

Original article

Clinical outcomes between transradial and transfemoral primary percutaneous coronary intervention in patients with ST-segment elevation myocardial infarction in Chonburi Hospital

Artit Torpongpun^{ID*}, Pornchai Ngamjanyaporn^{ID}, Woravit Tantisiriwat^{ID}, Chanadda Rutnuntamongkon^{ID}, Gahn Nakornchai^{ID}, Paramaporn Suttirut^{ID}

Department of Internal Medicine, Chonburi Hospital, Chonburi, Thailand

Abstract

Background: Recent global data have shown that transradial primary percutaneous coronary intervention (PCI) in patients with ST-elevation myocardial infarction (STEMI) yields better procedural outcomes than transfemoral PCI.

Objective: This study compared clinical outcomes between the transradial approach (TRA) and the transfemoral approach (TFA) in primary PCI for patients with STEMI at Chonburi Hospital.

Methods: This retrospective study enrolled 913 patients with STEMI who underwent primary PCI at Chonburi Hospital between October 1, 2016, and September 30, 2023. Clinical data were extracted from medical records and the hospital's STEMI registry.

Results: Of the 913 patients with STEMI, 532 underwent TRA and 381 underwent TFA. The TRA group was significantly younger (58.3 ± 12.2 vs. 64.0 ± 14.0 years) and predominantly male (81.2% vs. 68.5%). The TFA group had a higher rate of diabetes (35.7% vs. 27.6%), cardiac arrest (19.7% vs. 11.1%), and Killip class IV (24.2% vs. 9.7%). The mean left ventricular ejection fraction was higher in the TRA group (50.3% vs. 47.1%), while infarct locations (anterior/inferior) were similar. TRA was associated with significantly better outcomes than TFA, including lower all-cause mortality (2.1% vs. 12.9%), major bleeding (0.4% vs. 1.6%), hemorrhagic stroke (0.0% vs. 0.8%), and shorter mean length of stay (3.0 vs. 4.1 days). Multivariate regression analysis identified Killip class (odds ratio (OR) 3.15; 95% confidence interval (CI) 2.21–4.49), cardiac arrest (OR 2.65; 95% CI 1.18–5.95), and age (OR 1.05; 95% CI 1.02–1.09) as predictors of mortality, while the TRA was independently associated with reduced mortality (OR 0.37; 95% CI 0.12–0.93).

Conclusion: In this study, the TRA was associated with significantly reduced all-cause mortality, major bleeding events, and hospital length of stay compared to the TFA, thereby confirming its benefit in patients with STEMI undergoing primary PCI.

Keywords: Primary percutaneous coronary intervention and ST-segment elevation myocardial infarction, transfemoral, transradial.

Acute coronary syndrome (ACS), especially ST-segment elevation myocardial infarction (STEMI), is a major health problem and a leading cause of death worldwide.⁽¹⁾ Although the death rate from STEMI in Thailand has decreased substantially over the last 20 years, it remains the third leading cause of death in

the country.⁽²⁾ This demonstrates that we urgently need to improve treatment strategies to enhance (or optimize) patient outcomes and survival rates.

The main goal of STEMI treatment is to restore blood flow to the heart quickly. Current guidelines strongly recommend primary percutaneous coronary intervention (PCI) rather than thrombolytic therapy.⁽³⁾

⁴⁾ This is because PCI is more effective at reducing death, preventing recurrent ischemia, and lowering the risk of serious complications such as intracranial hemorrhage.⁽⁵⁾ Furthermore, primary PCI results in shorter hospital stays and lower costs than fibrinolysis.⁽⁶⁾

*Correspondence to: Artit Torpongpun, Department of Internal Medicine, Chonburi Hospital, Chonburi 20000, Thailand.

E-mail: t.artit@hotmail.com

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With PCI established as the gold standard, the focus has shifted toward making the procedure safer, especially regarding the arterial access site. In the past, the femoral approach (TFA) was the standard choice because the vessel is larger and easier to use with equipment. However, the access site has a higher risk of bleeding. In contrast, the radial approach (TRA) is a safer alternative. Many studies, including meta-analyses and randomized trials, have shown that TRA substantially reduces major bleeding and, in some studies, reduces death compared to TFA.^(7, 8) Based on this evidence, specifically findings regarding reduced major bleeding and access-site complications,⁽⁹⁾ major guidelines, such as those by the European Society of Cardiology, have elevated TRA to a Class I recommendation.⁽¹⁰⁾

Beyond safety, TRA offers benefits for high-risk patients, including the elderly and those with notable comorbidities.⁽¹¹⁻¹³⁾ In addition, it allows patients to move around sooner and stay in the hospital for a shorter time, which reduces costs and the risks associated with hospitalization. However, choosing the access site depends on many factors, such as the patient's condition and the doctor's experience.^(14, 15)

Chonburi Hospital is a tertiary care center in Eastern Thailand that manages a high volume of patients with STEMI and utilizes TRA and TFA techniques. While global data favors TRA, validating these findings within the local context is essential. Therefore, this study aims to retrospectively compare the clinical outcomes of TRA vs. TFA for PCI in patients with STEMI at Chonburi Hospital. The objective is to provide local evidence to determine the most effective and safe approach, ultimately guiding clinical decision-making and improving patient care standards in the region.

Materials and methods

Study design and population

This descriptive retrospective study was conducted on patients diagnosed with STEMI who received primary PCI at Chonburi Hospital from October 1, 2016, to September 30, 2023. All data were collected from the Chonburi Hospital computer database, STEMI registry, cardiac catheterization room records, and inpatient medical records.

Patients eligible for the study were selected based on the following inclusion criteria: all patients with STEMI who were treated with primary PCI via the transradial or femoral arteries at Chonburi Hospital during the study period. The exclusion criteria

included patients with cardiogenic shock requiring intra-aortic balloon pump (IABP) insertion. This study was reviewed and approved by the hospital's ethics committee/internal review board (Chonburi Hospital Research Center).

Study outcomes assessment

The primary outcome of this study was to determine in-hospital mortality. The secondary outcomes included a comparison of major bleeding events, ischemic or hemorrhagic stroke events, vascular site hematoma, length of stay, procedure time, and radiation exposure between TRA and TFA.

Statistical analysis

Descriptive statistics were used to summarize the patient demographics, clinical characteristics, and outcomes. Data were presented as the mean $\pm$ standard deviation (SD) for continuous data and as numbers and percentages for categorical data. Two-sample *t*-tests were used to compare the mean outcomes between TRA and TFA. The chi-square test was used to assess differences in the categorical data between the two groups. Univariate regression analysis was initially performed to identify the potential predictors of mortality. Variables yielding a *P*-value < 0.10 in the univariate analysis were subsequently included in the multivariate logistic regression model to address the confounding factors. The results are presented as odds ratios (OR) with 95% confidence intervals (CI). The primary analyses were performed using SPSS software, version 29.0.1.0 (IBM), with statistical significance set at a two-sided *P* < 0.05 .

The required sample size was estimated using a two-sample proportions test with Pearson's chi-squared test. Based on findings from the RIFLE-STEACS study⁽⁹⁾, in which mortality in the TRA group was 5.2% compared with 9.2% in the TFA group, this study was designed to provide 80.0% statistical power. We estimated that 326 patients would need to be enrolled in each group to achieve this.

Results

Baseline clinical characteristics

A total of 1,645 patients diagnosed with STEMI were admitted to Chonburi Hospital between October 1, 2016, and September 30, 2023, and received either primary PCI or fibrinolysis. Coronary intervention was performed on 1,405 of these patients, with 947 patients (85.4%) undergoing primary PCI (**Figure 1**).

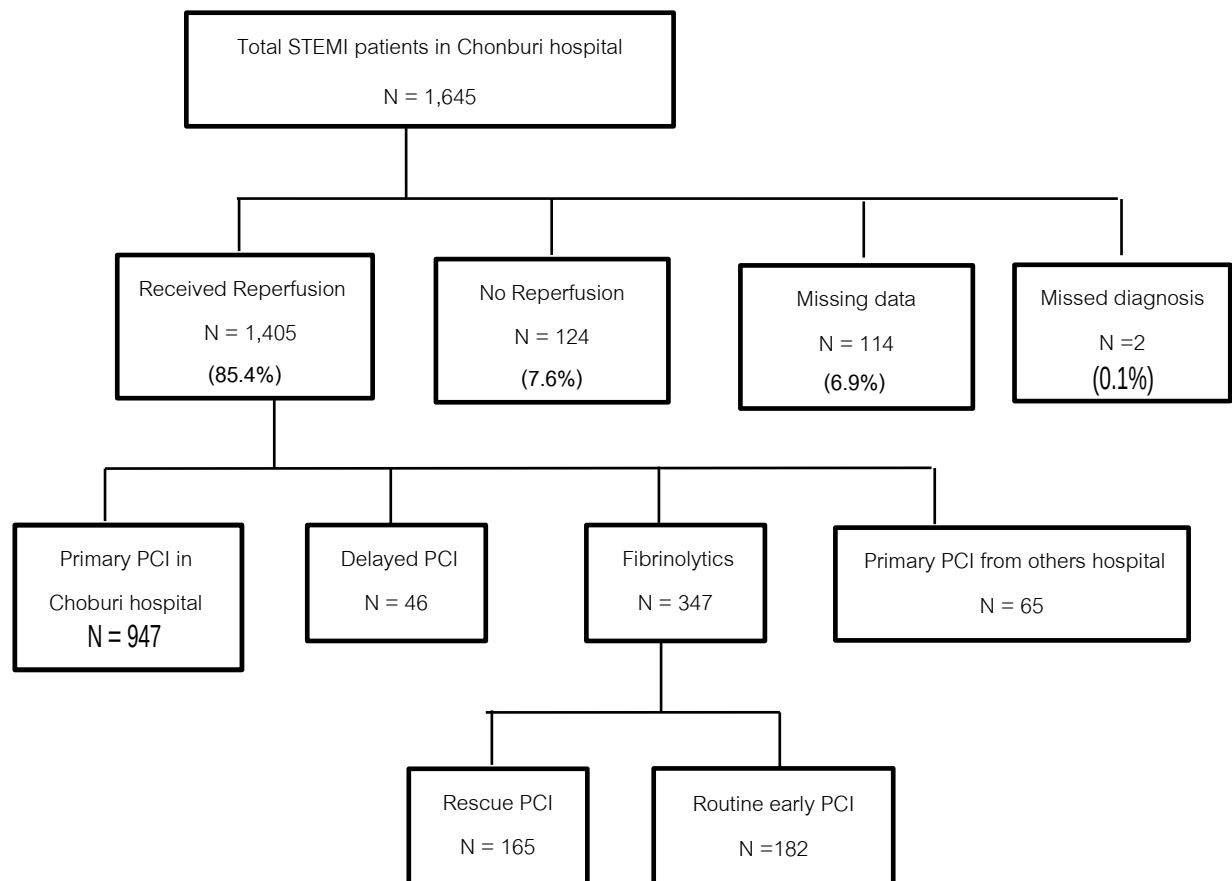


Figure 1. All STEMI patients were received treatment in Chonburi Hospital from 1st October 2016 – 30th September 2023.

Of the initial group of 974 patients, 36 had undergone IABP implantation. Consequently, 913 patients were included in the data analysis. Among them, 532 patients (58.3%) underwent primary PCI via the TRA, and 381 patients (41.7%) via the TFA. Baseline clinical data were compared between the TRA and TFA groups. Most patients were male (81.2% in the TRA group and 68.5% in the TFA group, $P < 0.001$). The mean age was 58.3 ± 12.2 years for the TRA group and 64.0 ± 14.0 years for the TFA group ($P < 0.001$). The mean body weight was 68.0 ± 13.5 kg for the TRA group and 63.2 ± 13.6 kg for the TFA group ($P < 0.001$). Medical histories revealed diabetes in 27.6% and 35.7% ($P = 0.006$), hypertension in 38.5% and 43.8% ($P = 0.077$), hypercholesterolemia in 18.0% and 26.5% ($P = 0.006$), and smoking in 49.4% and 42.5% ($P = 0.006$) of patients in the TRA and TFA groups, respectively. Cardiac arrest occurred in 59 patients (11.1%) in the TRA group and 75 patients (19.7%) in the TFA group ($P = 0.001$).

The severity of acute myocardial infarction, as indicated by Killip class, revealed Killip class III in 1.5% and 4.8%, and Killip class IV in 9.7% and 24.2% in the TRA and TFA groups, respectively ($P < 0.001$). The mean systolic blood pressure was 135.5 ± 25.7 mmHg and 125.8 ± 30.5 mmHg ($P < 0.001$), and the mean heart rate was 80.3 ± 17.5 beats/min and 84.3

± 24.6 beats/min ($P = 0.005$), in the TRA and TFA groups, respectively. The mean low-density lipoprotein cholesterol levels were 125.1 ± 70.9 mg/dL in the TRA group and 113.6 ± 43.5 mg/dL in the TFA group ($P = 0.007$). Left ventricular systolic function, measured by the left ventricular ejection fraction (LVEF), was $50.3 \pm 10.7\%$ in the TRA group and $47.1\% \pm 11.8\%$ in the TFA group ($P < 0.001$). STEMI was diagnosed as anterior wall in 51.4% and 49.9% of patients and inferior wall in 45.7% and 47.7% of patients in the TRA and TFA groups, respectively ($P = 0.883$). All baseline clinical characteristics are presented in **Table 1**.

Medication use in the first 24 h of hospital admission was not significantly different between the TRA and TFA groups for clopidogrel (77.0% vs. 81.3%) and ticagrelor (22.0% vs. 16.8%). However, there were differences in the use of certain medications between the TRA and TFA groups: IIb/IIIa inhibitors (3.4% vs. 6.6%, $P = 0.027$), heparin (4.5% vs. 8.7%, $P = 0.012$), statins (97.7% vs. 93.4%, $P = 0.002$), ACEI/ARB (55.1% vs. 45.9%, $P < 0.001$), beta-blockers (50.9% vs. 43.8%, $P < 0.001$), and proton pump inhibitors (64.3% vs. 74.5%, $P < 0.001$), respectively. All medication use details are presented in **Table 2**.

Table 1. Baseline clinical and laboratory characteristics of STEMI patients receiving primary PCI via radial and femoral approach.

Clinical and laboratory characteristics	Total N = 913	Radial group N = 532	Femoral group N = 381	P-value
Demographic data				
Age (year), mean ($\pm$ SD)	60.7 $\pm$ 3.2	58.3 $\pm$ 12.2	64.0 $\pm$ 14.0	<0.001
Male, n (%)	693 (75.9%)	432 (81.2%)	261 (68.5%)	<0.001
Weight (kg.), mean ($\pm$ SD)	66.0 $\pm$ 13.3)	68.0 $\pm$ 13.5	63.2 $\pm$ 13.6	<0.001
Referral status				
Chonburi Hospital, n (%)	198 (21.7%)	119 (22.4%)	79 (20.7%)	0.334
Other hospitals, n (%)	715 (78.3%)	413 (77.6%)	302 (79.3%)	
Medical condition				
DM, n (%)	283 (31.0%)	147 (27.6%)	136 (35.7%)	0.006
Hypertension, n (%)	372 (40.7%)	205 (38.5%)	167 (43.8%)	0.077
Dyslipidemia, n (%)	197 (21.6%)	96 (18.0%)	101 (26.5%)	0.006
Smoking				0.004
Current, n (%)	425 (46.5%)	263 (49.4%)	162 (42.5%)	0.075
Ex-smoking, n (%)	173 (18.9%)	108 (20.3%)	65 (17.1%)	
Prior PCI, n (%)	69 (7.6%)	35 (6.6%)	34 (8.9%)	
Prior CABG, n (%)	25 (2.7%)	13 (2.4%)	12 (3.1%)	0.167
Presentation				
Diagnosis				
STEMI anterior wall, n (%)	458 (50.8%)	271 (51.4%)	187 (49.9%)	0.001
STEMI inferior wall, n (%)	420 (46.6%)	241 (45.7%)	179 (47.7%)	
Other wall, n (%)	24 (2.6%)	15 (2.8%)	9 (2.4%)	
Cardiac arrest, n (%)	134 (14.7%)	59 (11.1%)	75 (19.7%)	<0.001
Killip classification				
Class I , n (%)	653 (72.3%)	421 (79.7%)	231 (61.6%)	0.883
Class II, n (%)	82 (9.1%)	48 (9.1%)	34 (9.1%)	
Class III, n (%)	26 (2.9%)	8 (1.5%)	18 (4.8%)	
Class IV, n (%)	142/903 (15.2%)	51/528 (9.7%)	91/375 (24.2%)	
Vital signs				
SBP (mmHg), mean ($\pm$ SD)	131.5 (28.2)	135.5 (25.7)	125.8 (30.5)	<0.001
HR (beat/minute), mean ($\pm$ SD)	81.9 (20.8)	80.3 (17.5)	84.3 (24.6)	0.005
Laboratory findings				
Total cholesterol (mg/d), mean ($\pm$ SD)	195.1 (51.0)	200.8 (50.9)	186.6 (50.1)	<0.001
Low-density lipoprotein (mg/d), mean ($\pm$ SD)	120.5 (61.5)	125.1 (70.9)	113.6 (43.5)	0.007
High-density lipoprotein (mg/d), mean ($\pm$ SD)	44.0 (12.3)	44.2 (11.4)	43.8 (13.6)	0.706
Echocardiogram				
LVEF (%), mean ($\pm$ SD)	49.0 (11.3)	50.3 (10.7)	47.1 (11.8)	<0.001

CABG, coronary artery bypass grafting; DM, diabetic mellitus; HR, heart rate; LVEF, left ventricular ejection fraction; PCI, percutaneous coronary intervention; SBP, systolic blood pressure; SD, standard deviation; STEMI, ST-elevation myocardial infarction.

Table 2. Medication use in the first 24 hours after admission and at discharge between radial and femoral groups.

Medications	Total N = 913	Radial group N = 532	Femoral group N = 381	P-value
At 1st 24 hr admission				
ASA, n (%)	912 (99.9%)	531 (99.8%)	381 (100%)	1.00
Clopidogrel, n (%)	721 (79.1%)	409 (77.0%)	312 (81.9%)	0.083
Ticagrelor, n (%)	181 (19.8%)	117 (22.0%)	64 (16.8%)	0.053
IIb/IIIa inhibitor, n (%)	43 (4.7%)	18 (3.4%)	25 (6.6%)	0.027
Heparin/LMWH, n (%)	57 (6.3%)	24 (4.5%)	33 (8.7%)	0.012
Statin, n (%)	876 (95.9%)	520 (97.7%)	356 (93.4%)	0.002
ACEI/ARB, n (%)	468 (51.3%)	293 (55.1%)	175 (45.9%)	<0.001
Beta blocker, n (%)	438 (48.0%)	271 (50.9%)	167 (43.8%)	<0.001
PPI, n (%)	626 (68.6%)	342 (64.3%)	284 (74.5%)	<0.001
At discharge				
ASA, n (%)	838 (98.1%)	512 (98.3%)	326 (97.9%)	0.673
Clopidogrel, n (%)	662 (77.5%)	396 (76.0%)	266 (79.9%)	0.208
Ticagrelor, n (%)	171 (20.0%)	114 (21.9%)	57 (17.2%)	0.096
Warfarin, n (%)	15 (1.9%)	10 (2.0%)	5 (1.6%)	0.794
Statin, n (%)	781 (96.5%)	486 (97.0%)	295 (95.5%)	0.330
ACEI/ARB, n (%)	590 (72.8%)	371 (74.1%)	219 (70.9%)	<0.001
Beta blocker, n (%)	591 (73.0%)	366 (73.1%)	225 (72.8%)	0.025
PPI, n (%)	540 (66.7%)	317 (63.3%)	223 (72.2%)	0.009

ACEI, angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker; ASA, aspirin; PPI, proton pump inhibitor.

Table 3. Patient outcomes between radial and femoral groups

Outcomes	Total N = 913	Radial group N = 532	Femoral group N = 381	P-value
Inhospital-all cause mortality, n (%)	60 (6.6%)	11 (2.1%)	49 (12.9%)	<0.001
Major bleeding except hemorrhagic stroke, n (%)	8 (0.9%)	2 (0.4%)	6 (1.6%)	0.019
Hemorrhagic stroke, n (%)	3 (0.3%)	0 (0%)	3 (0.8%)	0.019
Vascular site hematoma, n (%)	2 (0.2%)	0 (0%)	2 (0.5%)	0.174
Ischemic stroke, n (%)	2 (0.2%)	1 (0.2%)	1 (0.3%)	1.00
Length of stay, day(±SD)	3.5 ± 3.1	3.0 ± 2.6	4.1 ± 3.6	<0.001
Payment, baht (±SD)	120,879.6 ± 57,350.3	112,036.5 ± 38,394.5	133,227 ± 74,642.3	<0.001

SD, standard deviation.

Regarding discharge medications, most drug use between the TRA and TFA groups showed no significant differences, except for ACEI/ARB (74.1% vs. 70.9%, $P < 0.001$) and beta-blockers (73.1% vs. 72.8%, $P = 0.025$).

Patient outcomes

There were 11 cases of in-hospital mortality (2.1%) in the TRA group and 49 cases (12.9%) in the TFA group ($P < 0.001$). Major bleeding events, excluding hemorrhagic stroke, occurred in two cases (0.4%) in the TRA group and six cases (1.6%) in the TFA group ($P = 0.019$). There were no cases of hemorrhagic stroke (0.0%) in the TRA group and three cases (0.8%) in the TFA group ($P = 0.019$). The mean length of hospital stay was 3.0 ± 2.6 days for the TRA group and 4.1 ± 3.6 days for the TFA group ($P < 0.001$), and the mean hospital cost was $112,394.5 \pm 38,394$ and

$133,227.0 \pm 74,642.3$ baht, respectively ($P < 0.001$). No significant difference was found in the occurrence of vascular site hematoma (0 in the TRA group vs. 2 in the TFA group) or ischemic stroke (one case in each group). All outcomes are presented in **Table 3**.

When comparing other outcomes between the TRA and TFA groups, there was no significant difference in the time from catheter lab to wire crossing the lesion (35.6 ± 21.9 and 37.3 ± 18.9 min, $P = 0.224$), radiation dose (853.8 ± 778.2 and 832.4 ± 789.7 , $P = 0.683$), or dual antiplatelet therapy duration ($1,009.5 \pm 3,382.5$ and 832.4 ± 789.7 , $P = 0.540$), respectively. However, there were differences in the time from diagnosis to wire crossing the lesion (101.8 ± 44.8 vs. 112.4 ± 58.1 min, $P = 0.002$), procedure time in the catheter lab (29.3 ± 13.5 vs. 33.9 ± 18.2 min, $P < 0.001$), and fluoroscopy time (9.5 ± 6.2 vs. 11.8 ± 14.7 min, $P = 0.001$) between the TRA and

Table 4. Other outcomes between radial and femoral groups.

Outcomes	Total N = 913	Radial group N = 532	Femoral group N = 381	P-value
Time from cathlab to wire crossing lesion, minute ($\pm$ SD)	36.3 $\pm$ 20.7	35.6 $\pm$ 21.9	37.3 $\pm$ 18.9	0.224
Time from diagnosis to wire crossing lesion, minute ($\pm$ SD)	106.2 $\pm$ 50.9	101.8 $\pm$ 44.8	112.4 $\pm$ 58.1	0.002
Procedure time, minute ($\pm$ SD)	31.2 $\pm$ 15.8	29.3 $\pm$ 13.5	33.9 $\pm$ 18.2	<0.001
Flu time, minute ($\pm$ SD)	10.4 $\pm$ 10.7	9.5 $\pm$ 6.2	11.8 $\pm$ 14.7	0.001
Radiation dose, mSV ($\pm$ SD)	844.9 $\pm$ 782.7	853.8 $\pm$ 778.2	832.4 $\pm$ 789.7	0.683
Dose area product, Gy.cm ² ($\pm$ SD)	921.9 $\pm$ 3219.3	1009.5 $\pm$ 3382.5	815.8 $\pm$ 3015.3	0.540

DAP, dose area product; Gy.cm², gray-centimeter squared; SD, standard deviation.

Table 5. Results of univariate analysis of factors affecting in-hospital mortality in STEMI patients.

Clinical characteristics	Odds ratio	95% CI		P-value
Male	1.92	1.11	3.32	0.020
Age	1.03	1.01	1.05	0.003
DM	1.13	0.76	1.71	0.539
Diagnosis	1.21	0.77	1.89	0.397
Cardiac arrest	2.93	1.92	4.48	<0.001
Killip class	4.02	3.02	5.35	<0.001
Systolic BP	0.99	0.98	1.00	0.167
Radial approach	0.14	0.07	0.28	<0.001
LVEF	0.97	0.94	0.99	0.032
Major bleeding	1.81	0.53	6.17	0.345
Stroke event	14.44	0.89	233.78	0.060

BP, blood pressure; CI, confidence interval; DM, diabetic mellitus; LVEF, left ventricular ejection fraction; SBP, systolic blood pressure.

Table 6. Results of multivariate analysis of factors affecting in-hospital mortality in STEMI patients.

Clinical characteristics	Adjusted odds ratio	95% CI		P-value
Killip class	3.15	2.21	4.49	<0.001
Age	1.05	1.02	1.09	0.003
Cardiac arrest	2.65	1.18	5.95	0.018
Radial approach	0.37	0.12	0.93	0.036

TFA groups, respectively. Other outcomes are presented in **Table 4**.

Using univariate analysis revealed that male sex (OR 1.92; 95% CI 1.11–3.32), age (OR 1.03; 95% CI 1.01–1.05), cardiac arrest (OR 2.93; 95% CI 1.92–4.48), Killip class (OR 4.02; 95% CI 3.02–5.35), radial access (OR 0.14; 95% CI 0.07–0.28), and LVEF (OR 0.97; 95% CI 0.94–0.99) were significant (**Table 5**).

However, when analyzed using multivariate analysis, the factors that significantly affected in-hospital mortality in patients with STEMI were Killip class (OR 3.15; 95% CI 2.21–4.49; $P < 0.001$), cardiac arrest (OR 2.65; 95% CI 1.18–5.95; $P = 0.018$), age (OR 1.05; 95% CI 1.02–1.09; $P = 0.003$), and TRA (OR 0.37; 95% CI 0.12–0.93; $P = 0.036$) (**Table 6**).

Discussion

This retrospective study conducted at Chonburi Hospital demonstrates the superior clinical utility of the TRA for primary PCI in patients with STEMI. Our analysis indicates that the TRA is associated with a significant reduction in in-hospital mortality and major bleeding complications compared to the TFA. Furthermore, patients treated via the radial route experienced shorter hospital stays and incurred lower treatment costs, thus highlighting the safety and economic efficiency of this technique in a real-world clinical setting.

The survival benefit observed in our cohort aligns strongly with the landmark RIFLE-STEACS trial,⁽⁹⁾ which established that radial access reduces mortality in patients with STEMI. Similarly, our findings of

reduced major bleeding events and absence of hemorrhagic strokes in the TRA group corroborate the results from large-scale meta-analyses, including the RIVAL trial.⁽⁸⁾ This consistency reinforces the established evidence that minimizing access-site bleeding is a critical mechanism by which the TRA improves overall survival, as bleeding complications are strongly associated with adverse outcomes in patients with ACS.⁽¹⁰⁾

An important observation in this study was the difference in baseline characteristics between the two groups. Patients in the TFA group had more severe conditions, such as older age, higher rates of cardiac arrest, and severe heart failure (Killip class IV). This reflects common practice, in which doctors often choose TFA for patients who are hemodynamically unstable. However, multivariate analysis confirmed that the TRA remained an independent predictor of survival, even after adjusting for these confounding factors. This suggests that the lower mortality rate was not solely due to patient selection but also reflects the safety benefits of the TRA technique itself.

When comparing exclusion criteria, this study excluded patients with STEMI and cardiogenic shock who received IABP implantation, whereas the RIFLE-STEACS study included patients with cardiogenic shock requiring inotropic drugs.⁽⁹⁾ This study had a more severe population of patients with STEMI than the RIFLE-STEACS study, with 15.2% presenting with Killip class IV compared to 6.1%, which resulted in a higher mortality rate in this study. However, the trend suggests that the TRA could be a safer alternative, especially for patients with a higher Killip class and those experiencing cardiac arrest.

Beyond clinical outcomes, our study highlights the operational benefits of the TRA. The significantly shorter duration of hospital stay observed in the TRA group supports the findings from the OCEAN RACE trial,⁽¹⁶⁾ which linked radial access to earlier patient mobilization and improved quality of life.⁽¹⁴⁾ In our setting, this efficiency translated into reduced hospital costs without compromising the procedural quality. Furthermore, despite the technical demands of radial access, there were no significant delays in procedural times or increases in radiation exposure compared with the femoral approach, indicating the high level of operator proficiency at our center.

This retrospective study demonstrated the considerable survival benefit associated with TRA. However, these findings must be interpreted with

caution. Patients in the TFA group had a significantly higher baseline risk profile, including older age, higher prevalence of cardiac arrest, and Killip class IV upon presentation. Therefore, the observed lower mortality in the TRA group may partly reflect selection bias, in which the operators preferentially selected TFA for hemodynamically unstable or critically ill patients due to the need for rapid vascular access or larger-bore catheters. Although multivariate analysis was performed to adjust for these confounders, residual confounding affecting the outcomes cannot be entirely ruled out. Access site hematoma may have also been underreported due to the study's retrospective design. In addition, as this was a single-center study, generalizability may be limited. The success and safety of radial access depend heavily on the operator's experience and the hospital's procedure volume. Studies show that high-volume centers with trained personnel achieve better outcomes with radial access; however, this study could not analyze how operator experience at Chonburi Hospital influenced patient outcomes. While this study focused on short-term in-hospital outcomes, long-term follow-up is essential to assess the enduring benefits of TRA vs. TFA with respect to mortality, rehospitalization, and quality of life. Studies such as the OCEAN RACE trial⁽¹⁶⁾ emphasize the importance of monitoring patients' recovery and long-term cardiovascular health.

Expanding this research to a multicenter, prospective cohort study would provide robust data on the comparative effectiveness of TRA vs. TFA. Moreover, including a larger, diverse patient sample across different hospital settings would validate these findings and facilitate evidence-based guidelines applicable to broader clinical contexts.

Conclusion

This study validates the global shift toward TRA within the specific context of Chonburi Hospital. The TRA offers a robust advantage in reducing mortality and major bleeding while optimizing hospital resource utilization. Although the TFA remains necessary for specific high-risk scenarios, our evidence supports the adoption of TRA as the default strategy for primary PCI in patients with STEMI, consistent with current international guidelines^(3, 10) to maximize patient safety and clinical success.

Author contributions

AT contributed substantially to the concept and design of this study, acquiring the data, reviewing the literature, and its analysis and interpretation. All authors contributed substantially to acquiring the data. AT contributed to drafting the manuscript. AT edited the manuscript critically for important intellectual content. All authors approved the final version submitted for publication and take responsibility for statements made in the published article.

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Conflict of interest statement

All authors have completed and submitted the International Committee of Medical Journal Editors Uniform Disclosure Form for Potential Conflicts of Interest. All authors declare that they have no conflicts of interest.

Data sharing statement

All data generated or analyzed in the present study are included in the published article. Further details are available for non-commercial purposes from the corresponding author upon reasonable request.

ORCID

Artit Torpongpun  <http://orcid.org/0009-0009-3290-5756>

Pornchai Ngamjanyaporn  <http://orcid.org/0009-0003-8406-8677>

Woravit Tantisiriwat  <http://orcid.org/0009-0002-0350-0943>

Chanadda Rutnuntamongkon  <http://orcid.org/0000-0003-4830-3839>

Gahn Nakornchai  <http://orcid.org/0009-0004-2930-4611>

Paramaporn Suttirut  <http://orcid.org/0000-0001-7825-1991>

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