Tests	
					T or X ²	P-value
Age						
Range	31-70		44-69		0.599	0.551
Mean± SD	58.36±10.33		59.44±7.47			
Sex						
Female	8(16%)		12(24%)		1.000	0.317
Male	42(84%)		38(76%)			
Medical history						
Smoking	41(82%)		45(90%)		1.329	0.249
Diabetes Mellitus	36(72%)		15(30%)		17.647	<0.001**
Hypertension	27(54%)		20(40%)		1.967	0.161
Preoperative Heart rate (beat/min)						
Mean± SD	85.60±9.62		84.48±8.99		0.602	0.549
Diastolic Blood pressure (mm/Hg)						
Mean± SD	86.60±14.23		87.20±14.00		0.213	0.832
Systolic Blood pressure (mm/Hg)						
Mean± SD	131.80±20.77		133.40±20.06		0.392	0.696

There was no significant difference (p-value >0.05) in both groups according to pre-operative echo findings and post-operative ejection fraction as shown in Table (2).

Table (2) Comparison between the two groups as regard Preoperative Echo Findings and Post-operative ejection fraction (EF).

	Group A (n=50)		Group B (n=50)		Chi- square	
	N	%	N	%	X ²	P-value
Preoperative Echo Findings						
Normal	18	36	23	46	2.047	0.563
Dilated left atrium(LA)	15	30	11	22		
Dilated left ventricle(LV) - dilated LA - low EF	9	18	6	12		
Regional wall Motion Abnormality	8	16	10	20		
Post-Operative Ejection Fraction (EF)						
Normal (EF>55%)	26	52	22	44	0.707	0.702
Borderline (EF35-55)	12	24	15	30		
Impaired (EF<35)	12	24	13	26		

There was no statistically significant difference (P > 0.05) between the two groups as regard preoperative Fasting Blood Sugar level. Post-operative mean and maximum blood sugar level showed statistically significance (P-Value< 0.05) between the two groups which was significant in group A as shown in Table (3).

Table (3) Comparison between the two groups as regard preoperative Fasting Blood Sugar level, Post-operative Mean and Maximum blood sugar level.

Blood Sugar Level(mg/dl)	Group A (n=50)			Group B (n=50)			T-test	
	Mean	±	SD	Mean	±	SD	T	P-value
Preoperative Fasting blood sugar	115.12	±	18.8	122.16	±	20.49	1.790	0.077
Postoperative Mean blood sugar	176.68	±	53.65	157.88	±	27.81	2.200	0.030*
Postoperative Maximum blood sugar	277.37	±	58.91	255.00	±	47.01	2.098	0.038*

There was no statistically significant difference (P-value>0.05) between the two groups as regard Bypass Time , Cross Clamping Time ,Ventilation Time, ICU stay time, Blood and Blood products transfusion , postoperative Volume Balance , presence of intra- aortic

balloon. There was statistically significant difference (P-value < 0.05) between the two groups as regard postoperative drainage volume that was significant in group A than group B as shown in Table (4).

Table (4) Comparison between the two groups as regard Surgery steps and Post-operative period characters and Events.

	Group A	Group B	Tests	
	(n=50)	(n=50)	T or X ²	P-value
Bypass Time (min.)				
Range	60-140	60-140	0.117	0.907
Mean± SD	90.00±25.39	89.40±25.75		
Cross Clamping Time /min				
Range	30-110	30-105	1.318	0.191
Mean± SD	48.10±24.01	54.40±23.79		
Ventilation Time/ hour				
Range	6-35	6-47	0.926	0.357
Mean± SD	12.00±6.66	13.56±9.88		
ICU stay time /day				
Range	2-6	2-6	1.523	0.131
Mean± SD	3.1±1.45	2.72±1.01		
Blood and Blood products transfusion				
Fresh Blood	32(64%)	36(72%)	0.735	0.391
Packed RBCS	36(72%)	40(80%)	0.877	0.349
PLASMA	37(74%)	41(82%)	0.932	0.334
Postoperative Volume Balance				
Positive	5(10%)	4(8%)	0.122	0.727
Negative	45(90%)	46(92%)		
Postoperative drainage volume (cc)				
Range	500-1800	400-1200	6.118	<0.001**
Mean± SD	1164.00±401.91	768.00±218.94		
Intraortic balloon				
Yes	9(18%)	5(10%)	1.329	0.249
No	41(82%)	45(90%)		

4. Discussion

In our study, There were no significant differences (p-value >0.05) between both groups as regard age ,sex ,pre-operative heart rate and blood pressure (systolic and diastolic) ,medical history as regard to smoking and hypertension but history of DM was significant in group A (P-value< 0.001). According to Tatsuishi et al, 2017 age was identified as an independent risk factor for POAF that could be attributed to Age-related comorbidities [10, 11]

Amar et al, 2002, concluded that aging causes some changes as “shorter effective refractoriness, delayed SA and AV nodal conduction times, atrial stiffening, and splitting of the atrial excitation waveform caused by the pectinated trabeculae” [12].

In our study history of DM showed statistically significance between the two groups with (P-value <0.001). That also was significant according to studies of Tatsuishi et al, 2017 but did not show significance according to [10, 11, 13]

These findings were supported by Benjamin et al, 1994, who reported that DM is established as an independent risk factor for atrial fibrillation (AF) after 38 years of follow-up [14].

In our study, postoperative Mean blood sugar showed statistically significance (P-value 0.030) between the two groups which also was statistically significance according to Tatsuishi et al, 2017 and in our study Maximum blood sugar also showed statistically significance between the two groups with (p-value of 0.038).

According to Ismail et al, 2017 ventilation time and ICU stay time showed significance (p-value < 0.05) between the two groups which was explained as a result of arrhythmia but in our study and according to Tatsuishi et al, 2017 no significance detected as regard ventilation time and ICU stay (p-value > 0.05).

According to Ismail et al, 2017 preoperative heart rate, LA volume and depressed preoperative EF, showed significant (p-value < 0.05) between the two

groups .Enlarged LA size is consistently reproducible predictors for POAF. The influence of enlarged left atrial on POAF has been demonstrated with CABG in several studies [15].

5. Conclusion

We concluded that post-operative mean BS, maximum BS and post-operative drainage volume were significant risk factors for occurrence of POAF. In postoperative period, blood sugar should be tightly controlled and also preventing and managing any post-operative bleeding to make post-operative drainage volume as less as possible and making patient hemodynamic status more stable.

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