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EFFECT OF DIABETES MELLITUS ON POST-OPERATIVE ATRIAL FIBRILLATION IN PATIENTS UNDERGOING CARDIAC SURGERY: A COMPARATIVE STUDY

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Abstract

Background: *Post-operative atrial fibrillation (POAF) is a common complication following cardiac surgery, leading to increased morbidity and longer hospital stays. Diabetes mellitus may increase the risk of POAF, but its exact role in this population is still not fully understood.*

Objective: *To evaluate the effect of diabetes mellitus on the occurrence of post-operative atrial fibrillation in patients undergoing cardiac surgery and to examine the association of clinical factors, including myocardial infarction, infarction location, and type of surgical procedure, with the development of POAF.*

Materials and Methods: *This comparative cross-sectional study was conducted at a tertiary care hospital in Peshawar from July to December 2024, involving 140 adult cardiac surgery patients divided into diabetic and non-diabetic groups. Demographic and clinical variables were recorded, and POAF was monitored via ECG. Associations between diabetes, myocardial infarction, MI location, and surgical procedure with POAF were analyzed using Chi-square and t-tests, with $p < 0.05$ considered statistically significant.*

Results: *A total of 140 patients undergoing cardiac surgery were included, with a mean age of 55.6 ± 12.8 years. The majority were male (n = 99, 70.7%), and 62 (44.3%) had diabetes mellitus. Pre-operative atrial fibrillation (AF) was observed in 67 (47.9%) patients, increasing to 87 (62.1%) post-operatively. POAF occurred in 74.2% of diabetic versus 52.6% of non-diabetic patients ($p = 0.009$). While CABG was the most frequent procedure among patients who developed POAF (n = 72, 82.8%), the type of surgery was not significantly associated with POAF ($p = 0.060$).*

Conclusion: *Diabetes mellitus and myocardial infarction significantly increase the risk of developing POAF following cardiac surgery. Early identification and optimal management of these high-risk patients may improve surgical outcomes and reduce arrhythmic complications.*

INTRODUCTION

Post-operative atrial fibrillation (POAF) is one of the most frequent complications following cardiac surgery, including coronary artery bypass grafting (CABG), valve surgery, and combined procedures. It is characterized by new-onset atrial fibrillation occurring after surgery and is associated with increased morbidity, prolonged hospitalization, and higher healthcare costs (1-3). POAF affects approximately 20-55% of patients undergoing cardiac surgery (4-6). In nearly 90% of cases, it develops within the first six days after surgery, coinciding with the peak of the body's postoperative systemic inflammatory response. Furthermore, POAF serves as a strong predictor of both early and long-term cardiovascular complications, such as stroke, thromboembolism, infection, cardiac arrest, and the need for reoperation due to internal bleeding (7,8).

Despite advancements in surgical techniques and the use of perioperative prophylactic medications, POAF remains the most common postoperative complication in cardiac surgery. Patients undergoing CABG and valve surgeries are at particularly high risk. These procedures often result in structural alterations of the heart, such as fibrosis and valve dilation, which in turn affect atrial geometry and increase susceptibility to arrhythmias (9-11). The pathogenesis of POAF is multifactorial, involving structural and electrical remodelling of the atria, inflammation, oxidative stress, autonomic imbalance, and perioperative hemodynamic changes (12).

Diabetes mellitus (DM), a chronic metabolic disorder characterized by hyperglycaemia, insulin resistance, and systemic inflammation, is a well-recognized cardiovascular risk factor (13). In cardiac surgery patients, DM can contribute to atrial remodelling, fibrosis, and autonomic dysfunction, thereby creating a pro-arrhythmic substrate that increases susceptibility to POAF (14,15). Other clinical factors, including prior myocardial infarction and the type of surgical procedure, may further modulate this risk (16). Given the rising prevalence of diabetes and the increasing number of cardiac surgeries in Pakistan (17). It is important to determine the impact of DM on the development of POAF. Identifying this relationship may help improve perioperative risk stratification and guide targeted management strategies. Moreover, regional data on diabetes prevalence and cardiac surgery outcomes are limited, making this study particularly relevant to South Asian populations.

Materials and Methods:

This comparative cross-sectional study was conducted at a tertiary care hospital in Peshawar from July to December 2024. The study was approved by the Institutional Ethical Review Board (Ref: IPMS/ERB/2024/067), and informed consent was obtained from all participants. A total sample size of 140 patients was calculated based on an expected postoperative atrial fibrillation (POAF) incidence of 30%, with a 95% confidence level and 8% margin of error. A total of 140 patients aged 30-80 years undergoing cardiac surgery were enrolled through a non-probability consecutive sampling technique. Demographic variables (age, sex, BMI), clinical factors (diabetes mellitus, myocardial infarction, MI location), and surgical procedure type were recorded.

POAF was defined as new-onset atrial fibrillation detected by ECG or continuous telemetry lasting more than 30 seconds within seven days post-surgery. Continuous monitoring was performed until hospital discharge. Patients receiving beta-blocker prophylaxis were noted. Inclusion criteria: Adults aged 18-80 years undergoing elective or semi-elective cardiac surgery (CABG, valve, or combined). The DM group included patients with diagnosed diabetes or HbA1c ≥6.5%. Non-diabetic patients had normal glucose and HbA1c <6.5%. Exclusion criteria: Pre-existing arrhythmias (other than AF), severe electrolyte imbalances, use of class I or III antiarrhythmic drugs, or systemic illness (cancer or liver disease).

Data were analyzed using SPSS version 23.0. Continuous variables were presented as mean ± SD; categorical variables as frequencies and percentages. Chi-square and independent t-tests were used, with $p < 0.05$ considered significant.

Results:

In this study, 140 patients undergoing cardiac surgery were included. The mean age was 55.6 ± 12.8 years (range, 31-86), and the mean BMI was 28.4 ± 5.6 kg/m² (range, 17.3-44.3). The majority of patients were male (n = 99, 70.7%). Diabetes mellitus was present in 62 (44.3%) patients.

Coronary artery disease (CAD) was the most common diagnosis, present in 102 (72.9%) patients. Myocardial infarction (MI) was found in 126 (90.0%) patients, with anterolateral MI being the most frequent site (n = 36, 25.7%), followed by lateral (n = 31, 22.1%), anterior (n = 27, 19.3%), and other locations (n = 32, 22.9%). Surgical procedures performed were predominantly CABG (n = 109, 77.9%), followed by valve replacement (n = 29, 20.7%), and combined CABG with mitral valve replacement (n = 2, 1.4%). Table 1.

Pre-operative atrial fibrillation (AF) was present in 67 (47.9%) patients, increasing to 87 (62.1%) post-operatively. Table 2.

Table 1. Baseline, Clinical, and Surgical Characteristics of Patients (n = 140)

Variable	Category	n (%)	Mean ± SD / Range
Age (years)			55.6 ± 12.8 (31–86)
BMI (kg/m²)			28.4 ± 5.6 (17.3–44.3)
Sex	Male	99 (70.7)	
	Female	41 (29.3)	
Diabetes Mellitus		62 (44.3)	
Diagnosis	Coronary Artery Disease	102 (72.9)	
	Valvular Heart Disease	38 (27.1)	
Myocardial Infarction		126 (90.0)	
MI Location	Anterolateral	36 (25.7)	
	Lateral	31 (22.1)	
	Anterior	27 (19.3)	
	Other locations	32 (22.9)	
Surgical Procedure	CABG	109 (77.9)	
	Valve Replacement	29 (20.7)	
	CABG + MVR	2 (1.4)	

Table 2. Pre- and Post-Operative Atrial Fibrillation (AF)

AF Status	Yes, n (%)	No, n (%)
Pre-operative AF	67 (47.9)	73 (52.1)
Post-operative AF	87 (62.1)	53 (37.9)

The associations of risk factors with post-operative atrial fibrillation (POAF) are shown in Table 3. Diabetes mellitus was significantly associated with POAF (n = 46, 74.2% vs. n = 41, 52.6% in non-diabetic patients; p = 0.009). Similarly, the presence of MI was significantly associated with POAF (n = 84, 66.7% vs. n = 3, 21.4% in patients without MI; p = 0.001). Anterolateral MI was strongly correlated with POAF (n = 30, 34.5% vs. n = 41, 47.1% in other MI locations; p = 0.003). Although CABG was the most common procedure among patients with POAF (n = 72, 82.8%), the type of surgical procedure did not reach statistical significance (p = 0.060).

Table 3. Associations of Risk Factors with Post-Operative Atrial Fibrillation (POAF) (n = 140)

Variable	Category	POAF Yes, n (%)	POAF No, n (%)	χ^2 (df)	p-value
Diabetes Mellitus	Present	46 (74.2)	16 (25.8)	6.87 (1)	0.009
	Absent	41 (52.6)	37 (47.4)		
Myocardial Infarction	Present	84 (66.7)	42 (33.3)	10.96 (1)	0.001*
	Absent	3 (21.4)	11 (78.6)		
MI Location	Anterolateral	30 (34.5)	6 (11.3)	21.2 (7)	0.003*
	Other Locations	41 (47.1)	32 (60.4)		
Surgical Procedure	CABG	72 (82.8)	37 (69.8)	5.62 (2)	0.060
	Valve Replacement	13 (14.9)	16 (30.2)		
	CABG + MVR	2 (2.3)	0 (0)		

*Statistically significant ($p < 0.05$)

Discussion

Our study demonstrates a significant association between diabetes mellitus (DM) and the increased incidence of postoperative atrial fibrillation (POAF) among patients undergoing cardiac surgery. The age of study participants ranged from 31 to 86 years, with a mean body mass index (BMI) of 28.4 ± 5.6 kg/m², and males constituted 70.7% of the cohort. Diabetes mellitus was present in 44.3% of patients, coronary artery disease in 72.9%, and myocardial infarction (MI) in 90%, most frequently involving the anterolateral (25.7%), lateral (22.1%), and anterior (19.3%) regions. Surgically, 77.9% of patients underwent isolated coronary artery bypass grafting (CABG), 20.7% underwent valve replacement, and 1.4% underwent combined CABG with mitral valve replacement.

These demographic and clinical characteristics align with contemporary cardiac surgery cohorts, where male predominance and multiple comorbidities are consistently reported. For instance, a 2023 epidemiologic study showed that the proportion of male patients undergoing CABG increased from 79.7% in 2010 to 83.1% in 2023, reflecting a comparable demographic and risk profile (18). Similarly, studies evaluating BMI and surgical outcomes have described a non-linear ("U" or "J"-shaped) relationship between BMI and postoperative morbidity and mortality, particularly in CABG and valve surgery populations. Dai et al. (2022) reported that both underweight and extremely obese patients experienced higher postoperative mortality following combined CABG and valve procedures (19). Yeung et al. (2022) further observed that patients with low BMI (<18.5) had poorer outcomes in coronary surgery, though a modestly elevated BMI may not confer additional risk (20).

In the present study, 74.2% of diabetic patients developed POAF compared with 52.6% of non-diabetic patients ($p = 0.009$), highlighting diabetes as a significant predisposing factor. These findings are consistent with previous evidence linking DM to postoperative atrial arrhythmias. Jung et al. (2006) demonstrated that diabetic patients undergoing cardiac surgery exhibited a higher incidence of atrial arrhythmias, including POAF, than their non-diabetic counterparts (21). Likewise, a meta-analysis by Liu et al. (2024) confirmed that diabetes mellitus is associated with an increased risk of postoperative complications, particularly arrhythmias, after cardiac surgery (22).

The underlying mechanisms through which DM contributes to POAF are multifactorial. Chronic hyperglycemia and insulin resistance lead to structural and electrical remodeling of the atria, characterized by fibrosis, altered ion channel function, and impaired autonomic control. These changes create a substrate conducive to atrial arrhythmogenesis. Additionally, systemic inflammation and oxidative stress induced by poor glycemic control further increase susceptibility to POAF (23).

Our findings also revealed a strong relationship between myocardial infarction and the development of POAF. Among patients with MI, 66.7% developed POAF compared with only 21.4% of those without MI ($p = 0.001$). This is in agreement with previous studies identifying MI as a significant risk factor for postoperative arrhythmias. Hashemzadeh et al. (2013) similarly reported that patients with prior MI had a

markedly higher incidence of POAF following cardiac surgery (24).

Interestingly, although CABG was the most frequently performed procedure among patients who developed POAF (82.8%), the type of surgery itself did not show a statistically significant association (p = 0.060) (25). This observation suggests that intrinsic patient factors-particularly diabetes mellitus and myocardial infarction-may have a greater impact on POAF development than the specific surgical technique employed (26).

The findings of this study reinforce the need for vigilant perioperative glucose monitoring and aggressive management of cardiovascular comorbidities in diabetic patients undergoing cardiac surgery. Early identification and targeted prevention strategies, such as tight glycemic control and appropriate pharmacologic prophylaxis, may help reduce the incidence and severity of POAF and its associated complications.

Conclusion:

conclusion, our study confirms that diabetes mellitus is a significant and independent predictor of post-operative atrial fibrillation among patients undergoing cardiac surgery. These results emphasize the need for strict perioperative glucose regulation and continuous cardiac rhythm monitoring in diabetic individuals. Integrating targeted glycemic control and arrhythmia prevention strategies into surgical care protocols may help reduce postoperative complications and improve long-term cardiovascular outcomes.

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REFERENCE

Rum M, Er H, Yilmaz F, Ceylan L, Ketenci B. Postoperative atrial fibrillation following isolated coronary artery bypass grafting: incidence, predictors, and clinical outcomes. *J Coll Physicians Surg Pak.* 2025;35(9):1083–7. doi:10.29271/jcpsp.2025.09.1083.

Suero OR, Ali AK, Barron LR, Segar MW, Moon MR, Chatterjee S. Postoperative atrial fibrillation (POAF) after cardiac surgery: clinical practice review. *J Thorac Dis.* 2024 Feb 29;16(2):1503–20. doi:10.21037/jtd-23-1626. Epub 2024 Feb 23. PMID:38505057; PMCID:PMC10944787.

Nikolaou M, Pattakos G, Hitas C, Koniari K, Pitsis A, Iliopoulos D, Xintarakou A, Vardas EP, Pattakos S, Tzeis S, Vardas P. Atrial fibrillation post CABG and the risk of arrhythmia recurrence: the AFRODITE study. *Hellenic J Cardiol.* 2025;84:13–21. doi:10.1016/j.hjc.2024.03.003.

Awad AK, Elbahloul MA, Al-omoush O, Abdelnasser O, Hajali M, Abdelnasser A, et al. Impact of postoperative atrial fibrillation (POAF) on outcomes after coronary artery bypass grafting: A meta-analysis of unique 247,270 patients from 50 studies. *Am Heart J Plus Cardiovasc Res Pract.* 2025;59:100621. doi:10.1016/j.ahjo.2025.100621.

Albini A, Malavasi VL, Vitolo M, Imberti JF, Marietta M, Lip GYH, Boriani G. Long-term outcomes of postoperative atrial fibrillation following non-cardiac surgery: a systematic review and meta-analysis. *Eur J Intern Med.* 2021 Mar;85:27–33. doi:10.1016/j.ejim.2020.12.018. PMID: 33402281.

Arslan G, Erol G, Kartal H, Demirdas E, Bolcal C. The incidence of atrial fibrillation after on-pump versus off-pump coronary artery bypass grafting. *Heart Surg Forum.* 2021;24(4):E3873. doi:10.1532/hsf.3873.

Lopes LA, Agrawal DK. Post-operative atrial fibrillation: current treatments and etiologies for a persistent surgical complication. *J Surg Res (Houst).* 2022;5(1):159–72. doi:10.26502/jsr.10020209. Epub 2022 Mar 28. PMID:35445200; PMCID:PMC9017863.

Shah S, Chahil V, Battisha A, Haq S, Kalra DK. Postoperative atrial fibrillation: a review. *Biomedicines.* 2024 Sep 1;12(9):1968. doi:10.3390/biomedicines12091968. PMID:39335482; PMCID:PMC11428825.

pump versus off-pump coronary artery bypass grafting. *Heart Surg Forum.* 2021;24(4):E3873. doi:10.1532/hsf.3873.

Gudbjartsson T, Helgadottir S, Sigurdsson MI, Taha A, Jeppsson A, Christensen TD, et al. New-onset postoperative atrial fibrillation after heart surgery. *Acta Anaesthesiol Scand.* 2020;64:145–55.

Jagadish PS, Kirolos I, Khare S, Rawal A, Lin V, Khouzam RN. Post-operative atrial fibrillation: should we anticoagulate? *Ann Transl Med.* 2019 Sep;7(17):407. doi:10.21037/atm.2019.07.10. PMID:31660306; PMCID:PMC6787379.

Ballas C, Katsouras CS, Tourmousoglou C, Siaravas KC, Tzourtzos I, Alexiou C. A review on the etiologies of the development of atrial fibrillation after cardiac surgery. *Biomolecules.* 2025;15(3):374. doi:10.3390/biom15030374.

Siam NH, Snigdha NN, Tabasumma N, Parvin I. Diabetes mellitus and cardiovascular disease: exploring epidemiology, pathophysiology, and treatment strategies. *Rev Cardiovasc Med.* 2024 Dec 11;25(12):436. doi:10.31083/j.rcm2512436. PMID:39742220; PMCID:PMC11683709.

Ballas C, Katsouras CS, Tourmousoglou C, Siaravas KC, Tzourtzos I, Alexiou C. A review on the etiologies of the development of atrial fibrillation after cardiac surgery. *Biomolecules.* 2025;15(3):374. doi:10.3390/biom15030374.

Xu H, Xu X, Ma J, Zheng S, Song W, Zhong Z, Liu S. Preoperative risk factors for acute postoperative atrial fibrillation in patients undergoing mitral valve repair for degenerative mitral regurgitation: insights into cardiac geometry. *Rev Cardiovasc Med.* 2025 Aug 29;26(8):38938. doi:10.31083/RCM38938. PMID:40927107; PMCID:PMC12415746.

Gudbjartsson T, Helgadottir S, Sigurdsson MI, Taha A, Jeppsson A, Christensen TD, Riber LPS. New-onset postoperative atrial fibrillation after heart surgery. *Acta Anaesthesiol Scand.* 2020;64(2):145–55. doi:10.1111/aas.13507.

Azeem S, Khan U, Liaquat A. The increasing rate of diabetes in Pakistan: A silent killer. Ann Med Surg (Lond). 2022 Jun 3;79:103901. doi: 10.1016/j.amsu.2022.103901. PMID: 35860160; PMCID: PMC9289249.

Sela O, Gelman S, Gordon A, Farkash A, Pevni D, Kakoush M, Kfir J, Ben-Gal Y. Trends in patient characteristics and cardiothoracic surgeries over 14 years (2010–2023): A single center experience. *J Clin Med.* 2024;13(21):6467. doi:10.3390/jcm13216467

Dai C, Xu H, Chu T, Cao B, Ge J. Body mass index and postoperative mortality in patients undergoing coronary artery bypass graft surgery plus valve replacement: a retrospective cohort study. *PeerJ.* 2022;10:e13601. doi:10.7717/peerj.13601.

Yeung E, Smith S, Scharf M, Wung C, Harsha S, Lawson S, Rockwell R, Reitknecht F. BMI disparities in coronary artery bypass grafting outcomes: a single center Society of Thoracic Surgeons (STS) database analysis. *Surg Pract Sci.* 2022;10:100110. doi:10.1016/j.sipas.2022.100110.

Jung W, Meyerfeldt U, Birkemeyer R. Atrial arrhythmias after cardiac surgery in patients with diabetes mellitus. *Clin Res Cardiol.* 2006 Jan;95(Suppl 1):i88–97. doi:10.1007/s00392-006-1120-1. PMID:16598557.

Liu H, Chen J, Ling J, Wu Y, Yang P, Liu X, Liu J, Zhang D, Yin X, Yu P, Zhang J. The association between diabetes mellitus and postoperative cognitive dysfunction: a systematic review and meta-analysis. *Int J Surg.* 2025 Mar 1;111(3):2633–50. doi:10.1097/JS9.0000000000002156. PMID:39728730; PMCID:PMC12372729.

Grisanti LA. Diabetes and arrhythmias: pathophysiology, mechanisms and therapeutic outcomes. *Front Physiol.* 2018 Nov 26;9:1669. doi:10.3389/fphys.2018.01669. PMID:30534081; PMCID:PMC6275303.

Awad AK, Elbahloul MA, Al-Omoush O, Abdelnasser O, Hajali M, Abdelnasser A, Saleh O, Altiti A, Elgharably H, El Diasty M. Impact of postoperative atrial fibrillation (POAF) on outcomes after coronary artery bypass grafting: a meta-analysis of unique 247,270 patients from 50 studies. *Am Heart J Plus.* 2025 Sep 18;59:100621. doi:10.1016/j.ahjo.2025.100621. PMID:41049259; PMCID:PMC12494572.

Qu F, Yang W, He N, Qu S, Zhou X, Ma H, Jiang X. Effect of postoperative atrial fibrillation after cardiac surgery: a meta-analysis. *Clin Cardiol.* 2024 Dec 4. doi:10.1002/clc.70053.

Rum M, Er H, Yilmaz F, Ceylan L, Ketenci B. Postoperative atrial fibrillation following isolated coronary artery bypass grafting: incidence, predictors, and clinical outcomes. *J Coll Physicians Surg Pak.* 2025;35(9):1083–7. doi:10.29271/jcpsp.2025.09.1083.

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