Comparison of Official Hours versus Non-Official Hours: Percutaneous Coronary Intervention in Acute ST-Elevation Myocardial Infarction Patients

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Background: *Percutaneous coronary intervention (PCI) is now a favorable treatment for acute ST elevation myocardial infarction (STEMI). However, in non-official hours (non-OH), this modality of treatment has a questionable outcome because of the treatment delay.*
Objective: *To compare the outcomes of PCI during official hours (OH) with non-OH in acute STEMI patients.*
Material and Method: *A prospective consecutive registry of PCI in acute ST-elevation MI patients at King Chulalongkorn Memorial Hospital from May 1999 to December 2003 were analyzed. Kaplan Meier survival analysis was used to determine the in-hospital mortality. Multivariate analysis was used to determine the prognostic factors for in-hospital mortality.*
Results: *Two hundred and fifty six consecutive patients (OH-107, non-OH-149) who underwent PCI for acute STEMI were enrolled. Their mean age (61.9 $\pm$ 12.2 vs 60.6 $\pm$ 12.8 y, p = ns), male gender (73.8% vs 73.2%, p = ns), history of diabetes (30.2% vs 33.8%, p=ns), severity of the patients (percent of patients in Killip IV – 22.4 vs 21.5, p = ns), ejection fraction (48.7 $\pm$ 15.1 vs 45.9 $\pm$ 14.7, p = ns), cardiopulmonary resuscitation prior PCI (15.0% vs 14.2%, p = ns), anterior MI (55.1% vs 51.0%, p = ns) were similar in both groups. Hypertension was slightly less common (39.6% vs 52.7%, p = 0.04) but smoking was more common (62.6% vs 49.0%, p = 0.03) in OH group. Door to balloon time and decision to balloon time were significantly shorter in the OH group than the non-OH group (67.9 $\pm$ 47 vs 119.6 $\pm$ 83 min, p < 0.001 and 60.8 $\pm$ 35 vs 98.3 min, p < 0.001). However, the total delayed time was not statistically significantly different (402 $\pm$ 316 vs 424 $\pm$ 215, p = 0.55). Angiographic success rate was achieved in 98.1% for the OH group and 94.7% in the non-OH group (p = ns). In-hospital mortality rate was 10.3% and 10.7% respectively.*
Conclusion: *The door to balloon time for PCI in acute STEMI patients in the non-OH group was longer than the OH group; however, the total delayed time was not different. The in-hospital mortality rate was similar.*

Keywords: *Primary percutaneous coronary intervention, ST-elevation myocardial infarction, Official hours, Non-official hours*

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Primary percutaneous coronary intervention (PCI) is the treatment of choice for patients who had acute ST elevation myocardial infarction (STEMI) in an experienced center and can be done within a definite time[1,2]. Time is muscle and can be translated into outcomes[3,16]. In a set up where there are official and non-official working times; the process during non-official hours (non-OH) may be unavoidably delayed because of logistics and this may affect outcomes. In the last few years of the STEMI registry, the authors were able to look at the outcomes of the patients who underwent PCI in official hours (OH) and non-OH.

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Material and Method

The patients, who received a first PCI treatment between May 1999 and December 2003 at King Chulalongkorn Memorial Hospital, were enrolled. The data are prospectively and consecutively collected. Diabetes was defined when patients were already documented, received oral hypoglycemic agent/insulin for diabetic controlled, or had fasting plasma glucose over 126 mg/dl. Hypertension was defined when the patients were already documented, or had, according to the WHO criteria, 140/90 mmHg. Dyslipidemia was defined when patients have already received a lipid lowering agent, their total cholesterol was over 200 mg/dl, LDL over 130 mg/dl, or HDL was less than 40 mg/dl. The infarct related vessel means the vessel has to receive angioplasty and is related to the EKG location. Door to balloon time means the time since the patients arrived in the hospital to the time the infarct related artery was opened. Total delay time means the time from onset of chest pain to the time the infarct related artery was opened. The severity of the patients was classified according to the Killip classification. The criteria for diagnosis of cardiogenic shock were systolic blood pressure less than 90 mmHg or requirement of inotropic/vasopressor drug or intraaortic balloon pump (IABP) to maintain hemodynamic stability with clinical signs of hypoperfusion stage such as cold extremities or urine output less than 30 cc/hour. Pulmonary artery catheter was not necessary in every case but if the patient required a Swan-Ganz catheter to monitor pulmonary wedge pressure, it should be more than 15 mmHg. The first left ventricular (LV) ejection fraction by echocardiography was used to determine the LV function during hospitalization. Angiographic success was determined by the residual stenosis of infarct related artery less than 50% with TIMI 2 or TIMI 3 flow.

Statistical analysis

The Intercooled STATA version 6.0 was used for data analysis. The baseline characteristics for nominal variables were expressed in number and percent and continuous variables were expressed as mean $\pm$ SD. Chi-square and student t-test were used to compare the data between the two groups. Kaplan-Meier survival analysis was used to compare the in-hospital mortality. Log-rank univariate analysis test was used to determine the factors for in-hospital mortality and Cox proportional hazard with backward elimination was used for multivariate analysis. The results were reported as hazard ratio with 95% confidence interval. A p-value less than 0.05 was considered statistically significant.

Results

From May 1999 to December 2003, 256 patients underwent PCI for acute STEMI. One hundred and seven patients were treated during OH and 149 patients were treated during non-OH. Table 1 shows the baseline characteristics of the patients in both groups. Mean age, percentage of male gender, history of diabetes, and dyslipidemia were similar in both groups. Hypertension was less in the OH group (39.6% vs 52.7%, $p = 0.04$), however, the history of smoking was more common in the OH group (62.6% vs 49.0%, $p = 0.03$). Area of infarction, left ventricular ejection fraction (LVEF), percentage of cardiogenic shock and number of disease vessel were also not different in both groups. Door to balloon time and decision to balloon time were shorter in the OH when compared with the non-OH group (67.9 ± 47.1 vs 119.6 ± 83 minutes, $p < 0.001$, and 66.8 vs 98.3 ± 51, $p < 0.001$). However, the total delay time (time from onset of chest pain to balloon dilatation) was similar in both groups (402 ± 316 vs 424 ± 251 minutes, $p = 0.55$).

The results of PCI are shown in Table 2. The angiographic success rate was achieved in 98.1% in the OH group and 94.7% in the non-OH group ($p = 0.44$). Glycoprotein IIb/IIIa was used in about 50% as well as the stents being implanted in about 70% in both groups. About 16% of patients in both groups required intra-aortic balloon pump for hemodynamic support. Overall mortality rate was not statistically significant (10.3% for OH and 10.7% for non-OH, $p = 0.90$). Using bivariate analysis to evaluate predictors for survival, female gender, prior cardiopulmonary resuscitation, presence of cardiogenic shock, LVEF < 40 and angiographic success were demonstrated as significant predictors for in-hospital mortality (Table 3). When using Cox-regression model for multivariate analysis, cardiogenic shock was only one predictor for in-hospital mortality (Table 4). The time of procedure was not a predictor of death in the present study.

Discussion

Many reports[3-16] have demonstrated the benefit of early perfusion as soon as possible either thrombolysis or primary PCI in patients with acute STEMI will improve survival. The patients come to the hospital in OH, of course, the door to balloon time will be shorter than in the non-OH. The situation is prompted to start the procedure. However, in the non-OH, this

Table 1. Baseline characteristics of the patients

Characteristics	OH (n = 107)	Non-OH (n = 149)	p-value
Age (y)	61.9 ± 12.2	60.6 ± 12.8	0.40
Gender:Male (%)	73.8	73.2	0.90
Diabetes (%)	30.2	33.8	0.55
Hypertension (%)	39.6	52.7	0.04*
Smoking (%)	62.6	49.0	0.03*
Dyslipidemia (%)	53.6	64.1	0.11
: Total cholesterol (mg/dl)	204 ± 49	209 ± 51	0.46
: Triglyceride (mg/dl)	140 ± 81	150 ± 94	0.42
: HDL (mg/dl)	45.3 ± 11.4	44.2 ± 10.9	0.50
: LDL (mg/dl)	128 ± 43	134 ± 43	0.35
Anterior wall infarction (%)	55.1	51.0	0.51
Left ventricular ejection fraction (%)	48.7 ± 15.1	45.9 ± 14.7	0.20
Cardiogenic shock (%)	22.4	21.5	0.69
Prior cardiopulmonary resuscitation prior intervention (%)	15.0	14.2	0.86
Referral cases (%)	33.6	37.6	0.52
Diseased vessel			0.30
: 1-vessel disease	46.7	40.3	
: 2-vessel disease	29.9	27.5	
: 3-vessel disease	23.4	32.2	
Peak CKMB	360 ± 389	359 ± 369	0.98
Blood pressure			
: Systole	122 ± 30	124 ± 32	0.80
: Diastole	75 ± 17	78 ± 20	0.37
Heart rate	73.9 ± 16.4	82.3 ± 20.9	0.02**
Pain duration before admission (min)	294 ± 273	293 ± 249	0.99
Door to balloon time (min)	67.9 ± 47	119.6 ± 83	<0.001**
Decision to balloon time (min)	60.8 ± 35	98.3 ± 51	<0.001
Total time delay (min)	402 ± 316	424 ± 251	0.55

* Significant difference by Chi-square test
** Significant dufference by unpaired t-test

Table 2. Results of treatment in both groups

	OH (n = 107)	Non-OH (n = 149)	p-value
TIMI-flow pre-angioplasty (%)			0.60
: 0	73.8	67.1	
: 1	11.2	11.4	
: 2	6.5	10.1	
: 3	8.4	11.4	
TIMI-flow post-angioplasty (%)			0.27
: 0	0.9	2.7	
: 1	0.9	2.7	
: 2	5.6	10.1	
: 3	92.5	84.6	
Angiographic success (%)	98.1	94.7	0.44
Glycoprotein IIb/IIIa blocker used (%)	53.3	46.3	0.27
Stent implantation (%)	75.5	70.9	0.44
Intra-aotic ballon pump insertion (%)	15.9	16.2	0.94
Temporally pacing implantation (%)	8.4	10.1	0.64
Re-occlusion (%)	1.9	2.7	0.67
In-hospital mortality (%)	10.3	10.7	0.90

Table 3. Bivariate analysis of factors that effect survival time

Variable	Crude hazard ratio (95%CI)	p-value
Age group (year)		0.15
: 31-52	1	
: 53-62	1.57 (0.37-6.56)	
: 63-71	1.29 (0.30-5.48)	
: 72-92	3.25 (0.90-11.75)	
Sex:Female	2.30 (1.39-8.43)	0.04
Cardiogenic shock	11.29 (4.14-30.78)	<0.0001
Diabetes	1.82 (0.82-4.01)	0.14
Hypertension	1.62 (0.73-3.59)	0.23
Smoking	0.48 (0.21-1.08)	0.07
Dyslipidemia	0.41 (0.15-1.09)	0.06
Total delay time > 6 hours	1.67 (0.76-3.68)	0.20
EKG – antertior wall	1.48 (0.67-3.26)	0.32
Ejection fraction < 40%	3.47 (1.55-7.78)	<0.01
CPR prior PCI	3.20 (1.42-7.19)	<0.01
Angiographic success	0.20 (0.23-0.54)	<0.01

CI-confidence interval, CPR-cardiopulmonary resuscitation, 1ry PCI-primary percutaneous coronary intervention

Table 4. Multivariate analysis of factors that effect survival time

Variable	Adjusted hazard ratio (95%CI)	p-value
Sex : Female	2.15 (0.74-6.24)	0.16
Cardiogenic shock	11.55 (2.47-53.99)	<0.002
Hypertension	4.51 (1.22-16.72)	0.02
Dyslipidemia	0.43 (0.13-1.47)	0.19
Angiographic success	0.12 (0.03-0.54)	0.006

CI-confidence interval, CPR-cardiopulmonary resuscitation, 1ry PCI-primary percutaneous coronary intervention

process is delayed, sometimes one to two hours, due to the transportation time of the staff from home to the hospital. How long the delay time is usually depends on the how far the staff's house is from the hospital as well as the traffic situation. In NRMI report of more than 30,000 patients, the delayed time for PCI in non-OH was about 21 minutes[17]. In-hospital mortality in OH and non-OH were similar (about 4.7%), however, after adjusted variable, the odd ratio of non-OH was slightly higher than OH (OR = 1.07, CI = 1.01-1.14, p = 0.02). In the present study, the average time delay was about 40-50 minutes when comparing OH with non-OH. Nevertheless, the outcomes particularly in-hospital mortality of both groups were similar. In the present study, the only predictors for in-hospital mortality were the presence of cardiogenic shock, history of hypertension and angiographic success. The other factors such as female gender, diabetes, location of infarction or poor LVEF did not reach statistical significance. It may be the effect of the small sample size of the present study to determine the in-hospital mortality. In the present study, the in-hospital mortality was higher than data from Western countries[17-22]. This result can be explained by the higher incidence of cardiogenic shock patients {21% from the present study compared to 7% in the GRACE registry[21]}. Average mortality in this group of patients was almost 50%. The SHOCK trial [23] has shown the benefit of revascularization over conservative treatment and the benefit was more when the revascularization was started as earlier as possible. When the patients with acute STEMI come in non-OH, the primary PCI is still recommended as in OH if the activation to balloon time is less than 60 minutes.

Conclusion

Primary PCI in non-OH is as effective as in OH. Delay of door to balloon time less than 60 minutes did not have any effect on the success rate of reperfusion and in-hospital mortality. Primary PCI should be encouraged for patients with acute STEMI in an experienced center to give maximal benefit to the patients.

References

1. Antman EM, Anbe DT, Armstrong PW, Bates ER, Green LA, Hand M, et al. ACC/AHA guidelines for the management of patients with ST-elevation myocardial infarction - executive summary: a report of the American College of Cardiology/ American Heart Association Task Force on Practice Guidelines (Writing Committee to Revise the 1999 Guidelines for the Management of Patients With Acute Myocardial Infarction). Circulation 2004; 110: 588-636.
2. Van de WF, Ardissino D, Betriu A, Cokkinos DV, Falk E, Fox KA, et al. Management of acute myocardial infarction in patients presenting with ST-segment elevation. The Task Force on the Management of Acute Myocardial Infarction of the European Society of Cardiology. Eur Heart J 2003; 24: 28-66.
3. O'Keefe JH Jr, Rutherford BD, McConahay DR, Ligon RW, Johnson WL Jr, Giorgi LV, et al. Early and late results of coronary angioplasty without antecedent thrombolytic therapy for acute myocardial infarction. Am J Cardiol 1989; 64: 1221-30.
4. Weaver WD, Cerqueira M, Hallstrom AP, Litwin PE, Martin JS, Kudenchuk PJ, et al. Prehospital-initiated vs hospital-initiated thrombolytic therapy. The Myocardial Infarction Triage and Intervention Trial. JAMA 1993; 270: 1211-6.
5. Weaver WD. Time to thrombolytic treatment: factors affecting delay and their influence on outcome. J Am Coll Cardiol 1995; 25(7 Suppl): 3S-9S.
6. Cannon CP. Time to Treatment: A Crucial Factor in Thrombolysis and Primary Angioplasty. J Thromb Thrombolysis 1996; 3: 249-55.
7. Cannon CP, Henry TD, Schweiger MJ, Haugland JM, Mckendall GR, Shah PK, et al. TIMI 9 Registry Investigators and Coordinators: Current management of ST elevation myocardial infarction and outcome of thrombolytic ineligible patients: results of the multicenter TIMI 9 Registry [abstract]. J Am Coll Cardiol 1995; Spec No: 231A-232A.
8. Sharkey SW, Bruneete DD, Ruiz E, Hession WT, Wysham DG, Goldenberg IF, et al. An analysis of time delays preceding thrombolysis for acute myocardial infarction. JAMA 1989; 262: 3171-4.
9. Kline EM, Smith DD, Martin JS. Treatment Study Group: GUSTO Time to Treatment Substudy: results of the phase II randomized trial [abstract]. Circulation 1993; 88(4 Pt 2): I-337.
10. Ellerbeck EF, Jencks SF, Radford MJ, Kresowik TF, Craig AS, Gold JA, et al. Quality of care for Medicare patients with acute myocardial infarction. A four-state pilot study from the Cooperative Cardiovascular Project. JAMA 1995; 273: 1509-14.
11. Fibrinolytic Therapy Trialists' (FTT) Collaborative Group. Indications for fibrinolytic therapy in suspected acute myocardial infarction: collaborative overview of early mortality and major morbidity results from all randomised trials of more than 1000 patients. Lancet 1994; 343: 311-22.
12. Zijlstra F, Patel A, Jones M, Grines CL, Ellis S, Garcia E, et al. Clinical characteristics and outcome of patients with early (< 2 h), intermediate (2-4 h) and late (> 4 h) presentation treated by primary coronary angioplasty or thrombolytic therapy for acute myocardial infarction. Eur Heart J 2002; 23: 550-7.
13. Cannon CP, Gibson CM, Lambrew CT, Shoultz DA, Levy D, French WJ, et al. Relationship of symptom-onset-to-balloon time and door-to-balloon time with mortality in patients undergoing angioplasty for acute myocardial infarction. JAMA 2000; 283: 2941-7.
14. Antoniucci D, Valenti R, Migliorini A, Moschi G, Trapani M, Buonamici P, et al. Relation of time to treatment and mortality in patients with acute myocardial infarction undergoing primary coronary angioplasty. Am J Cardiol 2002; 89: 1248-52.
15. Brodie BR, Stuckey TD, Muncy DB, Hansen CJ, Wall TC, Pulsipher M, et al. Importance of time-to-reperfusion in patients with acute myocardial infarction with and without cardiogenic shock treated with primary percutaneous coronary intervention. Am Heart J 2003; 145: 708-15.
16. De Luca G, Suryapranata H, Zijlstra F, van't Hof AW, Hoorntje JC, Gosselink AT, et al. Symptom-onset-to-balloon time and mortality in patients with acute myocardial infarction treated by primary angioplasty. J Am Coll Cardiol 2003; 42: 991-7.
17. Magid DJ, Wang Y, Herrin J, McNamara RL, Bradley EH, Curtis JP, et al. Relationship between time of day, day of week, timeliness of reperfusion, and in-hospital mortality for patients with acute

ST-segment elevation myocardial infarction. JAMA 2005; 294: 803-12.
18. Gibbons RJ, Holmes DR, Reeder GS, Bailey KR, Hopfenspirger MR, Gersh BJ. Immediate angioplasty compared with the administration of a thrombolytic agent followed by conservative treatment for myocardial infarction. The Mayo Coronary Care Unit and Catheterization Laboratory Groups. N Engl J Med 1993; 328: 685-91.
19. Grines CL, Browne KF, Marco J, Rothbaum D, Stone GW, O'Keefe J, et al. A comparison of immediate angioplasty with thrombolytic therapy for acute myocardial infarction. The Primary Angioplasty in Myocardial Infarction Study Group. N Engl J Med 1993; 328: 673-9.
20. Zijlstra F, de Boer MJ, Hoorntje JC, Reiffers S, Reiber JH, Suryapranata H. A comparison of immediate coronary angioplasty with intravenous streptokinase in acute myocardial infarction. N Engl J Med 1993; 328: 680-4.
21. Keeley EC, Boura JA, Grines CL. Primary angioplasty versus intravenous thrombolytic therapy for acute myocardial infarction: a quantitative review of 23 randomised trials. Lancet 2003; 361: 13-20.
22. Steg PG, Goldberg RJ, Gore JM, Fox KA, Eagle KA, Flather MD, et al. Baseline characteristics, management practices, and in-hospital outcomes of patients hospitalized with acute coronary syndromes in the Global Registry of Acute Coronary Events (GRACE). Am J Cardiol 2002; 90: 358-63.
23. Hochman JS, Sleeper LA, Webb JG, Sanborn TA, White HD, Talley JD, et al. Early revascularization in acute myocardial infarction complicated by cardiogenic shock. SHOCK Investigators. Should we emergently revascularize occluded coronaries for cardiogenic shock. N Engl J Med 1999; 341: 625-34.

การศึกษาผู้ป่วยที่รับการรักษาด้วยการทำบอลลูนขยายหลอดเลือดในเวลาราชการเปรียบเทียบกับนอกเวลาราชการในผู้ป่วยกล้ามเนื้อหัวใจตายเฉียบพลันชนิด ST-elevation

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ภูมิหลังและวัตถุประสงค์: *การทำบอลลูนขยายหลอดเลือดหัวใจเป็นการรักษาที่เหมาะสมที่สุดในผู้ป่วยที่มาด้วยภาวะกล้ามเนื้อหัวใจขาดเลือดเฉียบพลันที่เป็นแบบ ST elevation อย่างไรก็ตาม ในช่วงนอกเวลาราชการ การทำบอลลูนในผู้ป่วยเหล่านี้ยังเป็นที่สงสัยว่าจะมีประสิทธิภาพดีเท่าในเวลาราชการหรือไม่ ทั้งนี้เพราะคาดว่ามีการเสียเวลาไปในช่วงระหว่างรอเจ้าหน้าที่และแพทย์ ทำให้ผู้ป่วยได้รับการรักษาล่าช้าไป*

วัสดุและวิธีการ: *เป็นการเก็บข้อมูลลงทะเบียนผู้ป่วยที่มาด้วย ภาวะกล้ามเนื้อหัวใจขาดเลือดเฉียบพลันที่เป็นแบบ ST elevation ในโรงพยาบาลจุฬาลงกรณ์ตั้งแต่เดือน พฤษภาคมปี พ.ศ. 2542 จนถึงธันวาคม พ.ศ. 2547 การวิเคราะห์ทางสถิติใช้วิธี Kaplan Meier survival analysis เพื่อดูอัตราตายในโรงพยาบาล และ ใช้ multivariate analysis ในการดูปัจจัยที่มีผลต่อการตายในโรงพยาบาลของผู้ป่วย*

ผลการศึกษา: *ผู้ป่วยต่อเนื่องจำนวน 256 ราย {107 รายเป็นผู้ป่วยในเวลาราชการ (OH) และ 149 ราย เป็นผู้ป่วยนอกเวลาราชการ (non-OH)} ที่ได้รับการทำบอลลูนขยายหลอดเลือดหัวใจที่มาด้วยภาวะกล้ามเนื้อหัวใจขาดเลือดเฉียบพลันที่เป็นแบบ ST elevation อายุเฉลี่ย (61.9 $\pm$ 12.2 ปี เทียบกับ 60.6 $\pm$ 12.8 ปี, p = ns), เพศชาย (73.8% กับ 73.2%, p = ns), ประวัติการเป็นเบาหวาน (30.2% เทียบกับ 33.8%, p = ns), ความรุนแรงของโรค (ภาวะช็อก 22.4% เทียบกับ 21.5%), ความสามารถในการทำงานของหัวใจ (LVEF 48.7 $\pm$ 15.1 เทียบกับ 45.9 $\pm$ 14.7), ความจำเป็นต้องช่วยชีวิตผู้ป่วยโดยการกู้ชีวิต (15.0% เทียบกับ 14.2%), การตายของกล้ามเนื้อหัวใจตายส่วนหน้า ไม่พบมีความแตกต่างอย่างมีนัยสำคัญทางสถิติ ภาวะความดันโลหิตสูงพบน้อยกว่าในกลุ่ม OH (39.6% เทียบกับ 52.7%, p = 0.04) แต่ผู้ป่วยมีอัตราการสูบบุหรี่มากกว่า (62.6% เทียบกับ 49.0%, p = 0.03) ระยะเวลา door to balloon และระยะเวลาตั้งแต่ตัดสินใจจนถึงทำบอลลูน สั้นกว่าในกลุ่ม OH อย่างมีนัยสำคัญ (67.9 $\pm$ 47 เทียบกับ 119.6 $\pm$ 83 นาที, p < 0.001 และ 60.8 $\pm$ 35 เทียบกับ 98.3 นาที, p < 0.001) อย่างไรก็ตาม ระยะเวลาที่เริ่มเจ็บหน้าอกจนถึงได้รับการทำบอลลูนไม่แตกต่างกัน (402 $\pm$ 316 เทียบกับ 424 $\pm$ 215 นาที, p = 0.55) ความสำเร็จในการขยายบอลลูนในกลุ่ม OH เท่ากับ 98.1% เทียบกับ 94.7% ในกลุ่ม non-OH อัตราตายในโรงพยาบาลเท่ากับ 10.3% และ 10.7% ตามลำดับ*

สรุป: *ระยะเวลา door to balloon ในการทำบอลลูนขยายหลอดเลือดหัวใจในผู้ป่วยที่มาด้วยภาวะกล้ามเนื้อหัวใจขาดเลือดเฉียบพลันที่เป็นแบบ ST elevation ที่มาในเวลาราชการ จะสั้นกว่านอกเวลาราชการ แต่อย่างไรก็ตาม อัตราตายในผู้ป่วยทั้งสองกลุ่มไม่มีความแตกต่างกันอย่างมีนัยสำคัญทางสถิติ*