Posterior left pericardiotomy reduces postoperative atrial fibrillation in patients undergoing coronary artery bypass grafting surgery

Check for updates

Nikhil Sahdev, MBBS,[a] Guiqing Liu, MD,[a] Sahar Hasanzade, MD,[a] Jasleen Nagi, BSc,[a] Mansour Taghavi Azar Sharabiani, PhD,[b] and Prakash Punjabi, MD, FRCS[a,c]

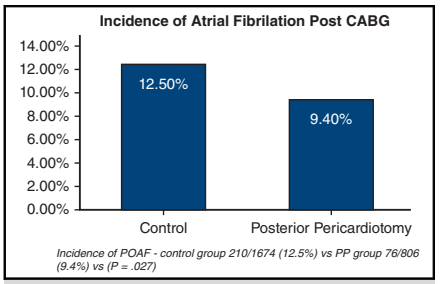
ABSTRACT

Objective: Atrial fibrillation (AF) is a common postoperative complication with an incidence of up to 10% to 33% after coronary artery bypass grafting surgery and is associated with worse morbidity and mortality. At present, studies have shown a promising reduction in postoperative AF (POAF) with posterior pericardiotomy (PP). However, there are limited data on the widespread use of PP amongst cardiac surgeons. This retrospective analysis assesses the influence of a real-world adoption of PP on the incidence and cumulative burden of POAF.

Methods: Patients who underwent coronary artery bypass grafting surgery between 2015 and 2022 were analyzed. One group had PP as part of their surgical procedure whilst the control group did not. For both groups, the incidence of POAF was analyzed. PP was performed via a 5-cm incision between the left inferior pulmonary vein and the phrenic nerve.

Results: Two thousand four hundred eighty patients were included in the analysis; 806 patients underwent PP and 1674 formed the control group. PP was associated with a 27.4% reduction in the odds of developing POAF (odds ratio, 0.73; 95% CI, 0.55-0.95; $P = .023$). Age was significantly associated with POAF, with a 4.3% increase in odds per additional year (odds ratio, 1.04; 95% CI, 1.03-1.06; $P < .001$). In the multivariate model for AF, PP remained significantly protective, reducing the odds of POAF by 26.9% (odds ratio, 0.73; 95% CI, 0.55-0.96; $P = .028$). Patients who underwent PP had significantly reduced cumulative POAF duration, with a 5.3% average reduction ($P = .002$).

Conclusions: Posterior left pericardiotomy is associated with reduced odds and duration of POAF. A large, multicenter trial is indicated to confirm this finding as well as the influence of PP and POAF on postdischarge clinical outcomes. (JTCVS Open 2025;25:120-5)



Incidence of POAF: control, 210/1674 (12.5%) versus PP, 76/806 (9.4%) (P = .027).

CENTRAL MESSAGE

This large, retrospective analysis of the influence of PP on POAF in patients undergoing CABG shows PP is associated with reduced odds and duration of POAF, thus supporting its use in CABG surgery.

PERSPECTIVE

This study is the largest retrospective analysis (2480 patients) of the influence of PP on POAF in patients undergoing CABG. These results show that PP is associated with a 27% reduction in odds of POAF (odds ratio, 0.73; 95% CI, 0.55-0.96; $P = .028$). This study, which includes a consecutive, nonselective group of patients, supports routine use of PP in CABG surgery.

From the [a]Department of Cardiothoracic Surgery, Hammersmith Hospital, Imperial College Healthcare NHS Trust, London, United Kingdom; [b]Imperial College School of Public Health, White City Campus, London, United Kingdom; and [c]National Heart and Lung Institute, Imperial College, London, United Kingdom.

Ethics Statement: The study was approved by the Imperial College Healthcare NHS Trust Audit Review Board (Reference: CAR-112; March 2025). Individual patient informed consent was not required due to the anonymous data management and the retrospective nature of this study.

Read at the 105th Annual Meeting of the American Association for Thoracic Surgery, Seattle, Washington, May 2-5, 2025.

Received for publication Feb 9, 2025; revisions received March 29, 2025; accepted for publication April 13, 2025; available ahead of print April 25, 2025.

Address for reprints: Prakash Punjabi, MD, FRCS, Department of Cardiothoracic Surgery, National Heart and Lung Institute, Imperial College, Du Cane Rd, London, W12 0HS, United Kingdom (E-mail: p.punjabi@imperial.ac.uk).

2666-2736

Crown Copyright © 2025 Published by Elsevier Inc. on behalf of The American Association for Thoracic Surgery. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

https://doi.org/10.1016/j.xjon.2025.04.006

Abbreviations and Acronyms
CABG = coronary artery bypass grafting
ECG = electrocardiogram
POAF = postoperative atrial fibrillation
PP = posterior pericardiotomy
RCT = randomized controlled trial

To view the AATS Annual Meeting Webcast, see the URL next to the webcast thumbnail.

Postoperative atrial fibrillation (POAF) is a common complication for patients undergoing coronary artery bypass grafting (CABG), with an incidence of between 10% and 33%.[1] POAF is associated with complications during the perioperative phase and long term.[2]

As a result, efforts are made preoperatively to reduce the risk of patients developing AF by risk factor optimization; as well as the use of pharmacological agents such as beta-blockers.[3] In addition, postoperatively there are many therapies for the treatment of AF[4] that are backed up by randomized controlled trials (RCTs).[5]

Intraoperatively, few methods are employed to reduce the incidence of POAF. One simple method that was described in 1995 was posterior pericardiotomy (PP).[6] This involves making an incision in the posterior pericardium to allow drainage of any pericardial collection into the left pleural space, reducing the risk of pericardial collection, which reduces the risk of tamponade and may lower the incidence of AF.

Since its initial description 30 years ago, the evidence supporting its use has evolved from being heavily scrutinized to now being recognized for significant benefits. Early studies reviewing this technique suggested that PP was not statistically significant in reducing the incidence of POAF.[7,8] In contrast, a more adequately powered, rigorous, prospective RCT with more than 400 patients across 4 years showed that PP was highly effective in reducing the incidence of AF after cardiac surgery.[9]

Despite high quality evidence in an RCT[9] and a meta-analysis[10] suggesting a promising reduction in POAF with PP in cardiac surgery, there are limited data on the widespread adoption of its use amongst cardiac surgeons. This may be due to surgeon familiarity, only recent inclusion into guidelines,[11,12] or perceived risks.

However, in our center the use of PP has been routinely practiced for more than 10 years and in this retrospective analysis we share our experience of adopting this technique by evaluating the influence of PP on the incidence of POAF, specifically in a large group of nonselective, consecutive patients undergoing CABG. We aim to provide further awareness and support for the routine use of PP in patients undergoing CABG.

METHODS

Study Design and Population

A retrospective cohort study was conducted using data from adult patients who underwent isolated CABG surgery at a single cardiothoracic center between January 2015 and November 2022. Patients who had a preoperative history of AF (or any other arrhythmia) or were undergoing concomitant mitral, aortic, or tricuspid surgery were excluded from the study because the risk of AF is different in these patients and would result in a heterogenous population. In addition, any redo or minimally invasive cases were excluded. Consecutive patients over the 8-year period were analyzed and spilt into 2 groups: patients who underwent PP (intervention group) and the remainder who formed the control group. The PP group had surgery performed by a single surgeon who routinely performed PP, whilst the control group had their surgery performed by the other 5 surgeons in the department. All patients who were taking beta-blockers preoperatively did not stop their medication before surgery.

Data Collection

Data were extracted from electronic medical records and included demographics (age, gender, and comorbidities), surgical details (number of distal anastomoses, bypass time, crossclamp time, and intraoperative products), and clinical details (incidence of AF, AF duration, return to theatre, and mortality). The study was approved by the Imperial College Healthcare NHS Trust Audit Review Board (CAR-112; March 2025). Individual patient informed consent was not required due to the anonymous data management and the retrospective nature of this study.

Procedure

All patients had a left internal thoracic artery graft to the left anterior descending artery and then patients either had subsequent arterial and/or vein grafts to the remaining distal targets. In case of a second arterial graft, usually the radial artery would be used. During CABG surgery before coming off bypass (because the heart needs to be lifted), patients had a PP performed by a 4- or 5-cm vertical incision using diathermy posterior to the left phrenic nerve and extending from the left inferior pulmonary vein to the diaphragm, resulting in free communication between the pericardial and left pleural cavity. There were no contraindications for the procedure unless the patients had dense adhesions. There were no other significant or consistent differences in the intraoperative care between surgeons and no patients had their pericardium closed routinely.

Postoperative Course

Postoperative management was similar for both groups and among surgeons; this was due to the intensive care unit following a standardized protocol for all patients undergoing cardiac surgery, including for the management of AF. All patients were prescribed routine use of postoperative beta-blockers for arrhythmia prophylaxis unless contradicted (eg, bradycardia, heart block, or hemodynamic instability). Those patients who developed POAF had their electrolyte levels checked and supplemented if necessary. If normal, patients were treated with a 300-mg intravenous amiodarone loading dose followed by a 900-mg maintenance dose. If no central line was in place, oral amiodarone was given. If POAF persisted, oral amiodarone was prescribed for up to 6 weeks until clinic review with a 12-lead electrocardiogram (ECG). Systemic anticoagulation was not routinely prescribed unless patients were in POAF for a period of >48 hours. Continuous ECG monitoring was available whilst in the intensive care unit during the first 48 hours and following this, daily ECGs were performed on the ward as well as additional ECGs if there was a

TABLE 1. Baseline characteristics and comorbidities

	Posterior pericardiotomy (n = 806)	Control (n = 1674)	*P* value
Male vs female gender (%)	657 (82) vs 149 (18)	1374 (82) vs 300 (18)	.774
Age (y)	64.2 ± 9.8	64.5 ± 9.7	.532
BMI	28.3 ± 11.9	28.4 ± 12.8	.454
Previous MI (%)	402 (49.9)	823 (49.2)	.772
Previous PCI (%)	183 (22.7)	349 (20.8)	.316
Diabetes (%)	433 (53.7)	724 (43.2)	**<.001**
Hypertension (%)	755 (93.7)	1436 (85.8)	**<.001**
Smoking history (%)	420 (52.4)	822 (49.2)	**.045**
Creatinine (μmol/L)	108 ± 106.8	104.2 ± 96.5	.191
LVEF (%)	53.5 ± 7.2	54.5 ± 7.2	**<.001**

Values are presented as n (%) or mean ± SD. Bold indicates signficiant *P* value. *BMI*, Body mass index; *MI*, myocardial infarction; *PCI*, percutaneous coronary intervention; *LVEF*, left ventricular ejection fraction.

suspicion of POAF. If the patient developed AF, he or she would be placed on continuous ECG monitoring for the remainder of the admission.

Statistics

A series of univariate and multivariable regression analyses were performed to investigate factors associated with AF in patients undergoing CABG operations. In the univariate analysis, logistic regression models were used to assess the association of individual predictors with the binary outcomes (AF and mortality). For the multivariable regression analysis, a stepwise selection approach was employed, integrating both statistical significance ($P < .05$ in univariate analysis) and clinical relevance. This approach ensures that clinically important variables are retained even if they do not reach strict statistical significance in univariate testing.

The final multivariable models included PP, age, and crossclamp time, which were identified based on a combination of univariate results and prior clinical evidence of association with POAF. Odds ratios (ORs) with 95% CIs were reported for the logistic regression models, whereas regression coefficients (estimates) with 95% CIs were reported for the linear regression models.

A nonparametric Mann-Whitney *U* test was used to compare POAF duration between groups. Given the skewed distribution of POAF duration, this test was selected because it does not require normality assumptions. All analyses were conducted using R version 4.4.1 (R Foundation for Statistical Computing).

RESULTS

A total of 2480 patients who underwent consecutive CABG operations were included in the analysis. Of these, 806 patients had undergone PP as part of their procedure and 1674 patients formed the control group without PP. Both groups (PP and control, respectively) were similar in terms of gender, age (64.2 vs 64.5 years; $P = .532$), and body mass index (28.3 vs 28.4; $P = .454$). The PP group (vs control) had a higher incidence of comorbidities such as diabetes (54% vs 43%; $P \leq .001$), hypertension (94% vs 86% $P \leq .001$), and smoking history (52% vs 49%; $P = .045$) (Table 1).

The PP group had greater mean number of distal anastomoses 3.6 versus 3.0 ($P \leq .001$); however, mean crossclamp time (49 vs 49 minutes) remained the same. The PP group had a slightly longer bypass time of 87 versus 82 minutes ($P \leq .001$) but the use of intraoperative blood products (23% vs 20%) was similar in PP versus control, respectively (Table 2).

Overall, the incidence of POAF was lower in the PP group 9.4% (76 out of 806) compared with the control group 12.5% (210 out of 1674) ($P = .027$). Cumulative mean POAF duration was lower in the PP group compared with the control group: 4.5 versus 7.9 hours ($P = .013$).

Postoperatively, both groups had a similar percentage of patients return to theatre for bleeding or any other cause. However, there were 2 patients in the PP group who had a diagnosis of cardiac tamponade compared with 8 cases in the control group ($P = .515$). Intrahospital mortality (10 [1.24%] vs 11 [0.66%]), was not statistically different between both groups (Table 3).

Factors Associated With AF

The univariate regression analysis showed that several factors were significantly associated with POAF. PP was associated with a 27.4% reduction in the odds of

TABLE 2. Operation factors

	Posterior pericardiotomy (n = 806)	Control (n = 1674)	*P* value
Distal anastomosis	3.6 ± 1	3 ± 0.9	**<.001**
Bypass time (min)	86.6 ± 37	81.8 ± 26.2	**<.001**
Crossclamp time (min)	48.8 ± 20.7	49 ± 18.6	**.045**
No. of operations where intraoperative blood products were administered	184 (23.1)	342 (21)	.262

Values are presented as mean ± SD or n (%). Bold indicates signficiant *P* value.

TABLE 3. Postoperative factors

	Posterior pericardiotomy (n = 806)	Control (n = 1674)	*P* value
Incidence of AF	76 (9.4)	210 (12.5)	**.027**
Mean cumulative POAF duration (h)	4.5	7.9	**.013**
Median length of stay (d)	9	9	1.000
Return to theatre	15 (1.9)	31 (1.9)	1.000
Tamponade	2 (0.2)	8 (0.5)	.515
Bleeding	5 (0.6)	10 (0.6)	1.000
Any other cause	8 (1.0)	13 (0.8)	.641
Death	10 (1.24)	11 (0.66)	.211

Values are presented as n (%) unless otherwise noted. Bold indicates signficiant *P* value. *AF*, Atrial fibrillation; *POAF*, postoperative atrial fibrillation.

developing POAF (OR, 0.73; 95% CI, 0.55-0.95; $P = .023$). Age was also significantly associated with AF, with a 4.3% increase in odds per additional year (OR, 1.04; 95% CI, 1.03-1.06; $P < .001$). Cumulative crossclamp time had a modest but significant effect on POAF (OR, 1.006; 95% CI, 1.00-1.01; $P = .041$) (Table 4).

Posterior Pericardiotomy and AF

In the multivariable model for POAF, which accounted for confounding variables, PP remained significantly protective, reducing the odds of POAF by 26.9% (OR, 0.73; 95% CI, 0.55-0.96; $P = .028$) (Table 5). Age also remained a significant predictor (OR, 1.04; 95% CI, 1.03-1.06; $P < .001$).

PP and the Duration of AF

Patients in the PP group had a significantly lower cumulative POAF duration than the control group. When multiple regression was used to account for age and gender, this equated to a 5.3% average reduction in POAF duration ($P = .0016$). In addition, each increased minute of crossclamp time significantly increased POAF duration by 0.08% ($P = .049$). Each additional year of age was also significantly associated with a 0.51% increase in POAF duration ($P < .001$) (Table 6).

DISCUSSION

This study is large, retrospective analysis of patients undergoing PP as part of their CABG procedure and its effect on the incidence and duration of POAF. A major strength of the study is the large number of patients and the consecutive inclusion into the study. Therefore, this study provides a real-life interpretation of the adoption of PP on the incidence of POAF in, specifically, patients undergoing CABG.

The PP group mainly consisted of patients from a referral base of a dominantly Southeast Asian population, which explains the higher incidence of diabetes and hypertension.[13,14] Despite patients in the PP group being significantly more hypertensive and diabetic, which increases the risk of developing POAF,[15] the incidence of POAF was lower in the group that underwent PP.

A multivariable regression analysis was used to adjust for confounding factors. It showed that PP reduced the odds of developing POAF by 27% independent of age and crossclamp time (OR, 0.73; 95% CI, 0.55-0.96; $P = .028$). Our results differed from Haddadzadeh and colleagues'[8] RCT involving more than 200 patients. They reported no significant difference in the incidence of POAF between the PP group (5 out of 105 [4.8%]) and the control group (6 out of 102 [5.9%]). Additionally, Arbatli and colleagues[16] reported a decrease in POAF (12.96% vs 20.34%; $P = .32$ for PP vs control) with the use of PP in their trial involving 113 patients; however, they also were unable to reach statistical significance. Our results were not consistent with earlier studies largely because those were underpowered to reach significance.

Soletti and colleagues[10] studied PP in more than 3500 patients undergoing cardiac surgery and showed a significantly lower incidence of POAF (OR, 0.45; $P < .0001$). When reviewing more specifically the effect of PP on POAF in patients undergoing CABG surgery, our results were consistent with the meta-analysis of 10 RCT trials by Xiong and colleagues.[17] The analysis had more than 1800 patients and reported a risk ratio of 0.45 ($P < .0001$) for patients developing POAF after undergoing PP during CABG surgery. Similarly, Gaudino and colleagues[9] reported a relative

TABLE 4. Univariate logistic regression results for atrial fibrillation

Predictor	Odds ratio	95% CI	*P* value
Posterior pericardiotomy	0.73	0.55-0.95	**.023**
Creatinine (μmol/L)	0.999	0.997-1.000	.084
Gender	0.78	0.55-1.09	.153
Age	1.04	1.03-1.06	**<.001**
Crossclamp time	1.006	1.000-1.01	**.041**

Bold indicates signficiant *P* value.

TABLE 5. Multivariate logistic regression results for atrial fibrillation

Predictor	Odds ratio	95% CI	*P* value
Posterior left pericardiotomy	0.73	0.55-0.96	**.028**
Age	1.04	1.03-1.06	**<.001**
Crossclamp time	1.006	1.000-1.012	.052

Bold indicates signficiant *P* value.

TABLE 6. Summary of multiple regression on postoperative atrial fibrillation duration

Predictor	Estimate, coefficient (β)	*P* value	Exponentiated estimate, exp (β) with 95% confidence intervals
Posterior left pericardiotomy	−0.0530	**.002**	0.9484 (0.914-0.984)
Age	0.0051	**<.001**	1.0051 (1.004-1.006)
Male gender	−0.0357	.0807	0.9649 (0.936-1.001)
Cumulative crossclamp time	0.0008	**.0499**	1.0008 (1.000-1.002)

Bold indicates signficiant *P* value.

risk of 0.55 of patients developing POAF in the PP group versus control. This is an impressive reduction in POAF in a cohort of more than 400 patients undergoing CABG, aortic valve, and aortic procedures. However, although the CABG-only subgroup in Gaudino and colleagues'[9] trial (19% vs 25%) did not reach conventional statistical significance, the authors reported no significant treatment-by-subgroup interaction, indicating a consistent overall treatment effect across all surgery types. This suggests the CABG subgroup alone was underpowered to demonstrate significance. Nevertheless, our large, CABG-specific dataset shows a statistically significant reduction in POAF with PP, underscoring that a real benefit likely extends to patients undergoing isolated CABG as well.

Despite evidence suggesting PP reduces the incidence of POAF, the routine use of PP has not been well documented in the literature. One potential barrier to the widespread use of PP may include limited familiarity among surgeons and we hope more studies like this will increase awareness of reduction in POAF by using this technique. PP has only recently (2024) been adopted into the American Heart Association/American College of Cardiology guidelines for the management of postoperative AF[12] as class IIa evidence and hence may not yet be standard practice amongst surgeons. There may also be concerns about complications associated with PP. However, in a large meta-analysis, patients undergoing PP did not have an increased risk of operative mortality, re-exploration, pulmonary complications, need for intra-aortic ballon pump, or longer hospital or intensive care unit length of stay.[10] To our knowledge, there is only 1 report of graft herniation[18] and the most likely cause was excessive length of the graft. We did not experience any graft herniation or phrenic nerve injury during hospital admission or increased length of stay or mortality in our cohort of patients.

Our results not only suggest that performing PP significantly reduces the chances of developing POAF in patients undergoing CABG but also showed that the PP group had a significantly lower cumulative AF duration (4.5 vs 7.9 hours; $P = .013$). When calculating the mean duration of POAF, all patients were included in the analysis, assigning an AF duration of 0 to those who did not develop AF. This methodology allows for a true estimate of cumulative AF burden, capturing both incidence and duration in a single measure. By doing so, it ensures that PP was evaluated not only for its ability to reduce AF duration in affected patients but also for their potential to prevent AF altogether. We adopted this inclusive methodology, providing a more accurate and clinically relevant comparison between treatment groups and avoids systematic bias.

Our results also showed crossclamp time was a significant predictor of developing POAF and furthermore for every additional minute of crossclamp time, the duration of AF would increase by 0.08%. This emphasizes the need to reduce crossclamp times to optimize outcomes.

A potential mechanism to explain our results is that after cardiac surgery it is common for blood to collect in the pericardial space, most prominently in the left posterior segment.[19] Following this, breakdown of blood products, activation of the coagulation cascade, and oxidative stress can contribute to a high inflammatory state within the pericardial space that can trigger AF.[20] The aim of performing a PP is that any collected blood can drain into the left pleural cavity thus preventing triggering of AF. One other potential method of reducing the incidence of POAF is the use of a pericardial drain,[21] which has not been proven in any RCTs; however, in comparison, the use of PP has been backed up by multiple high-quality studies. In addition, placing an extra drain reduces the risk of pain, infection, and potential bleeding.

Limitations

Because this is a nonrandomized, retrospective study, there is potential for selection bias, missing information, and confounding variables, although in this study we have accounted for potential variables that may have contributed to AF. In addition, because the study is retrospective, we can imply there is an association between PP and POAF but cannot suggest causality. The study was also done in a single center with all PP procedures being performed by 1 surgeon, whereas the control group was operated on by the remaining surgeons in the unit and hence this study is open to expertise bias. POAF was more likely to be recorded during the first 48 hours because patients had continuous ECG monitoring and were less likely to be recorded beyond 48 hours because ECG readings were generally only performed daily if there was clinical suspicion of POAF. The incidence of POAF may have been higher if continuous monitoring was available. We

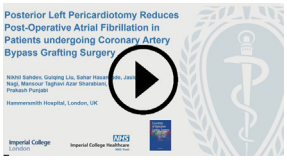
did not collect data on antiarrhythmia medication or anticoagulation use postoperatively. Because blood from the pericardial sac can move freely into the left pleural space, there has been a reported incidence in the literature of increased pleural effusions in the PP group, but this rarely led to pulmonary complications.[10] This outcome was not measured in the study, but effusions can often be easily managed with a chest drain and therefore the benefit of doing a PP (reduced tamponade and reduction in AF) outweighs the risks. When performing PP, it is important to review the drain output from the pleural drain because PP has the potential to mask drain output from the mediastinal drain in the initial postoperative phase.

CONCLUSIONS

This study provides further support and awareness to the adoption of PP in reducing the incidence of POAF. It shows that posterior left pericardiotomy is associated with a 27% reduction in odds of developing POAF and 5.6% reduction in duration of POAF in patients undergoing CABG. A large, multicenter trial is indicated to confirm this finding as well as the influence of PP and POAF on postdischarge clinical outcomes such as all-cause mortality, stroke, and readmission in the long term.

Webcast

You can watch a Webcast of this AATS meeting presentation by going to: https://www.aats.org/resources/posterior-left-pericardiotomy–9846.



Audio

Audio Recording: You can listen to the audio recording of the presentation and discussion associated with this paper: https://doi.org/10.1016/j.xjon.2025.04.006.

Conflict of Interest Statement

The authors reported no conflicts of interest.

The *Journal* policy requires editors and reviewers to disclose conflicts of interest and to decline handling or reviewing manuscripts for which they may have a conflict of interest.

References

1. Turagam MK, Mirza M, Werner PH, et al. Circulating biomarkers predictive of postoperative atrial fibrillation. *Cardiol Rev*. 2016;24(2):76-87. https://doi.org/10.1097/CRD.0000000000000059
2. Caldonazo T, Kirov H, Rahouma M, et al. Atrial fibrillation after cardiac surgery: a systematic review and meta-analysis. *J Thorac Cardiovasc Surg*. 2023;165(1):94-103.e24. https://doi.org/10.1016/j.jtcvs.2021.03.077
3. Echahidi N, Pibarot P, O'Hara G, Mathieu P. Mechanisms, prevention, and treatment of atrial fibrillation after cardiac surgery. *J Am Coll Cardiol*. 2008;51(8):793-801. https://doi.org/10.1016/j.jacc.2007.10.043
4. Karamchandani K, Khanna AK, Bose S, Fernando RJ, Walkey AJ. Atrial fibrillation: current evidence and management strategies during the perioperative period. *Anesth Analg*. 2020;130(1):2-13. https://doi.org/10.1213/ANE.0000000000004474
5. Gillinov AM, Bagiella E, Moskowitz AJ, et al. Rate control versus rhythm control for atrial fibrillation after cardiac surgery. *N Engl J Med*. 2016;374(20):1911-1921. https://doi.org/10.1056/NEJMoa1602002
6. Mulay A, Kirk A, Angelini G, Wisheart J, Hutter J. Posterior pericardiotomy reduces the incidence of supra-ventricular arrhythmias following coronary artery bypass surgery. *Eur J Cardiothorac Surg*. 1995;9(3):150-152. https://doi.org/10.1016/S1010-7940(05)80063-6
7. Kongmalai P, Karunasumetta C, Kuptarnond C, et al. The posterior pericardiotomy. Does it reduce the incidence of postoperative atrial fibrillation after coronary artery bypass grafting? *J Med Assoc Thai*. 2014;97(Suppl 10):S97-S104.
8. Haddadzadeh M, Motavaselian M, Rahimianfar AA, Forouzannia SK, Emami M, Barzegar K. The effect of posterior pericardiotomy on pericardial effusion and atrial fibrillation after off-pump coronary artery bypass graft. *Acta Med Iran*. 2015;53(1):57-61.
9. Gaudino M, Sanna T, Ballman KV, et al. Posterior left pericardiotomy for the prevention of atrial fibrillation after cardiac surgery: an adaptive, single-centre, single-blind, randomised, controlled trial. *Lancet*. 2021;398(10316):2075-2083. https://doi.org/10.1016/S0140-6736(21)02490-9
10. Soletti GJ, Perezgrovas-Olaria R, Harik L, et al. Effect of posterior pericardiotomy in cardiac surgery: a systematic review and meta-analysis of randomized controlled trials. *Front Cardiovasc Med*. 2022;9:1090102. https://doi.org/10.3389/fcvm.2022.1090102
11. Van Gelder IC, Rienstra M, Bunting KV, et al. 2024 ESC guidelines for the management of atrial fibrillation developed in collaboration with the European Association for Cardio-Thoracic Surgery (EACTS). *Eur Heart J*. 2024;45(36):3314-3414. https://doi.org/10.1093/eurheartj/ehae176
12. Joglar JA, Chung MK, Armbruster AL, et al. 2023 ACC/AHA/ACCP/HRS guideline for the diagnosis and management of atrial fibrillation: a report of the American College of Cardiology/American Heart Association Joint Committee on clinical practice guidelines. *Circulation*. 2024;149(1):e1-e156. https://doi.org/10.1161/CIR.0000000000001193
13. Mohan V, Seedat YK, Pradeepa R. The rising burden of diabetes and hypertension in Southeast Asian and African regions: need for effective strategies for prevention and control in primary health care settings. *Int J Hypertens*. 2013;2013:1-14. https://doi.org/10.1155/2013/409083
14. Jayawardena R, Ranasinghe P, Byrne NM, Soares MJ, Katulanda P, Hills AP. Prevalence and trends of the diabetes epidemic in South Asia: a systematic review and meta-analysis. *BMC Public Health*. 2012;12(1):380. https://doi.org/10.1186/1471-2458-12-380
15. Lau DH, Nattel S, Kalman JM, Sanders P. Modifiable risk factors and atrial fibrillation. *Circulation*. 2017;136(6):583-596. https://doi.org/10.1161/CIRCULATIONAHA.116.023163
16. Arbatli H, Demirsoy E, Aytekin S, et al. The role of posterior pericardiotomy on the incidence of atrial fibrillation after coronary revascularization. *J Cardiovasc Surg (Torino)*. 2003;44(6):713-717.
17. Xiong T, Pu L, Ma YF, et al. Posterior pericardiotomy to prevent new-onset atrial fibrillation after coronary artery bypass grafting: a systematic review and meta-analysis of 10 randomized controlled trials. *J Cardiothorac Surg*. 2021;16(1):233. https://doi.org/10.1186/s13019-021-01611-x
18. Yorgancıoglu C. An unusual experience with posterior pericardiotomy. *Eur J Cardiothorac Surg*. 2000;18(6):727. https://doi.org/10.1016/S1010-7940(00)00586-8
19. Pepi M, Muratori M, Barbier P, et al. Pericardial effusion after cardiac surgery: incidence, site, size, and haemodynamic consequences. *Heart*. 1994;72(4):327-331. https://doi.org/10.1136/hrt.72.4.327
20. St Onge S, Perrault LP, Demers P, et al. Pericardial blood as a trigger for postoperative atrial fibrillation after cardiac surgery. *Ann Thorac Surg*. 2018;105(1):321-328. https://doi.org/10.1016/j.athoracsur.2017.07.045
21. Rabelo LG, Zindovic I, Astrom DO, et al. A posterior pericardial chest tube is associated with reduced incidence of postoperative atrial fibrillation after cardiac surgery: a propensity score-matched study. *J Thorac Cardiovasc Surg Open*. 2024;22:244-254. https://doi.org/10.1016/j.xjon.2024.09.003

Key Words: atrial fibrillation, posterior, pericardiotomy, duration