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Original Research Article

CONSEQUENCES OF A NEW ONSET POSTOPERATIVE ATRIAL FIBRILLATION ON MORTALITY FOLLOWING CORONARY ARTERY BYPASS GRAFTING

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Abstract: *Approximately 20% to 40% of individuals having coronary artery bypass grafting (CABG) develop new-onset postoperative atrial fibrillation (POAF).* ***Objective:*** *This study examined the impact of POAF on both early and late mortality following CABG.* ***Methods:*** *This research study was conducted at the Choudhury Pervaiz Elahi Institute of Cardiology in Wazirabad, Pakistan. The study was conducted retrospectively and involved analyzing data from patients who underwent isolated CABG (Coronary Artery Bypass Grafting) surgery between December 2022 and December 2023. The study included 110 participants who had preoperative sinus rhythm and no previous history of atrial fibrillation. To minimize the impact of confounding factors, propensity score matching was used. Both early and late mortality were analyzed using logistic and Cox regression.* ***Results:*** *The study had a mean follow-up time of 18±3.3 months, and 26 patients (23.6%) reported postoperative atrial fibrillation (POAF). The early death rates were 2.2% in all patients, 3.2% in the POAF group, and 1.7% in the non-POAF group (p = 0.001). However, a multivariate analysis did not show POAF as an independent risk factor for early death (p = 0.172). The logistic regression analysis also did not indicate that POAF was a risk factor for early death after quintiles of the propensity score were considered (OR, 1.46; 95% CI, 0.97 to 2.21; p = 0.152). Interestingly, postoperative AF remained an independent risk factor for early death in our multivariate analysis, with an HR of 1.37 (95% CI, 1.05 to 1.84; p = 0.035). Furthermore, the HR of POAF for overall mortality, adjusted for quintiles of the propensity score of POAF, was 1.38 (95% CI, 1.10 to 1.75; p = 0.008).* ***Conclusions:*** *POAF independently predicts overall and late mortality following independent CABG, whereas it does not predict early mortality.*

Keywords: Coronary Artery Bypass Grafting, Early Mortality, Late Mortality, Post-Operative Atrial Fibrillation

Introduction

Around 20% to 40% of individuals having coronary artery bypass grafting (CABG) develop newly developed postoperative atrial fibrillation (POAF) (1). After cardiac surgery, postoperative AF can lead to complications such as CVA, diseases (e.g., septicemia, respiratory illnesses, and mediastinitis), and kidney failure (2). POAF has been associated with increasing patient age (3). However, with an aging population needing heart surgery, there is a greater need for a better knowledge of the impact on patient outcomes, medical facilities, and healthcare costs. Previous research has linked POAF following CABG with both early and late mortality (4). Age is a significant predictor of POAF, which also correlates with early and late mortality following CABG (5). The most significant risk for the beginning of POAF has been determined to occur within two distinct periods. The first is believed to occur between 18 hours and the next two days after surgery. (6), with a decrease in incidence occurring between 4 and 7 days after surgery (6). Even though AF can occasionally be well tolerated, patients with AF have a roughly three-fold increased risk of postoperative stroke (7). This study utilized multivariate analysis and propensity score match to determine if POAF is an independent indicator of early and late death following isolated CABG.

Methodology

The retrospective study evaluated patients who received isolated CABG at Choudhury Pervaiz Elahi Institute of Cardiology, Wazirabad, Pakistan, from December 2022 to December 2023. Data on demographics, risk factors for death, and hospital complications were obtained retrospectively. Only individuals with confirmed preoperative sinus rhythm and no history of AF were included. The Institutional Research Review Board approved the study and didn't call for patient consent owing to its retrospective nature.

Early mortality was characterized as death within 30 days of surgery or death at any time without leaving the hospital. Late mortality refers to deaths from any cause occurring after hospital discharge. POAF was characterized as new AF detected by electrocardiography or by constant monitoring for at least 30 minutes throughout the postoperative stay of the patient at our institution.

The hospital approach was to continue using beta-blocker medications before surgery till the day of surgery. All patients were given short-acting anesthetics to allow early extubation. Nonpulsatile flow was employed for the normothermic extracorporeal circulation—cold crystalloid cardioplegia (St Thomas solution) produced and sustained cardioplegia arrest. Eleven percent of all procedures were conducted without using extra corporal circulation.

After surgery, patients without contraindications for beta-blocking medications were given metoprolol as AF prophylaxis, and electrical cardioversions were performed as needed. Rhythm was consistently recorded for a

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minimum of 48 hours after surgery. After that, registration was done at least three times each day, or constantly in case of dysrhythmia. If AF lasted longer than forty-eight hours, an anticoagulant was introduced. Following discharge, the referring cardiologist assessed the appropriate AF treatment course based on recommendations.

Each of the statistical evaluations was performed using SPSS 21.0 software. Categorical data were evaluated utilizing the x2 or Fisher's exact test, as applicable, and expressed as percentages. The t-test was used to compare continuous data reported as means, standard deviations, medians, ranges, or interquartile ranges (IQR). Univariate and multivariate logistic regression analyses were used to assess factors of early death. A second analysis used a model stratified by POAF propensity score quintiles. The propensity score was generated using a multivariate logistic regression model, incorporating univariate POAF predictors with p-values < 0.10. We conducted Univariate and Multivariate Cox proportional hazard analysis to identify determinants of late mortality. A second study of late mortality was conducted using a model stratified by POAF propensity score quintiles. Variables having a p-value < 0.10 in univariate analyses were incorporated into the multivariate models. A second investigation of late mortality utilized a model stratified by POAF propensity score quintiles. Variables with a p-value less than 0.10 in the univariate study were included in the multivariate models.

Results

The study included 110 people with preoperative sinus rhythm and no prior history of atrial fibrillation. POAF was reported in 26 patients (23.6%). The following table shows the demographic details of patients included in this study.

Table 1 shows the characteristics of patients with and without POAF. POAF patients were older, had a higher risk of pre-operative CVA and hypertension, and had worse mean creatinine clearance. They were also more likely to undergo CABG with extracorporeal circulation, experience reoperation for bleeding, and require more perioperative blood transfusions. POAF patients had higher rates of perioperative infarction, postoperative pneumonia, and CVA. There was a significant difference in the NYHA class and the number of grafts.

Table 1: Patient demographics

Variable	No POAF	POAF group	P value
Age, (y)	63.8 ± 9.1	68.4 ± 7.7	0.02
Male	76.7	79.7	0.341
BMI, kg/m2	26.9 ± 3.7	27.2 ± 3.1	0.532
Obesity (BMI >35)	3.4	3.9	0.216
Diabetes	23.2	21.2	0.231
Hypertension	46.9	51.6	0.422
Peripheral vascular disease	11.9	13.8	0.643
NYHA class, mean	2.1± 1	2.2±1	0.324
Pre-op hemoglobin, g/dL	13.9 ± 1 1.4	14.2 ± 1 1.6	0.532
Creatinine clearance, mL/min	77.7 ± 25	71.4 ± 27	0.241
CABG with ECC	87.9	90.4	0.018
Grafts, No.	3.4 ± 1.2	3.6 ± 1.1	0.032
Re-op for bleeding	2.2	3.4	0.531
Peri-op infarction	2.9	4.1	0.153
Early death	1.7	3.2	0.001

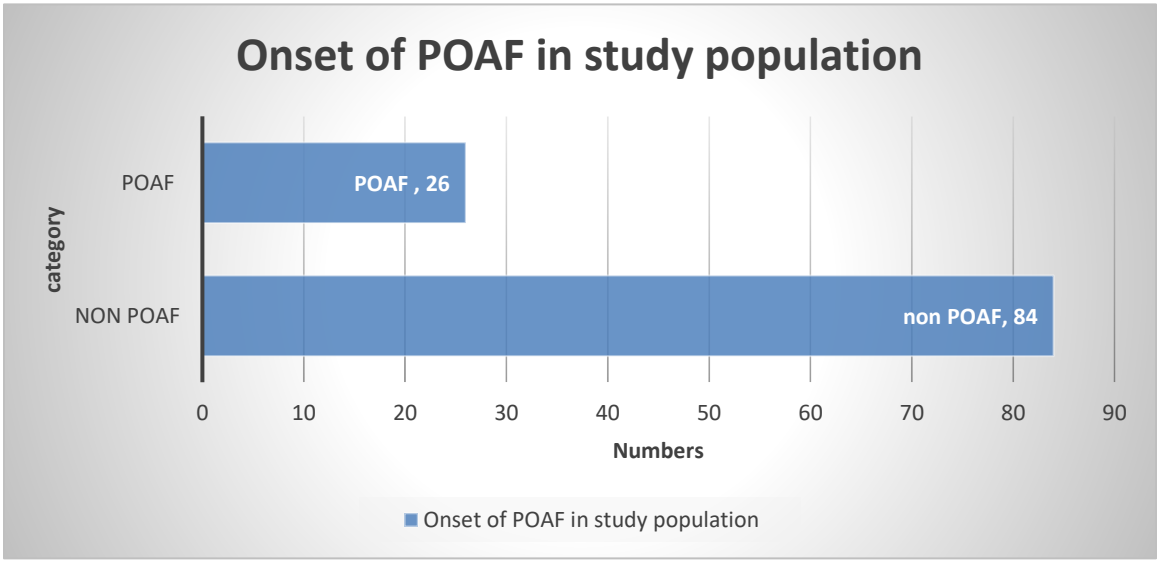

Figure 1: Showing the onset of POAF in the study population

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Table 2: univariate and multivariate analysis of early mortality

	Univariate analysis		Multivariate analysis	
Variable	**OR(95%CI)**	**P Value**	**OR(95%CI)**	**P Value**
Male	0.61(0.41–0.94)	0.017	1.27(0.81–2.14)	0.353
Age	1.23(1.11–1.21)	< 0.002	1.11(1.07–1.17)	< 0.002
Body mass index				
< 20kg/m2	2.86(0.92–8.73)	0.082	2.52(0.71–9.56)	0.183
>35kg/m2	0.91(0.31–2.83)	0.712	1.56(0.31–3.67)	1.22
COPD	3.11(1.97–4.94)	<0.0001	2.67(1.61–4.42)	<0.0001
Diabetes	1.68(1.11–2.48)	0.018	1.71(1.12–2.78)	0.041
Hypertension	0.94(0.69–1.39)	0.763	-	-
PVD	1.31(0.71–2.32)	0.342	-	-
Creatinine clearance				
60–90mL/min	2.09(1.04–4.39)	0.031	0.97(0.46–2.21)	0.432
<60mL/min	6.31(3.12–12.9)	<0.0001	1.09(0.47–2.61)	0.753
Pre-op hemoglobin	0.74(0.67–0.89)	<0.0001	0.99(0.83–1.16)	0.332
NYHA class	1.16(0.93–1.41)	0.324	-	-
Grafts, No.	0.86(0.72–0.95)	0.039	0.87(0.71–1.08)	0.172
IABP	17.7(10.5–30.4)	<0.0001	6.63(3.27–13.9)	<0.0001
ECC use	1.31(0.71–2.64)	0.423	-	-
Re-op for bleeding	3.31(1.51–7.26)	0.003	1.38(0.61–3.31)	0.632
ECC time,min	1.05(1.04–1.05)	<0.0001	1.03(1.02–1.04)	0.008
Peri-op infarction	5.11(2.81–9.31)	<0.0001	2.87(1.39–5.71)	0.004
POAF	1.98(1.31–2.97)	0.001	1.41(0.91–2.22)	0.172

Table 2 shows univariate and multivariate factors of early mortality. Early death rates were 2.2% in all patients, 3.2% in the POAF group, and 1.7% in the non-POAF group (p = 0.001). A multivariate analysis did not show POAF as an independent risk factor for early death (p = 0.172). Preoperative risk variables for early death were older age, diabetes, COPD, and decreased left ventricular function. Independent intraoperative and postoperative indicators of early death were the use of an Intra-aortic balloon pump, perioperative myocardial infarction, intraoperative use of blood products, and time of extracorporeal circulation. In the logistic regression analysis, POAF was not shown to be a risk factor for early death after quintiles of the propensity score were considered (OR, 1.46; 95% CI, 0.97 to 2.21; p = 0.152).

Table 3: univariate and multivariate Cox proportional Hazard analysis of late mortality

	Univariate analysis		Multivariate analysis	
Variable	**HR(95%CI)**	**P Value**	**HR(95%CI)**	**P Value**
Male	1.11(0.81–1.52)	0.532	1.81(1.31–2.56)	0.002
Age	1.13(1.09–1.15)	<0.0001	1.09(1.07–1.12)	<0.0001
Body mass index				
< 20kg/m2	2.71(1.21–6.11)	0.019	2.71(1.17–6.19)	0.011
>35kg/m2	0.99(0.48–2.09)	0.478	1.22(0.57–2.66)	0.546
COPD	2.25(1.61–3.13)	<0.0001	1.85(1.38–2.61))	<0.0001
Diabetes	1.81(1.36–2.37)	0.001	1.561(1.21–2.18)	0.001
Hypertension	1.23(0.95–1.61)	0.175	-	-
PVD	2.22(1.61–3.12)	<0.0001	1.72(1.24–2.41)	0.003
Creatinine clearance				
60–90mL/min	1.87(1.19–2.99)	0.02	1.18(0.71–1.88)	0.864
<60mL/min	4.39(2.81–6.93)	<0.0001	1.63(0.94–2.77)	0.202
Pre-op hemoglobin	0.78(0.72–0.87)	<0.0001	0.91(0.82–0.93)	0.008
NYHA class	1.09(0.94–1.26)	0.363	-	-
Grafts, No.	1.09(0.97–1.23)	0.275	-	-
IABP	1.58(0.67–3.81)	0.234	-	-
ECC use	1.14(0.75–1.75)	0.643	-	-
Re-op for bleeding	1.88(0.97–3.53)	0.065	1.57(0.81–3.12)	0.102
ECC time, min	1.01(1.01–1.02)	0.136	-	-
Peri-op infarction	2.44(1.45–4.18)	0.001	2.26(1.31–3.91)	0.005
POAF	1.77(1.35–2.34)	0.0001	1.37(1.05–1.84)	0.035

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At five years following CABG, patients with POAF had a cumulatively higher risk of overall death (16% vs. 11%, p <0.0001) than patients without POAF. In our multivariate analysis, postoperative AF remained an independent risk factor, with an HR of 1.37 (95% CI, 1.05 to 1.84; p =0.035). The HR of POAF for overall mortality, adjusted for quintiles of the propensity score of POAF, was 1.38 (95% CI, 1.10 to 1.75; p =0.008).

Discussion

According to this study, 23.6% of our population had newly developed POAF following CABG. This incidence is in line with previous research. (8, 9). In contrast to early mortality, POAF was an independent predictor of late death.

Despite the nearly twofold increase in early death in the POAF group, multivariate and propensity score-adjusted models did not find POAF to be a separate risk indicator for early mortality. Age has a significant impact on the likelihood of getting POAF. (10, 11). This clearly explains why the POAF patient's mean age is approximately 4.5 years older than that of the non-POAF group. Early mortality has a significant correlation with age as well (12). When age and other risk factors for early mortality are taken into account, it becomes clear that POAF is not an independent cause of early death. Bianco and colleagues came to the same conclusion in extensive research on POAF in patients undergoing heart surgery using propensity score matching and multivariate analysis (13). When risk variables were considered in Woldendrop and colleagues' investigation, POAF was a significant indicator of early mortality (14). After CABG or any heart surgery, patients with POAF had far greater rates of early death, according to a vast number of studies (3, 15). However, none of these studies have found POAF to be a reliable indicator of early mortality.

Additional investigations have assessed POAF's impact on long-term survival following CABG. In a more extensive sample size research following first-time isolated CABG, Malhotra, and colleagues found an elevated risk of overall and late mortality among individuals with POAF (adjusted HR of 1.6 and 1.6, correspondingly) (16) . Age was, however, treated as a dichotomous variable in their multivariate model, which would have led to an underestimation of the impact of age on mortality and the possibility of a residual confounding influence. A case-matched evaluation of the same investigation produced an HR of 3.4 for POAF about long-term mortality. Only 20% of all cases of POAF were utilized in that specific analysis because the examined patient group did not accurately reflect the POAF group as a whole; care should be used while interpreting the previously mentioned HR.

In a research involving 1832 patients, researchers computed an adjusted HR of 2.14 for POAF on all causes of death following isolated CABG (16). Since only individuals with a history of permanent AF were removed from the research, it is possible that individuals who had preoperative paroxysmal and chronic AF were included in that research. By taking these individuals into account, it's probable that some of the impact of POAF on survival might be related to preoperative AF. Researchers have discovered in a study that individuals who had CABG procedures had an HR of 1.24 for POAF when multivariate analysis was performed (13). Unlike in our study, individuals who were operated on without the need for extra corporal circulation were excluded. They failed to account for gender in the multivariate model, even though it was an independent risk factor in other investigations (17).The analysis's conclusions may have been affected as gender was not taken into account.

A new study by Bramer and associates found that POAF was an age-independent risk factor for late death following CABG (HR, 1.57) (18). In their multivariate investigation, the only factors that were significant indicators of late death were lower left ventricular fraction, age, diabetes, and POAF.

The inability to obtain the reasons for mortality in our investigation represents a significant limitation of our study. According to one research, embolic events may be a substantial factor in postoperative mortality for patients with POAF. (19). This agrees with our results that patients with POAF had a noticeably greater frequency of postoperative cerebrovascular accidents in hospitals. We did not investigate the impact of treatment therapies on POAF mortality. Since the development of POAF after discharge was not documented, it's possible that the incidence of POAF was underreported in our study. Nonetheless, most of the new POAF episodes occur in the first four to six days following heart surgery, with the incidence peaking on the second day. (20). The duration of POAF was not entered in our records, making it impossible to assess how it affected mortality. Further research with a larger sample size is required to address these issues.

Conclusion

We conclude that POAF is not associated with early death. However, it does predict overall and late mortality after independent CABG in patients.

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.
Ethics approval and consent to participate
Approved by the department Concerned.
Consent for publication
Approved
Funding
Not applicable

Conflict of interest

The authors declared absence of conflict of interest.

Author Contribution

MUHAMMAD AMER IQBAL QURESHI (Associate Professor)
Coordination of collaborative efforts.
Study Design, Review of Literature.
Conception of Study, Development of Research Methodology Design, Study Design,, Review of manuscript, final approval of manuscript.
SYED QAISER ABBAS (Assistant Professor)
Manuscript drafting.
Data entry and Data analysis, drafting article.

FAISAL SHEHZAD ROOMI (Assistant Professor)
Conception of Study, Final approval of manuscript. Manuscript revisions, critical input.

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