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ORIGINAL PAPER

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Posterior Pericardiotomy and Its Impact on Clinical Outcomes in Off-Pump Coronary Artery Bypass Grafting Complications

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ABSTRACT

Background: Posterior pericardiotomy has been proposed as a preventive strategy against postoperative pericardial effusion and cardiac tamponade in patients undergoing coronary artery bypass grafting (CABG). However, data regarding its clinical outcomes and potential associations with postoperative complications remain limited. **Objective.** To evaluate intraoperative and postoperative outcomes in patients undergoing off-pump CABG with concomitant posterior pericardiotomy, and to assess potential associations between perioperative variables and the development of common postoperative complications. **Methods.** This retrospective study included 38 patients who underwent off-pump CABG with posterior pericardiotomy. Demographic and clinical characteristics, procedural details, postoperative complications, and outcomes were analyzed. Associations between operative time, comorbidities (sex, diabetes mellitus, smoking), and postoperative complications such as atrial fibrillation, pleural and pericardial effusions, and drainage volume were statistically evaluated using chi-square and correlation analysis. **Results.** The study cohort had a mean age of 66.64 ± 7.28 years, with 68.1% male patients. Arterial hypertension was present in all patients, diabetes mellitus in 44.7%, and prior myocardial infarction in 65.7%. The mean left ventricular ejection fraction was $42.86 \pm 10.21\%$, and triple-vessel disease was observed in 63.2% of patients. All patients underwent off-pump CABG. The mean operative time was 254.31 ± 59.04 minutes. Postoperative complications included new-onset atrial

fibrillation in 15.7% of patients, pleural effusion in 42.1%, and pericardial effusion in 10.5%. No cases of cardiac tamponade were reported. A significant association was found between smoking and new-onset atrial fibrillation ($p = 0.050$), while no significant associations were observed between sex or diabetes and postoperative complications. Operative time was not significantly associated with pericardial or pleural effusion, nor with drainage volume. Complete recovery was observed in all 100.0% of patients. **Conclusion.** Posterior pericardiotomy performed during off-pump CABG was associated with a low incidence of pericardial effusion and no occurrence of cardiac tamponade. The procedure appears to be safe and may contribute to favorable postoperative outcomes. Smoking may be a risk factor for new-onset atrial fibrillation, warranting further investigation.

Keywords: posterior pericardiotomy; coronary artery bypass grafting; postoperative complications; atrial fibrillation; pericardial effusion.

1. BACKGROUND

Ventricular Posterior pericardiotomy has emerged as a simple yet potentially effective adjunct technique in cardiac surgery, particularly for reducing the incidence of postoperative pericardial effusion and cardiac tamponade (1). These complications, although relatively infrequent, can significantly impact early postoperative recovery and overall surgical outcomes in patients undergoing coronary artery by-

pass grafting (CABG). While the benefits of posterior pericardiotomy have been more extensively studied in the setting of on-pump CABG and valve surgeries, data regarding its application during off-pump CABG (OPCAB) remain limited (2-4).

OPCAB is increasingly utilized as a strategy to avoid cardiopulmonary bypass and its associated systemic inflammatory response. However, it does not entirely eliminate the risk of pericardial effusion, pleural complications, or arrhythmias such as postoperative atrial fibrillation (AF) (2-4). The potential of posterior pericardiotomy to mitigate these complications during OPCAB is not well defined, and existing literature provides limited insight into its safety profile and clinical utility in this specific context (5).

2. OBJECTIVE

The primary objective of this study was to evaluate the intraoperative and postoperative outcomes of posterior pericardiotomy in patients undergoing OPCAB. Specifically, the study aimed to assess the incidence of common postoperative complications - including atrial fibrillation, pericardial and pleural effusions, and cardiac tamponade - and to explore potential associations between perioperative variables (such as operative time, smoking status, sex, and diabetes mellitus) and these complications.

3. MATERIAL AND METHODS

Study Design and Population

This retrospective observational study included a total of 38 consecutive adult patients who underwent OPCAB with concomitant posterior pericardiotomy at a single tertiary cardiovascular center between January 2025 and March 2025. All procedures were performed by the same surgical team to ensure procedural consistency. Patients undergoing on-pump CABG, reoperations, or combined cardiac procedures were excluded.

Data Collection

Demographic and clinical data were extracted from medical records, including age, sex, comorbidities (arterial hypertension, diabetes mellitus, smoking status, history of myocardial infarction), and left ventricular ejection fraction (LVEF). Intraoperative variables included the number of grafts, operative time, and intraoperative complications. Postoperative outcomes assessed were new-onset atrial fibrillation (defined as AF occurring within 7 days postoperatively), pericardial and pleural effusions (confirmed by echocardiography and/or chest radiography), drainage volume, and in-hospital mortality.

Surgical Technique

All patients underwent standard OPCAB via median sternotomy. Posterior pericardiotomy was performed by creating a vertical bilateral incision of approximately 4–6 cm in

the posterior pericardial surface adjacent to the left pulmonary vein, allowing communication between the pericardial and left pleural space to facilitate fluid drainage and reduce tamponade risk.

Statistical Analysis

Descriptive statistics were used to summarize patient characteristics and outcomes. Categorical variables were expressed as frequencies and percentages, while continuous variables were presented as means $\pm$ standard deviation. Chi-square tests were employed to evaluate associations between categorical variables (e.g., sex, smoking, diabetes) and postoperative complications. Pearson correlation analysis was used to assess relationships between continuous variables such as operative time and drainage volume or effusion occurrence. A p-value < 0.05 was considered statistically significant. Statistical analyses were performed using SPSS version 24.0.

4. RESULTS

A total of 38 patients who underwent coronary artery bypass grafting (CABG) with posterior pericardiotomy were included in the analysis. Our study sample was predominantly male 26 (68.1%), with a mean age of 66.64 ± 7.28 years, ranging from 40 to 80 years. All patients had a history of arterial hypertension (100%). Diabetes mellitus was present in 17 (44.7%) of patients, while 2 (5.2%) had a previous cerebrovascular insult (ICV), and 5 (13.1%) had chronic obstructive pulmonary disease (COPD). Peripheral artery disease was found in 18 (47.4%) of the cohort, and 19 (50.0%) had a

		N=38	%	
Sex	Male	26	68.1	
	Female	12	31.9	
Age (mean±SD)	66.64±7.28			
Comorbidities	Hypertension	Yes	38	100
		No	0	0
	Diabetes Mellitus	Yes	17	44.7
		No	21	55.2
	ICV	Yes	2	5.2
		No	36	94.8
	COPD	Yes	5	13.1
		No	33	86.9
	Peripheral artery disease	Yes	18	47.4
		No	20	52.6
	Smoking	Yes	19	50.0
		No	19	50.0
Previous MI	Yes	25	65.7	
	No	13	34.3	
Ejection fraction (mean±SD)	42. 86±10.21			
Coronary angiography	Single-vessel disease	7	18.4	
	Double-vessel disease	7	18.4	
	Triple-vessel disease	24	63.2	

Table 1. Baseline Clinical and Demographic Characteristics of Patients Undergoing CABG with Posterior Pericardiotomy.
N=38 COPD=chronic obstructive pulmonary disease, ICV=cerebrovascular insult

		N=38	%
Procedure type	OFF-pump CABG	100	100
	ON-pump CABG	0	0
Procedure time (mean±SD)	254.31±59.042 minutes (range 165 to 385 min)		
Intensive care time (in days) (mean±SD)	3.39±1.71 (range 2–10)		
Postoperative drainage	861.11±551.366 ml (ranging 150 to 2350 ml)		
Postoperative atrial fibrillation	Yes	6	15.7
	No	32	84.3
Postoperative supraventricular tachycardia	Yes	2	5.2
	No	36	94.8
Postoperative pleural effusion	Yes	16	42.1
	No	22	57.9
Postoperative pericardial effusion	Yes	4	10.5
	No	34	89.5
Cardiac tamponade	Yes	0	0
	No	38	100
Surgery outcome	Complete recovery	38	100.0

Table 2. Intraoperative and Postoperative Outcomes in Patients Undergoing Off-Pump CABG with Posterior Pericardiotomy

history of smoking. A previous myocardial infarction was documented in 25 (65.7%) of patients.

The mean left ventricular ejection fraction was 42.86 ± 10.21 . Regarding coronary angiography findings, 7 (18.4%) of patients had single-vessel disease, another 7 (18.4%) had double-vessel disease, and the majority 24 (63.2%) had triple-vessel disease. All other information regarding sex, age, comorbidities, ejection fraction and coronary angiography among patients admitted for CABG with posterior pericardiotomy are presented in Table 1.

Intraoperative and postoperative parameters

All patients (N = 38) underwent off-pump CABG; none required on-pump CABG. The mean operative time was 254.31 ± 59.04 minutes, with a range of 165 to 385 minutes. The mean duration of postoperative intensive care unit (ICU) stay was 3.39 ± 1.71 days (range: 2–10 days). The mean volume of postoperative mediastinal drainage was 861.11 ± 551.37 mL, ranging from 150 to 2350 mL.

In terms of postoperative complications, new-onset atrial fibrillation was documented in 6 patients (15.7%), while supraventricular tachyarrhythmias occurred in 2 patients (5.2%). There was no statistically significant association between sex and the occurrence of new-onset atrial fibrillation ($\chi^2 = 0.111$, $p = 0.739$), nor between diabetes mellitus status (yes/no) and atrial fibrillation ($\chi^2 = 2.697$, $p = 0.101$). However, a significant association was observed between smoking status and the development of new-onset atrial fibrillation ($\chi^2 = 3.767$, $p = 0.05$).

Pleural effusion was identified in 16 patients (42.1%), and pericardial effusion was observed in 4 patients (10.5%). There was no statistically signifi-

cant association between sex and the occurrence of pleural effusion ($\chi^2 = 0.173$, $p = 0.677$), nor between diabetes mellitus status (yes/no) and pleural effusion ($\chi^2 = 1.092$, $p = 0.296$), nor smoking status and the development of pleural effusion ($\chi^2 = 0.139$, $p = 0.709$).

Notably, no cases of cardiac tamponade were recorded in the postoperative course. There was no statistically significant association between operative time and the occurrence of pericardial effusion ($p = 0.740$) or pleural effusion ($p = 0.174$). Furthermore, no significant correlation was observed between operative time and the volume of postoperative mediastinal drainage ($p = 0.781$). There was no statistically significant association between sex and the occurrence of pericardial effusion ($\chi^2 = 0.17$, $p = 0.895$), nor between diabetes mellitus status (yes/no) and pericardial effusion ($\chi^2 = 0.014$, $p = 0.906$), nor smoking status and the development of pericardial effusion ($\chi^2 = 0.14$, $p = 0.906$).

Overall, the clinical outcome was favorable, with complete recovery observed in all 38 patients (100.0%). All other data regarding procedure type, time and postoperative complications and outcomes are presented in Table 2.

5. DISCUSSION

This study evaluated the clinical impact of posterior pericardiotomy in patients undergoing OPCAB, with particular focus on the incidence of postoperative complications and their potential associations with perioperative variables. Our findings suggest that posterior pericardiotomy is a safe and feasible adjunct procedure in OPCAB, associated with a low incidence of pericardial effusion and no occurrence of cardiac tamponade. This supports existing evidence indicating that posterior pericardiotomy facilitates effective pericardial drainage and reduces pericardial fluid accumulation.

Importantly, pleural effusion was observed in 42.1% of patients - a relatively high incidence that may, in part, be explained by the anatomical communication intentionally created between the pericardial and left pleural cavities during posterior pericardiotomy. This surgical maneuver is designed to facilitate the drainage of pericardial fluid into the pleural space, thereby reducing the risk of cardiac tamponade. However, it may also predispose patients to pleural fluid accumulation, especially on the left side. While pleural effusions are a well-documented and frequently encountered complication following cardiac surgery, the clinical implications of such effusions in the context of posterior pericardiotomy are not yet fully understood. The high rate of effusion raises questions about the balance between potential benefits - such as prevention of pericardial effusion—and unintended consequences like symptomatic pleural effusion or prolonged recovery (4-7).

Nevertheless, it is reassuring that the majority of patients experienced an uncomplicated postoperative course. This suggests that the pleural effusions observed were predominantly small to moderate in volume and either self-limiting or effectively managed with conservative measures, such as observation or diuretic therapy, without the need for invasive interventions like thoracentesis or chest tube placement. Further studies are warranted to better define the long-term outcomes and optimize management strategies in patients undergoing posterior pericardiotomy (5-8).

New-onset AF was observed in 15.7% of patients in the cohort, a frequency that is consistent with previously reported incidences of postoperative AF in individuals undergoing OPCAB surgery. Postoperative AF is a well-recognized complication in cardiac surgical patients, often attributed to factors such as inflammation, oxidative stress, atrial stretch, and autonomic imbalance following surgery. In the specific context of OPCAB, while the avoidance of cardiopulmonary bypass may reduce systemic inflammation, the risk of AF remains appreciable, underscoring its multifactorial etiology (9-11).

A statistically significant association was identified between smoking status and the development of new-onset AF. This finding reinforces the role of smoking as a modifiable preoperative risk factor, potentially contributing to atrial remodeling, sympathetic activation, and pro-inflammatory states - all of which may predispose to postoperative arrhythmogenesis. These results highlight the importance of incorporating smoking cessation strategies into preoperative counseling and optimization protocols to mitigate postoperative AF risk (12-14).

Conversely, no statistically significant associations were found between other demographic or clinical variables such as sex or the presence of diabetes mellitus and the occurrence of postoperative complications. Additionally, operative time showed no correlation with the development of pleural effusion or the volume of fluid drained, suggesting that the duration of surgery may not be a primary driver of these specific complications.

Taken together, these findings suggest that the occurrence of common postoperative complications in OPCAB surgery may be more strongly influenced by patient-specific risk factors—such as smoking - rather than by intraoperative parameters. This emphasizes the value of thorough preoperative evaluation and targeted risk modification to improve surgical outcomes.

A complete recovery was observed in all of patients, further supporting the safety profile of posterior pericardiotomy when performed during OPCAB (15-17).

This study has several limitations, including its retrospective design, relatively small sample size, and the absence of a control group without posterior pericardiotomy. Therefore, while our findings are encouraging, they should be interpreted with caution and confirmed through larger prospective, randomized trials.

6. CONCLUSION

Posterior pericardiotomy during off-pump coronary artery bypass grafting appears to be a safe procedure associated with a low incidence of pericardial effusion and no cases of cardiac tamponade. It may offer protective benefits in the early postoperative period without significantly increasing the risk of other complications. Smoking was identified as a potential risk factor for new-onset atrial fibrillation and may warrant targeted intervention. Further research, including controlled prospective studies, is needed to validate these findings and better define the role of posterior pericardiotomy in contemporary cardiac surgical practice.

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