

ปัจจัยทำนายการเสียชีวิตในโรงพยาบาลของผู้ป่วยกล้ามเนื้อหัวใจขาดเลือดเฉียบพลันชนิด ST-segment Elevation ที่เข้ารับการรักษาในโรงพยาบาลนาน

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โรงพยาบาลน่าน

รับต้นฉบับ 16 เมษายน 2569
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บทคัดย่อ

ความเป็นมา

ภาวะกล้ามเนื้อหัวใจขาดเลือดเฉียบพลันชนิด ST-segment elevation myocardial infarction (STEMI) เป็นภาวะฉุกเฉินที่มีอัตราการเสียชีวิตสูง โดยเฉพาะในพื้นที่ชนบท การศึกษานี้มีวัตถุประสงค์เพื่อหาปัจจัยทำนายการเสียชีวิตในโรงพยาบาลของผู้ป่วย STEMI ที่เข้ารับการรักษาในโรงพยาบาลนาน

วิธีการศึกษา

การศึกษาแบบย้อนหลังชนิด retrospective cohort ในผู้ป่วย STEMI จำนวน 312 ราย ที่เข้ารับการรักษาระหว่างวันที่ 1 ตุลาคม พ.ศ. 2563 ถึง 30 กันยายน พ.ศ. 2566 เก็บข้อมูลลักษณะพื้นฐาน อาการทางคลินิก และแนวทางการรักษา วิเคราะห์ปัจจัยที่สัมพันธ์กับการเสียชีวิตด้วย multivariable logistic regression

ผลการศึกษา

อัตราการเสียชีวิตในโรงพยาบาลเท่ากับร้อยละ 20.8 การวิเคราะห์หาค่าตัวแปรพบว่า อายุที่เพิ่มขึ้น (adjusted OR 1.04, 95% CI 1.00–1.07, $p=0.031$) การมาถึงโรงพยาบาลล่าช้ามากกว่า 6 ชั่วโมงหลังเริ่ม

มีอาการ (adjusted OR 2.78, 95% CI 1.29–5.97, $p=0.009$) และภาวะช็อกจากหัวใจ (adjusted OR 4.28, 95% CI 1.05–17.49, $p=0.043$) เป็นปัจจัยทำนายอิสระของการเสียชีวิตในโรงพยาบาล ขณะที่ระดับครีเอตินิน ความดันโลหิตซิสโตลิก ภาวะหัวใจหยุดเต้นเมื่อมาถึง ระดับ Killip และการรักษาด้วย Primary PCI ไม่มีความสัมพันธ์อย่างมีนัยสำคัญหลังการปรับปัจจัยกวน

สรุป

อายุที่มากขึ้น การมาถึงโรงพยาบาลล่าช้า และภาวะช็อกจากหัวใจ เป็นปัจจัยทำนายสำคัญของการเสียชีวิตในผู้ป่วย STEMI การลดระยะเวลาก่อนถึงโรงพยาบาลและการวินิจฉัยพร้อมรักษาภาวะช็อกจากหัวใจอย่างรวดเร็ว อาจช่วยลดอัตราการเสียชีวิตได้

คำสำคัญ

STEMI; การเสียชีวิตในโรงพยาบาล; ปัจจัยทำนาย; ภาวะช็อกจากหัวใจ; การมาถึงโรงพยาบาลล่าช้า

Abstract

Predictors of In-Hospital Mortality in Patients with ST-Segment Elevation Myocardial Infarction at Nan Hospital

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Background

ST-segment elevation myocardial infarction (STEMI) remains a major cause of mortality, particularly in rural and resource-limited settings. This study aimed to identify predictors of in-hospital mortality among patients with STEMI admitted to Nan Hospital.

Methods

A retrospective cohort study was conducted among 312 consecutive STEMI patients admitted between October 1, 2020 and September 30, 2023. Baseline characteristics, clinical presentation, and treatment strategies were collected. Independent predictors of in-hospital mortality were identified using multivariable logistic regression analysis.

Results

The in-hospital mortality rate was 20.8%. Multivariable analysis demonstrated that increasing age (adjusted OR 1.04, 95% CI 1.00–1.07; $p=0.031$), delayed presentation to the emergency department >6 hours after symptom onset (adjusted OR 2.78, 95% CI 1.29–5.97; $p=0.009$), and cardiogenic

shock (adjusted OR 4.28, 95% CI 1.05–17.49; $p=0.043$) were independent predictors of in-hospital mortality. Serum creatinine, systolic blood pressure, cardiac arrest at presentation, Killip class III–IV, and primary percutaneous coronary intervention were not independently associated with mortality after adjustment.

Conclusions

Older age, delayed hospital presentation, and cardiogenic shock independently predicted in-hospital mortality among STEMI patients. Strategies aimed at reducing pre-hospital delay and improving the early recognition and management of cardiogenic shock may improve clinical outcomes.

Keywords

ST-segment elevation myocardial infarction; in-hospital mortality; predictors; cardiogenic shock; delayed presentation

Introduction

Acute ST-elevation myocardial infarction (STEMI) is a critical medical emergency and a leading cause of morbidity and mortality worldwide and also in Nan province. Prompt recognition and treatment are crucial for improving outcomes; however, the in-hospital mortality rate remains substantial, even in settings with advanced medical care.(1, 2) In Thailand, cardiovascular diseases, including STEMI, represent a significant public health challenge, contributing heavily to both mortality and healthcare burden. (3, 4) The need for data-driven insights into patient outcomes, particularly in specific regional settings such as Nan province, is critical for tailoring interventions and improving care.

Nan province, located in the northern region of Thailand, presents unique healthcare challenges due to its geographical and socioeconomic characteristics. With a predominantly rural population and limited access to advanced medical facilities, patients with acute STEMI often face delays in diagnosis and treatment. Furthermore, variations in healthcare infrastructure, patient demographics, and disease presentation can significantly influence clinical outcomes. (5, 6) The mortality rate associated with STEMI in Nan can be as high as 28.42%. Despite these challenges, there is limited data on the predictors of in-hospital mortality among STEMI patients. Therefore, this study aims to identify the predictors of in-hospital mortality among patients presenting with acute STEMI at Nan Hospital.

Methods

Study design

This is a cross-sectional retrospective cohort study conducted in Nan hospital. Ethics approval was obtained from April 2025.

Study protocol

Patients presenting with acute STEMI admitted at Nan hospital during a period of 1st October 2020 to 30th September 2023, 312 patients were enrolled.

Inclusion criteria were patients aged 18 and older who met the inclusion criteria for STEMI, according to the fourth Universal Definitions of Myocardial Infarction,(7).

Missing data were assessed for all candidate predictors. Variables with minimal missing data were analyzed using complete-case analysis. Patients with missing outcome data were excluded.

Patients with STEMI were managed using one of three approaches: (a) Medical reperfusion therapy with or without early invasive CAG according to guideline recommendation, (b) Primary coronary intervention (PCI), or (c) Conservative treatment.

Hypotension was defined by systolic blood pressure less than 90 mmHg

Data collection

Baseline characteristics including age, gender, co-morbidities, disease presentation, clinical parameters and treatment strategies were collected. The study outcome was in-hospital mortality.

Statistical analysis

Continuous variables were represented as either means with standard deviations when they followed a normal distribution, or as medians and interquartile ranges when the distribution was not normal.

To compare variations among the distinct groups, the Mann-Whitney U test or the Student t-test was employed. Categorical variables were

displayed as frequencies (%) and their comparison between groups was conducted using Fisher's exact test.

Univariable and multivariable logistic regression analyses were performed to identify predictors of in-hospital all-cause mortality. Candidate variables for multivariable analysis were selected based on clinical relevance and previously established predictors of STEMI mortality, including age, renal function, systolic blood pressure, delayed presentation, cardiogenic shock, cardiac arrest at presentation, Killip class, and reperfusion strategy. Variables demonstrating clinical importance or an association with mortality in univariable analyses were entered into the multivariable model. Complete-case analysis was performed for patients with available data for all variables included in the final model. Statistical significance was defined as a two-sided p-value <0.05.

The statistical analysis was performed using the SPSS software package version 23 (IBM Corp., Armonk, NY, USA, <https://www.ibm.com/products/spss-statistics>).

Results

From 1st October 2020 to 30th September 2023, A total of 312 patients were included in our cohort, 190 (60.9%) were males. The mean age was 66.2 ± 12.2 years. There were 63 (20.2%) patients with diabetes mellitus, 142 (45.5%) patients with hypertension, 101 (32.4%) patients with dyslipidemia, 9 (2.9%) patients with ischemic stroke, 26 (18.3%) with chronic kidney disease and 17 (5.4%) patients with coronary artery disease. Baseline characteristics between survivors and non survivors are demonstrated in Table 1.

During the study period, 65 patients died, and the in-hospital mortality rate was 20.8%. Non-survivors were older with a mean age of 69.2 ± 13.5 years, compared to survivors, with

a mean age of 65.4 ± 11.7 years ($p=0.010$). There was no statistically significant difference in the proportion of male and female gender, $p=0.118$. Non-survivors had higher creatinine levels (1.5 ± 1.3 mg/dl vs. 1.2 ± 1.3 mg/dl, $p=0.001$) and lower systolic and diastolic blood pressures (116.3 ± 33.3 vs. 134.5 ± 29.1 mmHg, $p<0.001$ and 74 ± 20.1 vs. 80.4 ± 18.6 mmHg, $p=0.022$, respectively). Hypotension was more frequent in non-survivors (20.3% vs. 4.1%, $p<0.001$).

There were no significant differences in rates of diabetes, hypertension, dyslipidemia, chronic kidney disease, ischemic stroke, or coronary artery disease. Smoking status varied significantly ($p=0.013$), with a higher proportion of current smokers among non-survivors. Treatment strategy also differed, as a higher percentage of non-survivors received conservative treatment or undergone percutaneous coronary intervention (1.2% vs 32.3%, 21.9% vs. 35.4%, respectively) while survivors were more likely to receive medical reperfusion therapy with streptokinase (76.9% vs. 32.3%), $p<0.001$. The patients with anterior wall STEMI had a similar outcome with those who had non-anterior wall STEMI ($p=0.406$).

The comparison of baseline characteristics of patients across three treatment groups were demonstrated in Table 2 as follows; 24 (7.7%) patients with conservative treatment, 211 (67.6%) patients with medical reperfusion therapy and 77 (24.7%) patients with primary percutaneous intervention. There were no significant differences in age and gender distribution across treatment groups ($p=0.057$ and $p=0.214$, respectively). The duration between onsets of chest pain to emergency room visit was significant longer in the conservative treatment group (556.9 ± 1265.5 minutes) compared to the medical reperfusion therapy group (142.2 ± 154.3 minutes)

and primary percutaneous coronary intervention group (369.8 ± 611.5 minutes, $p < 0.001$). Similarly, delayed presentation (onset to emergency room > 6 hours) were less frequent in the medical reperfusion therapy group (6.7%) compared to the others ($p < 0.001$).

There were no significant differences were observed in body weights, creatinine levels, or the prevalence of diabetes, hypertension, dyslipidemia, chronic kidney disease, and stroke. However, hypotension was more common in the Primary PCI group (22.1%) compared to the others ($p < 0.001$). There were also significant differences in systolic and diastolic blood pressures among groups, with the lowest systolic pressure in the Primary PCI group (121.4 ± 37.8 mmHg) and the lowest diastolic pressure in the conservative treatment group (77.3 ± 22.3 mmHg, $p = 0.013$). Coronary artery disease was more prevalent in the Primary PCI group (13.0%) compared to the others ($p = 0.003$).

Smoking status showed no significant differences, although a higher proportion of current smokers was noted in the medical

reperfusion therapy and primary PCI groups ($p = 0.077$). The anterior wall involvement proportion was similar across all treatment groups ($p = 0.245$).

A multivariable logistic regression analysis including established predictors of STEMI mortality is presented in Table 3. Increasing age remained independently associated with in-hospital mortality (adjusted OR 1.04, 95% CI 1.00–1.07, $p = 0.031$). Delayed presentation to the emergency department more than 6 hours after symptom onset was associated with a nearly three-fold increase in mortality risk (adjusted OR 2.78, 95% CI 1.29–5.97, $p = 0.009$). Cardiogenic shock was the strongest independent predictor of mortality (adjusted OR 4.28, 95% CI 1.05–17.49, $p = 0.043$).

In contrast, cardiac arrest at presentation, Killip class III–IV, serum creatinine, systolic blood pressure, and primary PCI were not independently associated with mortality after adjustment. These findings suggest that age, delayed presentation, and cardiogenic shock are the principal determinants of in-hospital mortality

in this cohort.

Table 1. Baseline characteristics between survivors and non-survivors

Characteristics	Total (n=312)	Survivors (n=247)	Non-survivors (n=65)	P-value
Age	66.2±12.2	65.4±11.7	69.2±13.5	0.010
Male	190 (60.9%)	156 (63.2%)	34 (52.3)	0.118
Onset to emergency room (min)	100±491.4	96.0±346.9	140±828.2	0.256
Onset to emergency room>6 hours	44 (14.5%)	29 (12.0%)	15 (23.8%)	0.026
Weight (kg)	56.3±13.4	56.7±13.6	55.0±12.8	0.398
Creatinine (mg/dl)	1.3±1.3	1.2±1.3	1.5±1.3	0.001
Systolic blood pressure (mmHg)	131.0±30.8	134.5±29.1	116.3±33.3	<0.001
Diastolic blood pressure (mmHg)	79.1±19.1	80.39±18.6	74.0±20.1	0.022
Hypotension*	22 (7.2%)	10 (4.1%)	12 (20.3%)	<0.001
Diabetes mellitus	63 (20.2%)	50 (20.2%)	13 (20.0%)	1.000
Hypertension	142 (45.5%)	112 (45.3%)	30 (46.2%)	1.000
Dyslipidemia	101 (32.4%)	83 (33.6%)	18 (27.7%)	0.456
Chronic kidney disease	26 (8.3%)	20 (8.1%)	6 (9.2%)	0.801
Stroke	9 (2.9%)	8 (3.2%)	1 (1.5%)	0.691
Coronary artery disease	17 (5.4%)	15 (6.1%)	2 (3.1%)	0.540
Smoking status				0.013
Never	163 (52.2%)	120 (48.6%)	43 (66.2%)	
Current smoke	80 (25.6%)	72 (29.1%)	8 (12.3%)	
Ex-smoke	69 (22.1%)	55 (22.3%)	14 (21.5%)	
Treatment group status				<0.001
No treatment	24 (7.7%)	3 (1.2%)	21 (32.3%)	
Streptokinase	211 (67.6%)	190 (76.9%)	21 (32.3%)	
Percutaneous coronary intervention	77 (24.7%)	54 (21.9%)	23 (35.4)	
Wall status				0.406
Non-anterior wall	168 (53.8%)	136 (55.1%)	32 (49.2%)	
Anterior wall	144 (46.2%)	111 (44.9%)	33 (50.8%)	

*Systolic blood pressure<90 mmHg

Table 2. Patients' characteristics among different treatment strategies

Characteristics	No treatment (n=24)	Streptokinase (n=211)	Primary PCI (n=77)	P-value
Age	68.4±16.2	65.1±11.5	68.6±12.2	0.057
Gender, male	11 (45.8%)	134 (63.5%)	45 (58.4%)	0.214
Onset to emergency room (min)	556.92±1265.5	142.2±154.3	369.8±611.5	<0.001
Onset to emergency room>6 hours	6 (25.0%)	14 (6.7%)	24 (34.3%)	<0.001
Weight (kg)	55.5±17.1	56.7±13.4	55.5±12.5	0.755
Creatinine (mg/dl)	1.9±1.7	1.3±1.5	1.2±0.5	0.141
Systolic blood pressure (mmHg)	124.9±32.8	135.0±26.7	121.4±37.8	0.003
Diastolic blood pressure (mmHg)	77.3±22.3	81.2±17.0	73.9±22.5	0.013
Hypotension*	2 (11.1%)	3 (1.4%)	17 (22.1%)	<0.001
Medical history				
Diabetes mellitus	5 (20.8%)	44 (20.9%)	14 (18.2%)	0.880
Hypertension	13 (54.2%)	91 (43.1%)	38 (49.4%)	0.435
Dyslipidemia	7 (29.2%)	67 (31.8%)	27 (35.1%)	0.817
Chronic kidney disease	2 (8.3%)	15 (7.1%)	9 (11.7%)	0.461
Stroke	1 (4.2%)	5 (2.4%)	3 (3.9%)	0.733
Coronary artery disease	0 (0.0%)	7 (3.3%)	10 (13.0%)	0.003
Smoking status				0.077
Never	18 (75.0%)	105 (49.8%)	40 (51.9%)	
Current smoke	5 (20.8%)	59 (28.0%)	16 (20.8%)	
Ex-smoke	1 (4.2%)	47 (22.3%)	21 (27.3%)	
Wall status				0.245
Non-anterior wall	9 (37.5%)	117 (55.5%)	42 (54.5%)	
Anterior wall	15 (62.5%)	94 (44.5%)	35 (45.5%)	

*Systolic blood pressure<90 mmHg

Table 3. Predictors of all-cause mortality

Risk factor	Multivariate analysis	
	Adjusted OR (95% CI)	P-value
Age	1.04 (1.00-1.07)	0.031
Creatinine (mg/dl)	1.01 (0.76-1.34)	0.968
Delayed presentation (onset to ER > 6 hours)	2.78 (1.29-5.97)	0.009
Systolic blood pressure (mmHg)	0.99 (0.98-1.00)	0.104
Cardiogenic shock	4.28 (1.05-17.49)	0.043
Cardiac arrest at presentation	1.99 (0.50-7.97)	0.329
Primary PCI	1.05 (0.44-2.50)	0.916
Killip class III-IV	1.84 (0.49-6.83)	0.365

Discussion

Identifying the factors associated with in-hospital mortality in patients presenting with acute STEMI is essential for several reasons. First, it provides critical insights into the clinical and systemic barriers, leading to optimal care. Second, it helps in the development of targeted strategies to address modifiable risk factors and improve healthcare delivery. Lastly, such information is invaluable for resource allocation and policy formulation, ensuring that high-risk patients receive timely and effective interventions. We aim to identify key factors influencing outcomes and provide actionable recommendations for improving care in this region by analyzing patient characteristics, clinical parameters, and treatment modalities. This knowledge gap will not only enhance patient care in Nan province but also contribute to the STEMI management in resource-limited settings.

This study revealed significant finding of key predictors of mortality in patients presenting with STEMI. Increasing age significantly raised the risk of mortality, consistent with previous studies demonstrating age as a primary determinant of adverse outcomes.(8) Delayed presentation (>6 hours) significantly increased mortality risk,

underscoring the critical importance of rapid recognition and treatment, consistent with previous study from Chao Phraya Abhaibhubejhr Hospital found that elderly (age $\geq$ 60 years) and delayed first medical contact > 120 minutes had higher mortality rates.(9) Lower systolic blood pressure was strongly associated with higher mortality, focusing on maintaining adequate perfusion in acute settings is important.(1, 5, 8) In the adjusted model, cardiogenic shock emerged as an independent predictor of mortality, whereas systolic blood pressure was no longer statistically significant. This finding suggests that the association between hypotension and mortality observed in unadjusted analyses may largely reflect the presence of cardiogenic shock. Cardiogenic shock is a well-established determinant of mortality in STEMI and likely represents a more direct measure of hemodynamic compromise than blood pressure alone.

Although primary PCI is known to improve outcomes in STEMI(10, 11), no independent association with mortality was observed in our study. This finding may be explained by confounding by indication, as patients selected for primary PCI often presented with greater clinical severity,

including cardiogenic shock, cardiac arrest, or delayed presentation. Furthermore, the benefit of reperfusion therapy is highly dependent on total ischemic time. In a rural province such as Nan, prolonged symptom-to-door intervals may attenuate the mortality benefit of primary PCI. Consequently, the observed lack of association between treatment strategy and outcomes likely reflects the clinical complexity of late presenters such as cardiogenic shock and sudden cardiac arrest either PEA or ventricular fibrillation with successful cardiopulmonary resuscitation rather than the ineffectiveness of PCI itself. These results highlight the need for future studies to better account for treatment selection bias and further explore strategies to improve outcomes in patients presenting late after symptom onset.

Conclusions

The in-hospital mortality rate for patients with acute STEMI admitted to Nan Hospital was relatively high. Our analysis found that older age, delayed presentation (>6 hours), and cardiogenic shock were independent predictors of in-hospital mortality among STEMI patients admitted to Nan Hospital. Strategies aimed at reducing pre-hospital delay and improving early recognition and management of cardiogenic shock may help improve outcomes in this high-risk population.

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