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Factors in Predicting Short Term Mortality in ST Elevation Myocardial Infarction Patients Undergoing Primary Percutaneous Coronary Intervention

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Abstract

Background: Percutaneous coronary angiography and intervention have been applied in the diagnosis and treatment of coronary artery disease at Gia Dinh People's Hospital since April 2009 until now with very positive results, contributing to improving the quality of diagnosis and treatment. Treating cardiovascular patients with high technology. However, there is currently no research to help evaluate performance as well as prognostic factors affecting treatment outcomes at this unit. Therefore, we conducted this study with the research question: Short-term mortality rate in patients with ST-elevation acute myocardial infarction undergoing primary percutaneous coronary intervention at Gia Dinh People's Hospital. What is the year 2022 - 2023? What factors predict short-term mortality in patients with acute ST-segment elevation myocardial infarction undergoing primary percutaneous coronary intervention.

Materials and methods: There were 163 patients at the Gia Dinh People's Hospital from November 2022 to September, 2023. This was a cohort study.

Results: In-hospital and 30-day mortality rates after intervention were 4.29% and 4.91%, respectively. Short-term mortality prognostic factors include systolic blood pressure < 100 mmHg, arrhythmia at admission, TIMI score > 6, cardiogenic shock before the procedure, blood potassium concentration with mortality rate within 30 days after PCI, with $p < 0.05$.

Conclusion: In clinical practice, attention should be paid to factors predicting 30-day mortality in STEMI patients include systolic blood pressure < 100 mmHg, arrhythmia at admission, TIMI score > 6, cardiogenic shock before the procedure, blood potassium concentration with mortality rate within 30 days after PCI.

Keywords: Short Term, STEMI, Primary Percutaneous Coronary Intervention

1. Introduction

Cardiovascular disease is the leading cause of death in the world, with an estimated 19.05 million deaths due to cardiovascular disease in 2020, accounting for 27% of total global deaths and 37% of total deaths. Deaths due to non-communicable diseases [1]. In Vietnam, in 2016, according to statistics from the World Health Organization, cardiovascular disease became the leading cause of death, accounting for 31% of total deaths. Overall, equivalent to 170,000 deaths, of which more than half are due to coronary artery disease [2]. Acute ST-segment elevation myocardial infarction is the form of coronary artery disease with the highest morbidity and mortality rate today. For treatment, there are 3 reperfusion measures applied: Thrombolysis, cannulation percutaneous coronary intervention, coronary artery bypass surgery. Among them, percutaneous coronary intervention, especially primary percutaneous coronary intervention, is the most effective and safest reperfusion method for infarction. Acute myocardial infarction with ST elevation. Since 2017, the guidelines have made many changes in the diagnostic criteria for acute ST-segment elevation myocardial infarction and indications for percutaneous coronary intervention have been expanded and given priority in the treatment of myocardial infarction. Acute ST-segment elevation [3]. With this change, to help clinicians evaluate patients with acute myocardial infarction with ST-segment elevation after percutaneous coronary intervention, early countries have conducted Research to re-evaluate mortality rates and prognostic factors for continued improvement in the future [4, 5]. Studies have shown prognostic factors in this group of patients including: age > 75, gender female, history of hypertension, history of myocardial infarction, chronic kidney disease, heart rate > 100 beats/minute, systolic blood pressure at admission < 90 mmHg, cardiogenic shock, Killip > II, ventricular arrhythmia, increased

leukocytosis, hyperglycemia, increased troponin T, decreased density lipoprotein cholesterol, left ventricular ejection fraction < 35%, ST elevation ≥ 0.2 mV, ST segment elevation after intervention, damage to multiple vascular branches coronary artery, the culprit coronary artery is the common trunk or right coronary artery, TIMI flow < 3 after intervention, GRACE score, TIMI score, PRECISE DAPT score [6]. However, most of these studies are all based on data from previous periods, so it is somewhat impossible to comprehensively evaluate the rate and prognostic factors of death in patients with ST-elevation acute myocardial infarction undergoing percutaneous coronary intervention. First tense in the present period. Percutaneous coronary angiography and intervention have been applied in the diagnosis and treatment of coronary artery disease at Gia Dinh People's Hospital since April 2009 until now with very positive results, contributing to improving the quality of diagnosis and treatment. Treating cardiovascular patients with high technology. However, there is currently no research to help evaluate performance as well as prognostic factors affecting treatment outcomes at this unit. Therefore, we conducted this study with the research question: Short-term mortality rate in patients with ST-elevation acute myocardial infarction undergoing primary percutaneous coronary intervention at Gia Dinh People's Hospital. What is the year 2022 - 2023? What factors predict short-term mortality in patients with acute ST-segment elevation myocardial infarction undergoing primary percutaneous coronary intervention? For the above reasons, we conducted the project: "Prognostic factors for short-term mortality in patients with ST-elevation acute myocardial infarction undergoing primary percutaneous coronary intervention at Gia Dinh People's Hospital"with the following two objectives:

1. Determine the short-term mortality rate in patients with acute ST-segment elevation myocardial infarction undergoing primary percutaneous coronary intervention at Gia Dinh People's Hospital.
2. Determine factors predicting short-term mortality in patients with ST-elevation acute myocardial infarction undergoing primary percutaneous coronary intervention at Gia Dinh People's Hospital.

2. Materials and methods

2.1 Study population

2.1.1 Inclusion criteria: all hospitalized patients ≥ 18 years old diagnosed with STEMI who received primary PCI at the Department of Interventional Cardiology at Gia Dinh People's Hospital during the period from November 2022 to September 2023 and followed up 30 days after PCI.

2.1.2 Exclusion criteria were as follow:

- Patients with acute myocardial infarction but without primary coronary intervention (have used fibrinolytic drugs for > 24 hours or have had CABG).
- There are contraindications to the use of contrast agents and antiplatelet drugs such as aspirin and clopidogrel.
- History of bleeding within 3 months (such as cerebral hemorrhage, gastrointestinal bleeding) or blood clotting disorder.
- Emergency medical condition: Diabetic coma, severe kidney failure, severe liver failure, severe infection, end-stage cancer.
- The patient is pregnant.

2.2 Methods

2.2.1 Study design: Cohort. This study complies with the Declaration of Helsinki and was approved by the local institutional review committees. All patients provided written informed consent.

Sample size:

$$n = Z^2_{1-\alpha/2} \frac{p(1-p)}{d^2}$$

Where: p = 9% according to Onur Zorbozan *et al* [7] recorded 30-day all-cause mortality

We chose d = 0,045, n = $1,96^2$ x 0,09 x 0,91/$0,045^2$ = 156.

So minimum sample size was 156 cases.

2.2.2 Laboratory data: Blood samples were taken within the first 24 h of hospital admission.

2.2.3 Statistical analysis: We performed all statistical analyses using the software SPSS for Windows (version 26; SPSS Inc., Chicago, IL, USA). We tested for normal distribution using the Kolmorgorov– Smirnov test or the Pearson's chi-squared test. Student's t-test for normally distributed data and the Mann–Whitney U test for non-normally distributed data were used to compare quantitative variables between groups. Chi square test or Fisher's exact test were used for qualitative variables, as appropriate. Independent factors associated with 30-day mortality were assessed by multivariate logistic regression analyses using univariate factors with a value of $p < 0.05$. A final model was derived by using backward stepwise selection. Statistical significance was assumed for $p < 0.05$.

3. Results

From November 2022 to September 2023 and followed up 30 days after PCI there were 163 patients who met the inclusion criteria and had no exclusion criteria.

3.1 Baseline characteristics

163 patients were enrolled and included in the analysis. The mean age of the sample was 62.24 ± 11.34 years, 114 (69.94%) were male. Baseline characteristics patients are summarized in Table 1 and TIMI, GRACE, PRECISE DAPT scores in Table 2.

Table 1: Baseline characteristics

Varables	Total (n=163)
Demographics and medical history	
Age (years)	62.24 ± 11.34
Male sex	114 (69.94)
BMI < 18.5 (kg/m^2)	3 (1.84)
BMI 18.5-22.9 (kg/m2)	74 (45.40)
BMI ≥ 23 (kg/m2)	86 (52.76)
Smoking	75 (46.01)
HTA	125 (76.69)
Dyslipidemia	107 (65.64)
DM	60 (36.81)
Old MI	3 (1.84)
Previous PCI	5 (3.07)
Prevous Stroke	7 (4.29)
CKD	21 (12.88)
Length of stay (days)	4 [3-6]
Vital signs	
SBP, mmHg	120 [110-140]
DBP, mmHg	70 [60-80]
HR, b.p.m	80 [66-90]
Hypotension	10 (6.13)
Cardiac arrest on admission	2 (1.23)

Arrythmia	31 (19.02)
Killip on admission	
Killip I	147 (90.18)
Killip II	2 (1.23)
Killip III	7 (4.29)
Killip IV	7 (4.29)
Laboratory	
LVEF (%)	49.18 ± 12.27
Potasium (mmol/L)	3.71 [3.42 – 3.94]
Glucose (mmol/l)	8.76 [6.58 – 12.83]
Creatinine (µmol/L)	90.40 [(73.00 – 107.00]
eGFR (mL/min/1.73m^2)	62.38 [(49.49 -75.83]
Hemoglobin (g/dL)	14.30 [12.80 – 17.30]
hsTroponin (ng/ml)	530.00 [72.51 – 7530.00]
WBC (K/µL)	11.98 [10.00 – 14.48]
Total Cholesterol (mmol/l)	4.81 [4.14 – 5.75]
LDL-Cholesterol (mmol/l)	3.11 [2.47 – 3.76]
HDL-Cholesterol (mmol/l)	1.05 [0.90 – 1.25]
Triglyceride (mmol/l)	1.74 [1.28 – 2.65]

Data are expressed as n (%); medium± SD; median [interquartile range] as appropriate. CAD: coronary artery disease; DBP: diastolic blood pressure, DM: diabetes mellitus; eGFR: estimated glomerular filtration rate; MI: Myocardial infarction; HR: heart rate; HTA: hypertension; LVEF: left ventricular ejection fraction; CKD: Chronic kidney disease was defined as eGFR eGFR <60 mL/min/1.73 m^2 using creatinine obtained at the admission, PCI: percutaneous coronary intervention. WBC: White blood cell

Table 2: TIMI, GRACE, PRECISE DAPT scores

Scores		Total (n=163)	
		n	Rate (%)
TIMI	0-3	70	42,94
	4-6	61	37,42
	≥ 7	32	19,63
	median [interquartile range]	4 (2-6)	
GRACE	48-125	34	20,86
	126-154	69	42,33
	≥ 155	60	36,81
	median [interquartile range]	147 (127-167)	
PRECISE DAPT	< 25	114	69,94
	≥ 25	49	30,06
	median [interquartile range]	20 (13-27)	

3.2 Short-term mortality after percutaneous coronary intervention (PCI)

Table 3: Short-term mortality after percutaneous coronary intervention

Outcomes	n	Rate (%)
In-hospital mortality	7	4,29
30 days after PCI mortality	8	4,91

3.3 Short-term mortality prognostic factors in patients with ST-segment elevation myocardial infarction undergoing primary percutaneous coronary intervention

After univariate analysis, variables included GRACE score ≥ 155, TIMI score > 6, Killip > II, PRECISE DAPT score ≥ 25, heart rate on ECG at admission, EF < 40%, cardiogenic shock before the procedure, glucose, blood potassium concentration, right femoral artery access had a statistically significant association with mortality within 30 days after PCI in univariate logistic regression analysis, with p < 0.050. Multivariable logistic regression analysis showed an independent, statistically significant association between arrhythmia factors at admission, TIMI score > 6, blood glucose concentration and blood potassium concentration with mortality rate. Within 30 days after PCI, with p < 0.05 showed in Table 4.

Table 4: Univariate and multivariate logistic regression analysis estimated the probability of death within 30 days after percutaneous coronary intervention

Univariate logistic regression				Multivariate logistic regression		
Variables	**p**	**OR**	**CI 95%**	**p**	**OR**	**CI 95%**
Age ≥ 85	0.331	0.33	0.04 - 3.07			
SBP < 100 mmHg	0.106	0.29	0.07- 1.30	0,076	31.77	0.70 - 1449.31
Arrythmia on admission	0.057	0.19	0.03 - 1.05	**0.029**	0.00	0.00 – 0.57
Length of stay (days)	0.768	0.96	0.75 - 1.23			
GRACE ≥ 155	**0.016**	0.07	0.01- 0.62			
TIMI > 6	**0.001**	0.03	0.00 - 0.23	**0.042**	0.03	0.00 – 0.89
Killip > II	**0.001**	0.07	0.02 - 0.32			
PRECISE DAPT ≥ 25	**0.027**	0.16	0.03 - 0.81			
Heart rate	**0.008**	1.05	1.01 - 1.08			
EF < 40%	**0.004**	0.09	0.02 - 0.45			
Q wave on ECG	0.866	0.89	0.17 - 4.47			
Cardiac shock on admission	< **0.001**	0.01	0.00 - 0.12			
Cardiac arrest	**0.001**	0.28	0.03 - 2.67			
Glucose	**0.003**	1.19	1.07 - 1.32	**0.020**	1.2	1.03 – 1.39
Potasium (mmol/L)	0.442	7.13	1.95 - 26.05	**0.014**	53.59	2.22 – 1296.35
Hemoglobin (g/L)	**0.001**	0.99	0.98 - 1.01			
Right femoral artery Access	**0.001**	0.06	0.01 - 0.31			

4. Discussion

A study by author Onur Zorbozan and colleagues conducted in 2018, evaluated factors predicting mortality in patients with cervical myocardial infarction undergoing primary PCI.[7] This is a prospective study on patients with cervical myocardial infarction undergoing PCI. Then follow up for 30 days. Univariate analysis was performed to identify risk factors influencing mortality. Significant factors were then included in the logistic regression model. The ROC curve will be applied to determine the best predictor of mortality. There were 167 patients included in the study, the mortality rate was 9% (15 out of 167 patients). The logistic regression model showed that significant factors included age (p = 0.002), modified shock index (MSI) (p = 0.028), systolic blood pressure (p = 0.028), and time between diagnosis. Predicted until starting the vascular intervention room (p = 0.047). The cutoff point that best predicts age-related mortality is 71.50, systolic blood pressure less than 95 mmHg, MSI 0.85; and the time from diagnosis to start-up of the intervention room was more than 3.5 minutes. Compared with our study, systolic blood pressure is also a risk factor affecting prognosis, besides the MSI modified shock index (heart rate divided by systolic blood pressure) is also known. Many studies have shown its role in predicting short-term mortality risk in patients with ACS undergoing PCI. A striking difference in the study of Onur Zorbozan and colleagues is that the time points from symptom onset to coronary revascularization are specifically described and

closely related to mortality rate. Through a linear regression model [7]. Research shows that the shadowing time is prolonged in cases of death. There are many factors that affect the shadowing time, including ECG analysis and intervention room start-up time. The author specifically analyzed each period of time from symptom onset to when the patient received intervention, and in multivariate regression analysis showed that consultation time and intervention room start-up time had significant effects. Meaningfully related to death. It is estimated that each additional 3.5 minutes will increase the risk of death by 8%. Compared with our study, the duration of the shadowing period was less than 90 minutes reaching more than 50%, however the time points did not affect the prognosis of in-hospital mortality and 30-day survival. This can be explained by the fact that our patient group is mainly Killip I (accounting for more than 90%), while author Onur Zorbozan studies a single center, at the highest-level hospital, receiving many serious patients. and the time from symptom onset to coronary revascularization is therefore long, so it can be clearly seen that the time factor affects disease prognosis [7]. Dubey and colleagues also conducted a study to evaluate the outcome of patients with cervical myocardial infarction, at a large center in Northern India [8]. The results showed that cardiogenic shock was the leading cause of death (accounting for 77%), followed by congestive heart failure (10%) and ventricular tachycardia/ventricular fibrillation (8%). 01 patient died due to pneumonia complicated by severe infection and 01 patient died due to left ventricular free wall rupture. Factors significantly related to mortality rate in multivariable regression analysis include shadowing time, Killip class, TIMI flow after PCI, and severe left ventricular dysfunction. In particular, Killip grade increases the risk of death 8 times when compared to other factors. Extending the duration of the shadow every minute increases the mortality rate by 2%. TIMI 3 flow after intervention reduced mortality by 60% when compared with non-TIMI 3 flows. The risk of death was 22 times higher in the group with severe left ventricular dysfunction. Compared with our study, partly because the group of patients in the main study Killip I, the majority were successfully intervened (high TIMI 3 flow restoration rate, up to 99.40%, 01 case TIMI 2, there are no cases of TIMI 1 or TIMI 0), which leads to factors in our regression model that are different from those of Dubey [8]. Research conducted in 2018 by author M. Ali and colleagues on 312 patients with ST-elevation acute MI, average age 67.1 ± 13.4 years, of which 211 patients (accounting for 68%) were men [9]. Rate In-hospital mortality was 10% (31 patients). In-hospital death related to pre-hospital cardiopulmonary resuscitation (CPR; n = 39/12.5%), older age, low systolic blood pressure, Killip > 1, 3-vessel coronary artery disease ($p < 0.0001$), Female gender ($p = 0.0158$), culprit lesion in the left common coronary artery (LMCA, $p = 0.0083$) and circumflex branch (RCX; $p = 0.0141$). Research shows that mechanical circulatory support is necessary in cases requiring CPR. Compared with our study, the characteristics of low systolic blood pressure and patients having cardiac arrest (usually followed by cardiogenic shock) are also factors predicting death. In terms of mortality rate, in M. Ali's study, the in-hospital mortality rate was up to 10% (higher than our study). Besides differences in patient characteristics, the place where author M. Ali's study was conducted did not have mechanical circulatory support devices, which increased the mortality rate in cases of cardiogenic shock [9].

5. Limitations

The study has some limitations:

1. This is a single-center study, the selected patients may not represent the general population, so the study results cannot be applied to a large population.
2. The follow-up period is short (30 days after PCI), so some factors affecting mortality prognosis may not have been fully observed, thereby affecting the overall prognostic model.

6. Conclusion

After conducting research on 163 patients with cervical myocardial infarction undergoing primary PCI at Gia Dinh People's Hospital, we drew the following two conclusions:

1. In-hospital and 30-day mortality rates after intervention are 4.29% and 4.91%, respectively.
2. Short-term mortality prognostic factors include systolic blood pressure < 100 mmHg, arrhythmia at admission, TIMI score > 6, cardiogenic shock before the procedure, blood potassium concentration with mortality rate within 30 days after PCI, with $p < 0.05$..

7. Funding

No.

8. Conflict of interest

None declared.

9. References

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