วารสารวิชาการสาธารณสุข
ปีที่ 35 ฉบับที่ 1 มกราคม - กุมภาพันธ์ 2569

Journal of Health Science of Thailand
Vol. 35 No. 1, January - February 2026

นิพนธ์ต้นฉบับ *Original article*

Risk Factors Associated with Short-term Mortality and Complication Rates After Open Heart Surgery in a Regional Hospital Setting

Prem Mongkolkeha, M.D.

Cardiothoracic Unit, Department of Surgery, Trang Hospital, Thailand

Corresponding author: Prem Mongkolkeha, Email: photo_redarmy@hotmail.com

Date received: 2025 Jan 15
Date revised: 2025 Nov 25
Date accepted: 2025 Dec 2

Abstract This study aimed to investigate the 30-day mortality rate, postoperative complications, and factors associated with short-term mortality among patients undergoing open heart surgery in a regional hospital in Thailand. A retrospective study was conducted using data from 106 patients who underwent open heart surgery at Trang Hospital, Thailand, between July 2022 and June 2024. The primary outcome was the 30-day mortality rate, while secondary outcomes included various postoperative complications and associated risk factors. Logistic regression analysis was employed to identify predictors of mortality. The results showed that six patients died within 30 days after surgery, representing a 30-day mortality rate of 5.7%. The rates of major complications were as follows: arrhythmias 21.7%, pulmonary or bloodstream infections 12.3%, kidney failure requiring dialysis 4.7%, stroke 2.8%, reoperation 2.8%, and deep sternal wound infection 0.9%. Preoperative factors significantly associated with 30-day mortality included older age and lower left ventricular ejection fraction, whereas postoperative predictors were stroke and kidney failure requiring dialysis. Moreover, patients with a predicted 30-day mortality rate greater than 8% according to the EuroSCORE II or GERAADA model had a substantially higher risk of death. In conclusion, the 30-day mortality rate after open heart surgery in this regional hospital remained relatively high compared with national reports. Advanced age, impaired cardiac function, and serious postoperative complications, particularly stroke and renal failure, were key determinants of early mortality. These findings underscore the importance of strengthening perioperative management, optimizing surgical risk assessment, and improving postoperative monitoring systems in regional hospital settings to reduce adverse outcomes.

Keywords: **surgical complications; mortality; open heart surgery; regional hospital**

Introduction

Reports on the outcomes for the patient after open heart surgery in a regional hospital, which usually has less experienced cardiac surgeons and a low volume of cases, were limited. This study aimed at investigating the short-term outcomes of open heart surgery

in a regional hospital setting. Open heart surgery in Thailand began in 1959, but systematic data collection on surgical outcomes only began in 2003. The reported mortality rate for patients undergoing elective open heart surgery was between 2.3% and 4.8% [1]. Initially, open heart surgery was largely limited to university hospitals, resulting in long waiting times for patients. However, following the establishment of the National Health Security Office in 2002, provincial hospitals were encouraged to develop the capacity to perform open heart surgeries to improve accessibility and reduce treatment delays[2]. In recent years, open heart surgery has become more widely practised across Thailand, and various models for predicting short-term outcomes after surgery have been developed. Among these, the European System for Cardiac Operative Risk Evaluation II (EuroSCORE II) and the Society of Thoracic Surgeons (STS) risk score are the most commonly used to predict 30-day mortality following cardiac surgery[3-5]. In emergency cases such as acute aortic dissection type A, the German Registry for Acute Aortic Dissection type A (GERAADA) score is applied to estimate early mortality[6]. These predictive models provide cardiac surgeons with useful tools for evaluating operative risks, assessing performance, and comparing patient outcomes with international benchmarks.

In addition to risk-prediction models, the experience of the cardiac surgeon and the surgical volume of the hospital play a critical role in determining postoperative outcomes. Several studies have demonstrated that hospitals and surgeons with higher case volumes and greater experience have significantly lower rates of mortality and complications compared to those with limited experience or lower surgical volume[7,8]. Consequently, regional hospitals, where cardiac surgery programmes are relatively new and the number of cases performed annually is often limited, may face challenges in achieving comparable outcomes to high-volume tertiary centers.

Despite the expansion of cardiac surgery services in regional hospitals across Thailand, evidence on short-term outcomes and mortality risk factors in these settings remains scarce. Most existing data originate from universities or specialized cardiac centers, leaving an important gap in understanding the safety and quality of open heart surgery in regional contexts. This study, therefore, aimed to investigate the 30-day mortality rate, postoperative complications, and factors associated with short-term mortality among patients undergoing open heart surgery in a regional hospital. The findings from this study were expected to provide valuable insights for improving perioperative management and enhancing surgical safety in similar healthcare settings across the country.

Methods

This retrospective study was conducted using data from patients who underwent open heart surgery at Trang Hospital, a regional hospital in southern Thailand, between July 2022 and June 2024. The primary outcome was the 30-day mortality rate, while secondary outcomes included postoperative complications and factors associated with mortality. Data were obtained from patient medical records and operative reports. The inclusion criteria were adult patients aged 18 to 90 years who underwent open heart surgery during the study period. Patients whose surgeries were performed by invited external surgeons with advanced subspecialty experience were excluded

to ensure the analysis reflected outcomes within the hospital's standard practice setting.

Demographic, clinical, and operative data were collected, including age, sex, comorbidities, left ventricular ejection fraction, urgency of surgery, and type of procedure. The predicted 30-day mortality rate was calculated using the EuroSCORE II model for most patients and the GERAADA score for those with acute aortic dissection type A. Postoperative complications such as stroke, renal failure requiring dialysis, reoperation, arrhythmias, deep sternal wound infection, and pulmonary or bloodstream infections were recorded within 30 days of surgery.

Categorical variables were summarized as frequency and percentage, whereas continuous variables were described as mean and standard deviation for normally distributed data or as median and interquartile range for non-normally distributed data. Logistic regression analysis was performed to identify factors associated with 30-day mortality. Variables with a p-value of less than 0.2 in univariate analysis were entered into multivariate logistic regression using a backward stepwise selection method based on the Akaike Information Criterion (AIC). Adjusted odds ratios (ORs) with 95% confidence intervals (CIs) were reported. All statistical analyses were conducted using IBM SPSS Statistics version 30. This study was approved by the Trang Hospital Research Ethics Committee (No. 060/10-2567).

Results

A total of 106 patients who underwent open heart surgery between July 2022 and June 2024 were included in this study. The baseline demographic and clinical characteristics are presented in Table 1. The median age of the patients was 63 years (interquartile

Table 1 Baseline demographic and clinical characteristics of patients undergoing open heart surgery (n = 106)

Variable	Value		Variable	Value	
	Number	%		Number	%
Male, n (%)	73	68.9	Urgency of surgery, n (%)		
Body mass index (kg/m^2)			1. Elective	88	83.0
Median, IQR)	23.65 (20.9, 26.7)		2. Urgency/Emergency*	18	17.0
Age (year), (median, IQR)	63	53,69	Procedure, n (%)		
Underlying disease, n (%)			1. Coronary artery bypass grafting	67	63.2
1. Diabetes mellitus	32	30.2	2. Single valvular heart surgery	15	14.2
2. Hypertension	72	67.9	3. Aortic surgery	4	3.8
3. Dyslipidemia	65	61.3	4. Congenital heart surgery	2	1.9
5. Cerebrovascular disease	17	16.0	5. Multiprocedural surgery	18	17.0
6. Chronic obstructive pulmonary disease	3	2.8	Predicted 30-day mortality rate (%)		
7. Chronic kidney disease	31	29.2	Median (IQR)†	1.48 (0.9, 3.6)	
Left ventricular ejection fraction (%)			Length of hospital stay after surgery (day),		
Median, IQR)	60 (47, 67)		Median, IQR)	5 (5,6)	

Remark: * Patients requiring surgery during hospitalization. † Calculated using EuroSCORE II or GERAADA score (for aortic dissection type A). IQR = interquartile range

range [IQR] = 53–69), and 68.9% were male. The most common underlying diseases were hypertension (67.9%), dyslipidemia (61.3%), and diabetes mellitus (30.2%). The median left ventricular ejection fraction (LVEF) was 60% (IQR = 47–67). Most surgeries were elective (83.0%), and the remaining 17.0% were urgent or emergency procedures. Coronary artery bypass grafting (CABG) was the most frequently performed operation (63.2%), followed by single valvular surgery (14.2%) and multiple procedures (17.0%). The overall median predicted 30-day mortality rate, calculated by EuroSCORE II or the GERAADA score for aortic dissection type A, was 1.48% (IQR = 0.9–3.6). The median length of postoperative hospital stay was 5 days (IQR = 5–6).

Within 30 days of surgery, six patients died, corresponding to a 30-day mortality rate of 5.7%. Among these, two deaths (1.9%) were due to cardiac causes, both from sustained ventricular arrhythmia, while four deaths (3.8%) were attributed to non-cardiac causes. The overall rates of postoperative complications are summarized in Table 2. The most frequent complication was arrhythmia requiring medication or device support, occurring in 21.7% of patients. Pulmonary or bloodstream infection occurred in 12.3% of cases, followed by renal failure requiring dialysis (4.7%), stroke (2.8%), reoperation (2.8%), and deep sternal wound infection (0.9%).

The results of multivariate logistic regression analysis examining the association between clinical factors and 30-day mortality are shown in Table 3. In the first model, which analysed individual preoperative and postoperative variables, older age (odds ratio [OR] = 1.19, 95% confidence interval [CI] = 1.02–1.40, p = 0.032), lower left ventricular ejection fraction (OR = 0.91, 95% CI = 0.84–0.98, p = 0.016), and postoperative stroke (OR = 87.54, 95% CI = 2.40–3196.56, p = 0.015) were significantly associated with increased mortality. In the second model, which incorporated the preoperative predicted mortality risk, a EuroSCORE II or GERAADA predicted 30-day mortality greater than 8% (OR = 13.04, 95% CI = 1.80–94.19, p = 0.011) and postoperative renal failure requiring dialysis (OR = 15.49, 95% CI = 1.30–183.94, p = 0.030) were identified as significant predictors. Postoperative stroke also demonstrated a trend toward higher mortality risk (OR = 12.87, p = 0.108).

Table 2 Postoperative complications within 30 days after open heart surgery (n = 106)

Type of complication	Number of patients	%
Stroke	3	2.8
Renal failure requiring renal replacement therapy	5	4.7
Reoperation	3	2.8
Arrhythmia requiring medication or specific devices	23	21.7
Deep sternal wound infection	1	0.9
Pulmonary or bloodstream infection	13	12.3

Table 3. Multivariate logistic regression analysis of factors associated with 30-day mortality after open heart surgery

Variable	Multivariate analysis		
	Odds Ratio	(95% CI)	p-value
Model 1: Individual pre- and postoperative factors			
Age (per year increase)	1.19	(1.02-1.40)	0.032
Left ventricular ejection fraction (%)	0.91	(0.84-0.98)	0.016
Postoperative stroke	87.54	(2.40-3196.56)	0.015
Model 2: Combined preoperative risk and postoperative complications			
Predicted 30-day mortality > 8% *	13.04	(1.80-94.19)	0.011
Postoperative stroke	12.87	(0.57-290.30)	0.108
Postoperative renal failure requiring renal replacement therapy	15.49	(1.30-183.94)	0.030

*Predicted by EuroSCORE II or GERAADA score (for aortic dissection type A), CI = confidence interval.

Discussion

The study found that the 30-day mortality rate after open heart surgery in the regional hospital is relatively high at 5.7%. This is in contrast to the predicted 30-day mortality rates based on EuroSCORE II or GERAADA score for emergency aortic dissection (Stanford type A), which have a median of 1.48%[3,6]. The mortality rate in this study is also higher than that reported by Arayawudhikul et al.[2], which was 2.3% for open heart surgery in a regional hospital. This discrepancy may be due to lower experience and lower case volume at the institution. Studies by Moon et al., Naito et al., and the STS Adult Cardiac Surgery Database also indicate that the experience and case volume of the institution affect the 30-day mortality rate post-surgery[4,7,8].

The analysis of causes of death following open heart surgery revealed that one-third of the patients died due to cardiac-related issues. The cause of death in both cases was attributed to sustained ventricular arrhythmia, with both patients passing away in the general surgical ward. A study by El-Chami et al. found that the presence of sustained ventricular arrhythmia after surgery significantly increases the mortality rate in patients, particularly among older patients, those with peripheral artery disease, those with low left ventricular ejection fraction, and those undergoing emergency surgery. This condition has a statistically significantly higher occurrence in these groups[9]. Management of this condition includes close monitoring, addressing underlying causes, and the administration of antiarrhythmic drugs or electrical cardioversion[10]. Therefore, patients at risk for sustained ventricular arrhythmia should be closely monitored and ready for treatment at all times, ideally in a specialised unit for postoperative cardiac care. Because the regional hospital does not have a specialised unit for postoperative cardiac care, this could be the reason why the 30-day mortality rate after open heart surgery is relatively high in the regional hospital.

Regarding complications following open heart surgery, the data analysis revealed the rates of various complications as follows: stroke at 2.8%, kidney failure at 4.7%, reoperation at 2.8%, arrhythmias at

21.7%, mediastinal wound infections at 0.9%, and infections in the lungs or bloodstream at 12.3%. These complication rates are relatively comparable to those reported in the STS Adult Cardiac Surgery Database, which shows rates for stroke, kidney failure, reoperation, arrhythmias, and mediastinal wound infections at 0.9-3.1%, 1.2-8.6%, 3.0-7.2%, 26.4-37.4%, and 0.03-0.6%, respectively [4].

Multivariate analysis identified several independent risk factors associated with 30-day mortality. In the first model, older age, lower left ventricular ejection fraction, and postoperative stroke were significant predictors of death. Both age and LVEF are well-established predictors in many risk-prediction models for cardiac surgery, including EuroSCORE II and other validated indices[3,11-15]. Postoperative stroke, which often reflects intraoperative embolic events or hypoperfusion, has also been reported as a major determinant of early mortality after cardiac surgery [16]. In the second model, patients with a preoperative predicted 30-day mortality exceeding 8% and those who developed acute kidney injury requiring dialysis postoperatively had markedly higher mortality risk. This finding is consistent with previous research showing that acute kidney injury remains one of the strongest predictors of early postoperative death and prolonged hospital stay following cardiac surgery[17,18].

The overall findings of this study highlight the challenges of providing complex cardiac surgery in regional hospitals. Limited case volume, lack of specialized postoperative care units, and restricted access to advanced monitoring may all contribute to poorer outcomes compared with tertiary centers. However, the successful implementation of open heart surgery programmes in regional settings remains essential for equitable access to cardiac care across Thailand. Strengthening perioperative management, improving infection control practices, and establishing dedicated cardiac postoperative monitoring units could help reduce complications and mortality in these hospitals.

This study has several limitations. The retrospective single-center design and relatively small sample size limit the generalizability of the findings. The study also focused on short-term outcomes, and long-term mortality or morbidity data were not available. Nevertheless, this study provides valuable preliminary evidence from a real-world regional hospital context and highlights key factors that may guide risk stratification and quality improvement efforts in similar healthcare settings. Future multicenter prospective studies with larger sample sizes are warranted to validate these findings and to develop context-appropriate strategies for improving cardiac surgical outcomes in regional hospitals.

Conclusions

The 30-day mortality rate after open heart surgery in this regional hospital was 5.7%, higher than national averages. The most frequent complications were arrhythmia, pulmonary or bloodstream infection, and renal failure requiring dialysis. Advanced age, reduced left ventricular ejection fraction, and severe postoperative events, particularly stroke and kidney injury, were significant predictors of early mortality. Strengthening perioperative care and postoperative monitoring may help reduce these adverse outcomes and improve surgical safety in regional hospitals.

Acknowledgements

The author would like to express sincere gratitude to Associate Professor Phoomjai Sornsenee, Depart-

ment of Family Medicine, Faculty of Medicine, Prince of Songkla University, for his valuable guidance and assistance with statistical analysis. Appreciation is also extended to the surgical and nursing teams at Trang Hospital for their cooperation and support throughout the study.

References

1. Sakornpant P, Kojaranjit V. Practice of adult cardiac surgery in Thailand: measuring performance and outcome. Bangkok: Soc Thorac Surg Thailand; 2011.
2. Arayawudhikul N, Cheewinmethasiri J, Chartirungsun A, Sripisuttrakoon B. Open heart surgery: the first three years' experience at Lampang Hospital. Thai J Surg 2013;34:60-5.
3. Nashef SA, Roques F, Sharples LD, Nilsson J, Smith C, Goldstone AR, et al. EuroSCORE II. Eur J Cardiothorac Surg 2012;41(4):734-44.
4. Bowdish ME, D'Agostino RS, Thourani VH, Schwann TA, Krohn C, Desai N, et al. STS Adult Cardiac Surgery Database: 2021 update on outcomes, quality, and research. Ann Thorac Surg 2021;111(6):1770-80.
5. STS Research and Analytic Center. STS short-term/operative risk calculator [Internet]. 2024 [cited 2024 Oct 1]. Available from: https://acsdriskcalc.research.sts.org/
6. Luehr M, Merkle-Storms J, Gerfer S, Li Y, Krasivskyi I, Vehrenberg J, et al. Evaluation of the GERAADA score for prediction of 30-day mortality in patients with acute type A aortic dissection. Eur J Cardiothorac Surg 2021;59(5):1109-14.
7. Moon MR, Henn MC, Maniar HS, Pasque MK, Melby SJ, Kachroo P, et al. Impact of surgical experience on operative mortality after reoperative cardiac surgery. Ann Thorac Surg 2020;110(6):1909-16.
8. Naito S, Demal TJ, Sill B, Reichenspurner H, Onorati F, Gatti G, et al. Impact of surgeon experience and centre volume on outcome after off-pump coronary artery bypass surgery: results from the European Multicenter Study on Coronary Artery Bypass Grafting (E-CABG) Registry. Heart Lung Circ 2023;32(3):387-94.
9. El-Chami MF, Sawaya FJ, Kilgo P, Stein WT, Halkos M, Thourani V, et al. Ventricular arrhythmia after cardiac surgery: incidence, predictors, and outcomes. J Am Coll Cardiol 2012;60(25):2664-71.
10. Peretto G, Durante A, Limite LR, Cianflone D. Postoperative arrhythmias after cardiac surgery: incidence, risk factors, and therapeutic management. Cardiol Res Pract 2014;2014:1-15.
11. Jones C, Taylor M, Sperrin M, Grant SW. A systematic review of cardiac surgery clinical prediction models that include intra-operative variables. Perfusion 2024;39(6):1-9.
12. Lamarche Y, Elmi-Sarabi M, Ding L, Abel JG, Sirounis D, Denault AY. A score to estimate 30-day mortality after intensive care admission after cardiac surgery. J Thorac Cardiovasc Surg 2017;153(5):1118-25.e4.
13. Zamperoni A, Carrara G, Greco M, Rossi C, Garbero E, Nattino G, et al. Benchmark of intraoperative activity in cardiac surgery: a comparison between pre- and post-operative prognostic models. J Clin Med 2022;11(11):3231.
14. Durant TJS, Jean RA, Huang C, Coppi A, Schulz WL, Geirsson A, et al. Evaluation of a risk stratification model using preoperative and intraoperative data for major morbidity or mortality after cardiac surgical treatment. JAMA Netw Open 2020;3(12):e2028361.
15. Mori M, Durant TJS, Huang C, Mortazavi BJ, Coppi A, Jean RA, et al. Toward dynamic risk prediction of outcomes after coronary artery bypass graft: improving risk prediction with intraoperative events using gradient

boosting. Circ Cardiovasc Qual Outcomes 2021;14(6):e007363.

16. Matthews CR, Hartman T, Madison M, Villelli NW, Namburi N, Colgate CL, et al. Preoperative stroke before cardiac surgery does not increase risk of postoperative stroke. Sci Rep 2021;11(1):9025.
17. Stoica SC, Sharples LD, Ahmed I, Roques F, Large SR, Nashef SA. Preoperative risk prediction and intraoperative events in cardiac surgery. Eur J Cardiothorac Surg 2002;21(1):41-6.
18. Vives M, Hernandez A, Parramon F, Estanyol N, Pardina B, Munoz A, et al. Acute kidney injury after cardiac surgery: prevalence, impact and management challenges. Int J Nephrol Renovasc Dis 2019;12:153-66.

ปัจจัยเสี่ยงที่ส่งผลต่ออัตราการเสียชีวิตระยะสั้นและภาวะแทรกซ้อนหลังการผ่าตัดหัวใจแบบเปิดในโรงพยาบาลระดับภูมิภาค

เปรม มงคลเคหา พ.บ.

หน่วยศัลยกรรมหัวใจและทรวงอก กลุ่มงานศัลยกรรม โรงพยาบาลตรัง

วารสารวิชาการสาธารณสุข 2569;35(1):156-63.

ติดต่อผู้เขียน: เปรม มงคลเคหา Email: photo_redarmy@hotmail.com

บทคัดย่อ: การศึกษานี้มีวัตถุประสงค์เพื่อศึกษาอัตราการเสียชีวิตภายใน 30 วัน ภาวะแทรกซ้อนหลังผ่าตัด และปัจจัยที่สัมพันธ์กับการเสียชีวิตระยะสั้นในผู้ป่วยที่เข้ารับการผ่าตัดหัวใจแบบเปิดในโรงพยาบาลระดับภูมิภาค โดยเป็นการศึกษาแบบย้อนหลังในผู้ป่วย 106 ราย ที่เข้ารับการผ่าตัดหัวใจแบบเปิด ณ โรงพยาบาลตรัง ระหว่างเดือนกรกฎาคม พ.ศ. 2565 ถึงเดือนมิถุนายน พ.ศ. 2567 โดยมีตัวชี้วัดหลักคืออัตราการเสียชีวิตภายใน 30 วันหลังผ่าตัด ส่วนตัวชี้วัดรอง ได้แก่ ภาวะแทรกซ้อนหลังผ่าตัดและปัจจัยเสี่ยงที่เกี่ยวข้อง โดยใช้การวิเคราะห์ถดถอยโลจิสติกเพื่อระบุปัจจัยพยากรณ์การเสียชีวิต ซึ่งผลการศึกษาพบว่ามีผู้ป่วยที่เสียชีวิตภายใน 30 วันหลังผ่าตัดจำนวน 6 ราย คิดเป็นร้อยละ 5.7 ส่วนภาวะแทรกซ้อนที่พบบ่อย ได้แก่ ภาวะหัวใจเต้นผิดจังหวะ ร้อยละ 21.7 การติดเชื้อในปอดหรือกระแสเลือด ร้อยละ 12.3 ภาวะไตวายที่ต้องล้างไต ร้อยละ 4.7 โรคหลอดเลือดสมอง ร้อยละ 2.8 การผ่าตัดซ้ำ ร้อยละ 2.8 และการติดเชื้อแบบลึกที่แผลหน้าอก ร้อยละ 0.9 โดยปัจจัยก่อนผ่าตัดที่มีความสัมพันธ์กับการเสียชีวิต ได้แก่ อายุที่มากขึ้นและการบีบตัวของหัวใจห้องล่างซ้ายที่ต่ำลง ส่วนปัจจัยหลังผ่าตัดที่สัมพันธ์กับการเสียชีวิต ได้แก่ ภาวะโรคหลอดเลือดสมองและภาวะไตวายที่ต้องล้างไต นอกจากนี้ผู้ป่วยที่มีค่าความเสี่ยงการเสียชีวิตมากกว่าร้อยละ 8 ตามแบบจำลองต่าง ๆ จะมีความเสี่ยงต่อการเสียชีวิตสูงขึ้นอย่างมีนัยสำคัญ ดังนั้นจึงสรุปได้ว่า อัตราการเสียชีวิตภายใน 30 วันหลังการผ่าตัดหัวใจแบบเปิดในโรงพยาบาลระดับภูมิภาคยังคงสูงกว่าค่ามาตรฐานระดับประเทศ โดยปัจจัยสำคัญที่เกี่ยวข้องได้แก่ อายุที่มากขึ้น การทำงานของหัวใจที่ลดลง และภาวะแทรกซ้อนรุนแรงหลังผ่าตัด โดยเฉพาะโรคหลอดเลือดสมองและภาวะไตวายที่ต้องล้างไต ทั้งนี้ การพัฒนาแนวทางการดูแลผู้ป่วยระหว่างการผ่าตัด การประเมินความเสี่ยงก่อนผ่าตัดอย่างเหมาะสม และการติดตามเฝ้าระวังหลังผ่าตัดอย่างใกล้ชิด เป็นแนวทางสำคัญในการลดอัตราการเสียชีวิตในโรงพยาบาลระดับภูมิภาค

คำสำคัญ: **ภาวะแทรกซ้อนจากการผ่าตัด; การเสียชีวิต; การผ่าตัดหัวใจแบบเปิด; โรงพยาบาลระดับภูมิภาค**