Predictors of In-Hospital Mortality in Non-ST Elevation Acute Coronary Syndrome in Thai Acute Coronary Syndrome Registry (TACSR)†

Songsak Kiatchoosakun MD*, Chaiyasith Wongvipaporn MD*, Adisai Buakhamsri MD**, Sopon Sanguanwong MD***, Worachat Moleerergpoom, MD****, Pongdech Sarakarn*****, Songkwan Silaruks MD*, Pyatat Tatsanavivat MD*

† *The Thai Acute Coronary Syndrome Registry (TACSR)*
* *Division of Cardiology, Department of Medicine, Faculty of Medicine, Khon Kaen University, Khon Kaen*
** *Division of Cardiology, Department of Medicine, Thammasat Chalermphakiat Hospital, Bangkok*
*** *Division of Cardiology, Pramongkutklao Hospital, Bangkok*
**** *Police General Hospital, Bangkok*
***** *Faculty of Public Health, Khon Kaen University, Khon Kaen*

Objective: *To determine baseline prognostic factors of in-hospital mortality in Thai patients with non-ST-elevation acute coronary syndrome (NSTE-ACS).*
Material and Method: *Among 5,537 NSTE-ACS patients enrolled in Thai Acute Coronary Syndrome Registry, a univariate analysis and multivariate analysis were used to estimate the relationship of baseline clinical variables and in-hospital mortality. Variables examined included demographics, history and presenting characteristics.*
Results: *The in-hospital mortality rate was 9.5%. The statistically significant, adjusted baseline prognostic factors of in-hospital death were older age(≥ 65 years)(odds ratio [OR] 2.2, 95% confidence interval [CI] = 1.54-3.09), shock at presentation (OR 4.6, 95%CI = 2.91-7.32), heart failure (OR 3.1, 95%CI = 2.15-4.38), positive cardiac marker (OR 1.7, 95%CI = 1.18-2.53), arrhythmia (OR 12.3, 95%CI = 8.71-17.35), major bleeding (OR 2.9, 95%CI = 1.84-4.51), and cerebrovascular accident (OR 4.9, 95% CI = 2.42-9.97). While dyslipidemia (OR 0.6, 95%CI = 0.45-0.87), having percutaneous coronary intervention (OR 0.6, 95% CI = 0.39-0.94), receiving aspirin (OR 0.6, 95%CI = 0.33-0.94), beta-blocker (OR 0.5, 95% CI = 0.40-0.73), angiotensin converting enzyme inhibitor (OR 0.6, 95% CI = 0.43-0.78) and nitrate (OR 0.5, 95%CI = 0.35-0.76) were associated with lower in-hospital mortality.*
Conclusion: *The in-hospital mortality is higher in Thai NSTE-ACS patients compared to other populations. The present study supports and confirms the prognostics importance of several baseline characteristics reported in previous studies.*

Keywords: *Acute coronary syndrome, Non-ST elevation, In hospital mortality, Predictor*

J Med Assoc Thai 2007; 90 (Suppl 1): 41-50
Full text. e-Journal: *http://www.medassocthai.org/journal*

Acute coronary syndrome (ACS) is a major health problem and represents a large number of hospitalizations annually worldwide[1]. It includes ST elevation myocardial infarction (STEMI), non-ST elevation myocardial infarction (NSTEMI), and unstable angina (UA). The in-hospital mortality of NSTEMI is lower than STEMI (10-15%), but one month to one year mortality is equal or even exceeds STEMI[2]. UA and NSTEMI share similar pathophysiology and clinical presentation, but NSTEMI is characterized by increase

Correspondence to : Kiatchoosakun S, Division of Cardiology, Faculty of Medicine, Khon Kaen University, Khon Kaen 40002, Thailand. Phone: 043-348-399, Fax: 043-202-047, E-mail: sonkia@ kku.ac.th

in the biochemical markers of myocardial injury. Therefore, from a practical standpoint, non-ST elevation acute coronary syndrome (NSTE-ACS) has become the preferred diagnosis for UA/ NSTEMI. NSTE-ACS includes patients with a widely varying risk and a range of therapeutic alternatives[3-6]. The outcome of patients with acute coronary syndromes (ACS) varies internationally. Patient factors played a more significant role than hospital and country factors in a large clinical trial[7], while the community and hospital factors are important determinants of individual outcomes after AMI in a country survey[8]. In addition, the GRACE study reveals substantial differences in the management of patients based on hospital type and location[9]. Therefore, how much patient, hospital, and country level factors contribute on clinical outcomes remains unclear. Since Thailand has recently implemented universal access to subsidized health care, "30 baht treat all" scheme, people pay 30 baht (£0.50, ¸0.7, $0.86) for each visit or admission[10], the Thai ACS Registry was conducted to obtain a needed locally- relevant database to maximize the benefit of the scheme and for improving local clinical practice guidelines. The present study was conducted as a part of the Thai ACS Registry to determine baseline, prognostic variables of in-hospital mortality in NSTE-ACS patients as baseline knowledge for future studies in the changing local health care system.

Material and Method

Patients population

The patients in Thai ACS registry were recruited from 17 major hospitals, both government and private, nationwide, from August 1, 2002, through October 31, 2005. The authors enrolled patients 18 years and older, presenting with typical acute ischemia symptom of less than 14 days with at least one of the following: electrocardiographic changes consistent with ACS and/or increase in serum cardiac markers of myocardial necrosis. The patients were then classified into three groups according to discharged diagnosis: STEMI, non-STEMI, and UA.

STEMI is diagnosed according to the WHO criteria[11] (symptom of chest pain compatible with ACS for more than 20 minutes, ST-elevation $\geq$ 1 mm in two consecutive leads or new or presumed new LBBB and elevated biochemical markers of myocardial necrosis either CK-MB or troponin (troponin T > 0.1 μg/dL or CK-MB > 2 upper limit of normal for participating institute).

NSTEMI was determined by chest pain compatible with ACS and abnormal ST depression or T wave inversion with elevated biochemical markers of myocardial necrosis; if cardiac markers were normal, the patient was classified as UA. Both NSTEMI and UA were combined as NSTE-ACS; such that, patients with STEMI or new left bundle branch block were excluded from our study.

Diabetes was diagnosed when the patient's fasting plasma glucose was 126 mg/dL or higher for at least two times or the patients had a history of diabetes either dietary controlled or treated with medications.

Hypertension was defined when the patient's systolic blood pressure >140 mmHg or diastolic blood pressure > 90 mmHg or the patient was previously diagnosed of hypertension.

Dyslipidemia was diagnosed when total cholesterol > 200 mg/dL or LDL cholesterol $\geq$ 130 mg/dL or HDL cholesterol < 40 mg/dL or the patient was previously diagnosed as dyslipidemia or currently on lipid lowering agents.

Smoking was defined when the patient habitually smoked or had quit smoking for less than 2 years. Both NSTEMI and UA were combined as NSTE-ACS, patients with STEMI or new left bundle branch block were excluded from the present study.

The present study complies with the *Declaration of Helsinki* and ethics committee for human research in each participating centre has approved the research protocol.

Data collection

Nurses from all sites were trained to extract data from medical records using the standardized case report form; each collected case report form was verified and countersigned by site investigator. Demographic characteristics, presenting symptoms, medication during the hospital stay and on discharge, cardiac procedures and hospital outcome data were collected.

Double data entries using the web-based data entry system of Thai ACS registry were performed. Each electronic submission was carefully examined by the central data centre to ascertain completeness and accuracy. Individual investigators were promptly queried vis-āvis any incomplete or confusing reports. Internal monitors and external audits at every site were regularly performed at 3-6 months interval.

End points and clinical definitions

Death was defined as all cause mortality during hospitalization. Stroke was defined as a neurological deficit occurring prior to admission and lasting

> 24 hrs. The diagnosis of shock included: 1) systolic blood pressure < 90 mmHg for ≥ 30 mins and 2) tissue hypoperfusion manifested by oliguria, peripheral vasoconstriction or altered mental status, or 3) low cardiac output not related to hypovolemia (cardiac index < 2.2L/min/m^2 and pulmonary capillary wedge pressure > 15 mmHg).

Statistical analysis

The distribution of a continuous variable was expressed as mean, standard deviation, or median where appropriate and discrete variables were presented as percentage. A univariate analyses were used to examine the individual relationship between each variable and in-hospital death and multivariate analyses to assess whether prognostic variables were still statistically significant when adjusted for other variables that were significantly associated with in hospital-death on the univariate analysis. A two-sided p-value < 0.05 was considered statistically significance. All analyses were performed by using STATA version 8.0 from STATA Corporation.

Results

Study population

Five thousand five hundred and thirty seven NSTE-ACS patients were enrolled in the Thai ACS registry from August 1, 2002, through October 31, 2005. All in-hospital mortality events were available. There were 526 in-hospital deaths (9.5%). The median time (minimum, maximum) from the onset of the episode of chest pain to admission was 6.0 (0,340.5) hours, the respective time of hospitalization and time of death after hospitalization were 7.2 (0.04, 185.1) days and 5.7 (0.04, 185.1) days.

Baseline characteristics and major cardiovascular events

Demographic characteristics, presenting clinical features, complications and medical treatment of patients who died and overall population are presented in Table 1. The present study population mean age was 67.2 ± 11.4; 54.0% were male; 72.5% had history of hypertension; 77.3% has dyslipidemia; smoking related history found in 24.7%; diabetes in 48.9%; 19.6% underwent percutaneous coronary intervention (PCI); 7.2% had coronary artery bypass graft, 45.8% had congestive heart failure, 38.8% of congestive failure were in Killip class III & IV; and, 1.6% had a cerebrovascular accident (CVA) while hospitalized and 63.1% had positive cardiac markers tested at hospital presentation. Only 2.1% had resuscitated cardiac arrest and 4.5% were in a stage of shock at presentation.

Aspirin was most frequently prescribed (94.4% of patients), while 81.6% were on statins, two-thirds on beta-blocker and low-molecular weight heparin (LMWH). About half of the patients received angiotensin converting enzyme inhibitors (ACEI) or angiotensin receptor blockers (ARB), while a quarter were on calcium channel blockers (CCB).

Unadjusted hospital mortality associated risks (Table 2)

In the univariate analysis, age ≥ 65 years, diabetes, dyslipidemia, congestive heart failure, resuscitated cardiac arrest, heart failure, positive cardiac markers, PCI and in-hospital complications (*viz.,* arrhythmia, major bleeding and CVA) were independently-related with an increase in in-hospital death. By comparison, sex, hypertension, smoking and the presence of coronary artery disease in the family had no associated risk with in-hospital death.

Adjusted hospital mortality associated risk-multivariable analyses

After adjustment for significant variables found in the univariate analysis, the multivariate analysis found seven variables significantly-associated with an increase in in-hospital death (*viz*., age ≥ 65 years (odds ratio [OR] 2.2, 95% confidence interval [CI] = 1.54-3.09), shock at presentation (OR 4.6, 95%CI = 2.91-7.32), heart failure (OR 3.1, 95%CI = 2.15-4.38), cardiac marker (OR 1.7, 95%CI = 1.18-2.53), arrhythmia (OR 12.3, 95%CI = 8.71-17.35), major bleeding (OR 2.9, 95%CI = 1.84-4.51) and CVA (OR 4.9, 95%CI = 2.42-9.97). On the other hand, a lower mortality was associated with: dyslipidemia (OR 0.6, 95%CI = 0.45-0.87), having PCI (OR 0.6, 95%CI = 0.39-0.94), receiving aspirin (OR 0.6, 95%CI = 0.33-0.94), beta-blocker (OR 0.5, 95% CI = 0.40-0.73), ACEI (OR 0.6, 95%CI = 0.43-0.78), and nitrate (OR 0.5, 95%CI = 0.35-0.76) were associated with lower mortality (Table 3).

Discussion

Of the eight independent predictors of in-hospital and 6 month mortality found in the GRACE study[12,13], three predictors- *i.e.,* older age, higher Killip class, and positive cardiac markers were also predictors in the present study and resuscitated cardiac arrest was not, while the other four predictors, systolic blood pressure, ST-segment deviation, serum creatinine level and heart rate were not collected in TACS. Other statistically significant in-hospital death predictors include

Table 1. Baseline characteristics

Risk factor	Overall population (n = 5537)	In-hospital survive (n = 5011)	In-hospital deaths (n = 526)
Demographics			
Age(year)			
Mean ± SD	67.2 ± 11.4	66.7 ± 11.3	72.1 ± 11.6
Median (min, max)	68.0 (22.8, 105.5)	67.6 (22.8, 102.6)	73.0 (34.9, 105.5)
Interquartile range	15.6	15.6	13.5
Age group (year)			
< 65	2172 (39.2%)	2047 (40.9%)	125 (23.8%)
≥ 65	3365 (60.8%)	2964 (59.2%)	401 (76.2%)
Sex : Male (%)	2992 (54.0%)	2720 (54.3%)	272 (51.7%)
Onset of symptom (hour)			
Mean ± SD	30.4 ± 54.7	30.8 ± 54.9	26.9 ± 51.7
Median (min, max)	6.0 (0, 340.5)	6.1 (0, 304.5)	5.0 (0, 336)
Interquartile range	27.5	28.5	23.1
In-hospital (day)			
Mean ± SD	10.6 ± 11.5	10.4 ± 10.5	12.8 ± 18.3
Median (min, max)	7.2 (0.04, 185.1)	7.2 (0.07, 184.8)	5.7 (0.04, 185.1)
Interquartile range	8.8	8.3	15.7
Medical history (%)			
Diabetes mellitus	2686/5486 (48.9%)	2410/4975 (48.4%)	276/511 (54.0%)
Hypertension	3994/5509 (72.5%)	3633/4992 (72.8%)	361/517 (69.8%)
Smoking	1337/5424 (24.7%)	1226/4920 (24.9%)	111/504 (22.0%)
Dyslipidemia	4023/5205 (77.3%)	3721/4749 (78.4%)	302/456 (66.2%)
Family history of CAD	490/4609 (10.6%)	458/4189 (10.9%)	32/420 (7.6%)
Presenting symptoms (%)			
Typical chest pain	3477/4562 (76.2%)	3239/4150 (78.1%)	238/412 (57.8%)
Atypical chest pain	674/4562 (14.8%)	594/4150 (14.3%)	80/412 (19.4%)
Shock	247/5537 (4.5%)	126/5011 (2.5%)	121/526 (23.0%)
Resuscitated cardiac arrest	115/5537 (2.1%)	54/5011 (1.1%)	61/526 (11.6%)
Heart failure (total)	2538/5537 (45.8%)	2122/5011 (42.4%)	416/526 (79.1%)
Heart failure within 48 hrs	2412/2538 (95.0%)	2033/2122 (95.8%)	379/416 (91.1%)
Killip II	1477/2412 (61.2%)	1342/2033 (66.0%)	135/379 (35.6%)
Killip III	634/2412 (26.3%)	534/2033 (26.3%)	100/379 (26.4%)
Killip IV	301/2412 (12.5%)	157/2033 (7.7%)	144/379 (38.0%)
Positive cardiac marker (%)	3333/5286(63.1%)	2895/4779 (60.6%)	438/507 (86.4%)
Reperfusion therapy (%)			
PCI	1083/5537 (19.6%)	1026/5011 (20.6%)	57/526 (10.8%)
CABG	396/5537 (7.2%)	352/5011 (7.0%)	44/526 (8.4%)
Complications (%)			
Arrhythmias	440/5537 (8.0%)	216/5011 (4.3%)	224/526 (42.6%)
Major bleeding	254/5537 (4.6%)	183/5011 (3.7%)	71/526 (13.5%)
CVA	89/5537 (1.6%)	58/5011 (1.2%)	31/526 (5.9%)
Medications (%)			
ASA	5229 (94.4%)	4780 (95.4%)	449 (85.4%)
Nitrate	4906 (88.6%)	4524 (90.3%)	382 (72.6%)
Beta-blocker	3616 (65.3%)	3426 (68.4%)	190 (36.1%)
LMWH	3800 (68.6%)	3490 (69.7%)	310 (58.9%)
ACEI	3138 (56.7%)	2920 (58.3%)	218 (41.4%)
Statin	4517 (81.6%)	4205 (83.9%)	312 (59.3%)
GP IIb/IIIa inhibitor	252 (4.6%)	228 (4.6%)	24 (4.6%)
Calcium blocker	1519 (27.4%)	1420 (28.3%)	99 (18.8%)
ARB	533 (9.6%)	501 (10.0%)	32 (6.1%)

Table 2. In-hospital mortality in relation to baseline characteristics

Risk factor category	Mortality rate (%)	OR (95%CI)	χ^2	p-value
Demographics				
Sex				
Male	9.1	0.9 (0.75-1.08)	1.3	0.261
Female	10.0			
Age group (year)				
≥ 65	11.9	2.2 (1.79-2.75)	58.3	<0.001
< 65	5.8			
Medical history				
Diabetes mellitus				
Yes	10.3	1.3 (1.04-1.51)	5.8	0.017
No	8.4			
Hypertension				
Yes	9.0	0.9 (0.71-1.06)	2.1	0.153
No	10.3			
Smoking				
Yes	8.3	0.9 (0.68-1.06)	2.1	0.151
No	9.6			
Dyslipidemia				
Yes	7.5	0.5 (0.44-0.67)	34.9	<0.001
No	13.0			
Family history of CAD				
Yes	9.7	1.1 (0.84-1.28)	0.1	0.729
No	9.4			
Presenting symptoms				
Typical chest pain				
Yes	6.8	0.4 (0.31-0.48)	85.1	<0.001
No	16.0			
Atypical chest pain				
Yes	11.9	1.4 (1.10-1.88)	7.8	0.005
No	8.5			
Shock				
Yes	49.0	11.6 (8.76-15.29)	468.9	<0.001
No	7.7			
Resuscitated cardiac arrest				
Yes	53.0	12.0 (8.10-17.91)	259.0	<0.001
No	8.6			
Heart failure				
Yes	16.4	5.2 (4.13-6.46)	258.8	<0.001
No	3.7			
Positive cardiac marker				
Yes	13.1	4.1 (3.17-5.44)	131.1	<0.001
No	3.5			
Reperfusion therapy				
PCI				
Yes	5.3	0.5 (0.35-0.63)	28.1	<0.001
No	10.5			
CABG				
Yes	11.1	1.2 (0.85-1.68)	1.3	0.256
No	9.4			
Complications				
Arrhythmias				
Yes	50.9	16.5 (13.12-20.64)	953.3	<0.001
No	5.9			

Table 2. In-hospital mortality in relation to baseline characteristics (continue)

Risk factor category	Mortality rate (%)	OR (95%CI)	χ^2	p-value
Complications				
Major bleeding				
Yes	28.0	4.1 (3.03-5.54)	105.4	<0.001
No	8.6			
CVA				
Yes	34.8	5.4 (3.31-8.50)	67.5	<0.001
No	9.1			
Medications				
ASA				
Yes	8.6	0.3 (0.21-0.38)	91.1	<0.001
No	25.0			
Nitrate				
Yes	7.8	0.3 (0.23-0.36)	146.9	<0.001
No	22.8			
Beta blocker				
Yes	5.3	0.3 (0.22-0.32)	218.5	<0.001
No	17.5			
LMWH				
Yes	8.2	0.6 (0.52-0.75)	25.4	<0.001
No	12.4			
ACEI				
Yes	7.0	0.5 (0.42-0.61)	54.9	<0.001
No	12.8			
Statin				
Yes	6.9	0.3 (0.23-0.34)	191.7	<0.001
No	21.0			
GP IIb/IIIa inhibitor				
Yes	9.5	1.0 (0.62-1.55)	0.0	0.989
No	9.5			
Calcium blocker				
Yes	6.5	0.6 (0.46-0.74)	121.7	<0.001
No	10.6			
ARB				
Yes	6.0	0.6 (0.39-0.85)	8.4	0.004
No	9.9			

shock at presentation, arrhythmia, major bleeding, and CVA.

The new variable that adds more predictive information in the present study is CVA, which occurred in 1.6% of overall population. Although stroke occurred rarely in NSTE-ACS but it can complicate the course of patient with acute coronary syndrome[14]. Interestingly, the unadjusted in-hospital mortality rate was not statistically higher in smokers than non-smokers, so smoker's paradox was not demonstrated in the present study as similar to other studies[15,16].

The use of aspirin (94% *vs*. 91%), ACE inhibitor (56.7% *vs.* 55%), and calcium channel blockers (27.4% *vs.* 29%) were closely similar to the GRACE study[9]. In contrast, a higher use of statins (81.6% *vs.* 51%), LMWH (68.6% *vs.* 51%) and lower use of beta-blocker (65.3% *vs.* 78%) were noted in TACSR.

There was a higher, in-hospital mortality (9.5%) among NSTE-ACS in the present study than other studies - *i.e.,* 1.5% in PRAIS-UK[17], 2.8% in GRACE high risk NSTE-ACS[18] and 2.4% in EURO-Heart Survey ACS[19]. The differences between in-hospital mortality and pharmacological therapies observed in the present study *vs.* other studies may include one of the following two reasons. Firstly, most of the presented participating hospitals are referral, tertiary care hospitals, scattered across four regions of the country, while in other studies the hospitals represent different

Table 3. Multivariable predictors of in-hospital mortality

Risk Factor	OR (95%CI)	Adjusted OR (95%CI)	p-value
Demographics			
Age group (year)#	2.2 (1.79-2.75)	2.2 (1.54-3.09)	<0.001
Medical history			
Dyslipidemia	0.5 (0.44-0.67)	0.6 (0.45-0.87)	<0.005
Presenting symptoms			
Shock	11.6 (8.76-15.29)	4.6 (2.91-7.32)	<0.001
Heart failure	5.2 (4.13-6.46)	3.1 (2.15-4.38)	<0.001
Cardiac marker	4.1 (3.17-5.44)	1.7 (1.18-2.53)	<0.005
Reperfusion therapy			
PCI	0.5 (0.35-0.63)	0.6 (0.39-0.94)	0.026
Complications			
Arrhythmias	16.5 (13.12-20.64)	12.3 (8.71-17.35)	<0.001
Major bleeding	4.1 (3.03-5.54)	2.9 (1.84-4.51)	<0.001
CVA	5.4 (3.31-8.50)	4.9 (2.42-9.97)	<0.001
Medications			
ASA	0.3 (0.21-0.38)	0.6 (0.33-0.94)	0.028
Beta-blocker	0.3 (0.22-0.32)	0.5 (0.40-0.73)	<0.001
ACEI	0.5 (0.42-0.61)	0.6 (0.43-0.78)	<0.001
Nitrate	0.3 (0.23-0.36)	0.5 (0.35-0.76)	0.001

Age ≥ 65 vs. < 65 years

Table 4. Major coronary risk factors in different studies comparing to TACSR

	Thai ACS	PRAIS-UK	GRACE	EURO-Heart survey
Diabetes	48.9%	16.3%	27.0%	23.5%
Hypertension	72.5%	37.0%	50.1%	63.6%
Dyslipidemia	77.3%	not available	36.0%	54.6%
Smoking	24.7%	22.9%	57.4%	53.8%

levels of hospitals and geographical regions. Secondly, the patients enrolled in the present study are at higher risk of developing adverse cardiac events due to older age, clinical heart failure (41.6% of the patients), objective evidence of ischemia on admission detected by electrocardiogram (all patients) and higher collective rates of main coronary risk factors (Table 4) (*i.e.,* diabetes, hypertension, dyslipidemia and smoking) than PRAIS-UK[17], the GRACE study[20] and the EURO-Heart survey[19].

Since TACSR population is consecutively recruited in general setting, a risk predictive model developed from this setting will provide better calibration in risk assessment across the spectrum of ACS than that derived from a clinical trial[21]. The authors therefore, developed a risk predictive model using the first phase recruited cohort and validates in the second phase recruited cohort. The predictive performance of the model was poor with the receiver operator curve of 65%. The model included nine variables, and some of important prognostic variables, shown in other studies as mentioned earlier, were not available for analysis. Therefore, the risk predictive model was not further advocated. Another utility of the Thai ACS Registry and NSTE-ACS, in particular, are the potential merits of a registry[11], which is timely, since it was initiated around the same time as the national universal health care coverage. When properly handled and planned, this registry will serve as a basis for the future useful repeated studies on health technology assessment and clinical practice guidelines development and implementation.

Limitations

Since this is the first large disease registry in Thailand, there were several constraints on conducting the present study, namely unfamiliar culture of teamwork approach, data quality assurance processes, and research prosecution with limited financial and human resources. Moreover, the authors did not systematically investigate left ventricular function and several important predictive risks of in-hospital death, including systolic blood pressure, heart rate at admission, serum creatinine and CRP[13,22-24].

Conclusion

The present study provides additional data and a better picture of clinical course, prognostic factors of in-hospital death of NSTE-ACS in a Southeast Asian country. Since the present study includes mainly major tertiary care hospitals, the prevalence of major coronary risks, as well as the in-hospital mortality, is higher in Thai NSTE-ACS patients than other populations. The present study also confirms the prognostic of several baseline characteristics reported from previous studies.

Contributors

The Thai Acute Coronary Syndrome Registry (TACSR) was supported by The Heart Association of Thailand under the Royal Patronage of H.M. the King, Thai Health Promotion Foundation, Clinical Research Collaboration Network (CRCN) and the Health Systems Research Institute (HSRI).

Acknowledgements

The authors wish to thank would like to express our gratitude to the patients and their relatives, to the personnel of the ICU and most of all, the research nurses who patiently and diligently assisted in all aspects of patient care and data collection and entry. The authors also wish to thank Mr. Bandit Thinkamrop for statistical advice and Mr. Bryan Roderick Hamman for assistance with the English language presentation of the manuscript.

References

1. Murray CJ, Lopez AD. Mortality by cause for eight regions of the world: Global Burden of Disease Study. Lancet 1997; 349: 1269-76.
2. Sheridan PJ, Crossman DC. Critical review of unstable angina and non-ST elevation myocardial infarction. Postgrad Med J 2002; 78: 717-26.
3. Antman EM, McCabe CH, Gurfinkel EP, Turpie AG, Bernink PJ, Salein D, et al. Enoxaparin prevents death and cardiac ischemic events in unstable angina/non-Q-wave myocardial infarction. Results of the thrombolysis in myocardial infarction (TIMI) 11B trial. Circulation 1999; 100: 1593-601.
4. Antman EM, Tanasijevic MJ, Thompson B, Schactman M, McCabe CH, Cannon CP, et al. Cardiac-specific troponin I levels to predict the risk of mortality in patients with acute coronary syndromes. N Engl J Med 1996; 335: 1342-9.
5. Boersma E, Pieper KS, Steyerberg EW, Wilcox RG, Chang WC, Lee KL, et al. Predictors of outcome in patients with acute coronary syndromes without persistent ST segment elevation. Results from an international trial of 9461 patients. The PURSUIT Investigators. Circulation 2000; 101: 2557-67.
6. Lindahl B, Toss H, Siegbahn A, Venge P, Wallentin L. Markers of myocardial damage and inflammation in relation to long-term mortality in unstable coronary artery disease. FRISC Study Group. Fragmin during Instability in Coronary Artery Disease. N Engl J Med 2000; 343: 1139-47.
7. Chang WC, Midodzi WK, Westerhout CM, Boersma E, Cooper J, Barnathan ES, et al. Are international differences in the outcomes of acute coronary syndromes apparent or real? A multilevel analysis. J Epidemiol Community Health 2005; 59: 427-33.
8. Alter DA, Austin PC, Tu JV. Community factors, hospital characteristics and inter-regional outcome variations following acute myocardial infarction in Canada. Can J Cardiol 2005; 21: 247-55.
9. Fox KA, Goodman SG, Klein W, Brieger D, Steg PG, Dabbous O, et al. Management of acute coronary syndromes. Variations in practice and outcome; findings from the Global Registry of Acute Coronary Events (GRACE). Eur Heart J 2002; 23: 1177-89.
10. Towse A, Mills A, Tangcharoensathien V. Learning from Thailand's health reforms. BMJ 2004; 328: 103-5.
11. Alpert JS. Are data from clinical registries of any value? Eur Heart J 2000; 21: 1399-401.
12. Eagle KA, Lim MJ, Dabbous OH, Pieper KS, Goldberg RJ, Van de WF, et al. A validated prediction model for all forms of acute coronary syndrome: estimating the risk of 6-month postdischarge death in an international registry. JAMA 2004; 291: 2727-33.
13. Granger CB, Goldberg RJ, Dabbous O, Pieper KS, Eagle KA, Cannon CP, et al. Predictors of hospital mortality in the global registry of acute coronary

events. Arch Intern Med 2003; 163: 2345-53.
14. Mahaffey KW, Harrington RA, Simoons ML, Granger CB, Graffagnino C, Alberts MJ, et al. Stroke in patients with acute coronary syndromes: incidence and outcomes in the platelet glycoprotein IIb/IIIa in unstable angina. Receptor suppression using integrilin therapy (PURSUIT) trial. The PURSUIT Investigators. Circulation 1999; 99: 2371-7.
15. Andrikopoulos GK, Richter DJ, Dilaveris PE, Pipilis A, Zaharoulis A, Gialafos JE, et al. In-hospital mortality of habitual cigarette smokers after acute myocardial infarction; the "smoker's paradox" in a countrywide study. Eur Heart J 2001; 22: 776-84.
16. Himbert D, Klutman M, Steg G, White K, Gulba DC. Cigarette smoking and acute coronary syndromes: a multinational observational study. Int J Cardiol 2005; 100: 109-17.
17. Collinson J, Flather MD, Fox KA, Findlay I, Rodrigues E, Dooley P, et al. Clinical outcomes, risk stratification and practice patterns of unstable angina and myocardial infarction without ST elevation: Prospective Registry of Acute Ischaemic Syndromes in the UK (PRAIS-UK). Eur Heart J 2000; 21: 1450-7.
18. Devlin G, Anderson FA, Heald S, Lopez-Sendon J, Avezum A, Elliott J, et al. Management and outcomes of lower risk patients presenting with acute coronary syndromes in a multinational observational registry. Heart 2005; 91: 1394-9.
19. Hasdai D, Behar S, Wallentin L, Danchin N, Gitt AK, Boersma E, et al. A prospective survey of the characteristics, treatments and outcomes of patients with acute coronary syndromes in Europe and the Mediterranean basin; the Euro Heart Survey of Acute Coronary Syndromes (Euro Heart Survey ACS). Eur Heart J 2002; 23: 1190-201.
20. Fox KA, Goodman SG, Anderson FA Jr, Granger CB, Moscucci M, Flather MD, et al. From guidelines to clinical practice: the impact of hospital and geographical characteristics on temporal trends in the management of acute coronary syndromes. The Global Registry of Acute Coronary Events (GRACE). Eur Heart J 2003; 24: 1414-24.
21. Yan AT, Jong P, Yan RT, Tan M, Fitchett D, Chow CM, et al. Clinical trial - derived risk model may not generalize to real-world patients with acute coronary syndrome. Am Heart J 2004; 148: 1020-7.
22. Morrow DA, Rifai N, Antman EM, Weiner DL, McCabe CH, Cannon CP, et al. C-reactive protein is a potent predictor of mortality independently of and in combination with troponin T in acute coronary syndromes: a TIMI 11A substudy. Thrombolysis in Myocardial Infarction. J Am Coll Cardiol 1998; 31: 1460-5.
23. Sabatine MS, Morrow DA, de Lemos JA, Gibson CM, Murphy SA, Rifai N, et al. Multimarker approach to risk stratification in non-ST elevation acute coronary syndromes: simultaneous assessment of troponin I, C-reactive protein, and B-type natriuretic peptide. Circulation 2002; 105: 1760-3.
24. Santopinto JJ, Fox KA, Goldberg RJ, Budaj A, Pinero G, Avezum A, et al. Creatinine clearance and adverse hospital outcomes in patients with acute coronary syndromes: findings from the global registry of acute coronary events (GRACE). Heart 2003; 89: 1003-8.

ปัจจัยทำนายการเสียชีวิตในโรงพยาบาลของผู้ป่วยกลุ่มอาการ non- ST elevation acute coronary syndromeในโครงการทะเบียนผู้ป่วยกล้ามเนื้อหัวใจขาดเลือดเฉียบพลันแห่งประเทศไทย

ทรงศักดิ์ เกียรติชูสกุล, ไชยสิทธิ์ วงศ์วิภาพร, อดิศัย บัวคำศรี, โสภณ สงวนวงษ์, วรชาติ โมฬีฤกษ์ภูมิ, พงษ์เดช สารขันธ์, ทรงขวัญ ศิลารักษ์, ปิยทัศน์ ทัศนาวิวัฒน์

ภูมิหลัง: *ผู้ป่วยกลุ่มอาการ non- ST elevation acute coronary syndrome มีความรุนแรงของโรคแตกต่างกันมาก การประเมินความรุนแรงของโรคโดยอาศัยข้อมูลพื้นฐานของผู้ป่วยจะเป็นประโยชน์ในการพยากรณ์โรค และการวางแผนดูแลรักษาผู้ป่วย*

วัตถุประสงค์: *เพื่อหาตัวทำนายการเสียชีวิตในโรงพยาบาลของผู้ป่วยกลุ่มอาการ non- ST elevation acute coronary syndrome*

วัสดุและวิธีการ: *ข้อมูลได้จากผู้ป่วย non-ST elevation acute coronary syndrome ในโครงการทะเบียนผู้ป่วยกล้ามเนื้อหัวใจขาดเลือดเฉียบพลันแห่งประเทศไทย ซึ่งเป็นการศึกษาใน 17 โรงพยาบาลทั่วประเทศ โดยทำการเก็บข้อมูลตั้งแต่เดือนสิงหาคม พ.ศ. 2545 ถึงเดือน ตุลาคม พ.ศ. 2548*

ผลการศึกษา: *จำนวนผู้ป่วยทั้งหมด 5,537 ราย อัตราการเสียชีวิตในโรงพยาบาลคิดเป็นร้อยละ 9.5 ลักษณะทางคลินิกที่มีความสัมพันธ์กับการเสียชีวิตในโรงพยาบาลคือ อายุที่มากกว่าหรือเท่ากับ 65 ปี (odds ratio [OR], 2.2; 95% Confidence Interval [CI] 1.54-3.09) ภาวะช็อก (OR 4.6; 95%CI 2.91-7.32) ภาวะหัวใจล้มเหลว (OR 3.1; 95%CI 2.15-4.38) การตรวจพบ cardiac marker (OR 1.7, 95%CI 1.18-2.53), ภาวะหัวใจเต้นผิดจังหวะ(OR 12.3; 95%CI 8.71-17.35) ภาวะเลือดออกชนิดรุนแรง (OR 2.9; 95%CI 1.84-4.51) และโรคหลอดเลือดสมอง (OR 4.9; 95%CI 2.42-9.97) ในขณะที่ภาวะไขมันผิดปกติ (OR 0.6, 95%CI 0.45-0.87) การขยายหลอดเลือดหัวใจผ่านทางผิวหนัง (OR 0.6; 95%CI 0.39-0.94) การได้รับยา aspirin (OR 0.6; 95%CI 0.36-0.97), beta-blocker (OR 0.5; 95%CI 0.38-0.73), angiotensin converting enzyme inhibitor (OR 0.6; 95%CI 0.33-0.94), beta-blocker (OR 0.5; 95%CI 0.40-0.73), angiotensin receptor antagonist (OR 0.6; 95%CI 0.43-0.78)และ nitrate (OR 0.5, 95%CI 0.35-0.76) จะมีผลทำให้อัตราการเสียชีวิตในโรงพยาบาลลดลง*

สรุป: *การศึกษานี้พบว่ามีปัจจัยหลายอย่างที่มีความสัมพันธ์กับการเสียชีวิตในโรงพยาบาลของผู้ป่วย non-ST elevation acute coronary syndrome คล้ายกับการศึกษาอื่นๆ และพบว่าโรคหลอดเลือดสมองมีความสัมพันธ์กับการเสียชีวิตในโรงพยาบาลของผู้ป่วยซึ่งยังไม่เคยมีในรายงานของการศึกษาก่อนหน้านี้*