

# Identifying Factors that Influence the Length of Stay in Patients with Non-ST Segment Elevation Acute Coronary Syndrome in Siriraj Hospital

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**Objective:** Acute coronary syndrome is a leading cause of hospitalization from cardiac disease. The Siriraj NSTEMI-ACS registry was developed in 2012 as a single center registry. This study purpose is to identify factors affecting the length of stay of the patients in the registry.

**Material and Method:** From January 2012 to March 2013, 130 patients were enrolled consecutively. The patients were classified into two groups; patients with length of stay >5 days, and a group of patients with length of stay ≤5 days. Comparison of variables of interest among the patient groups was performed using appropriate statistic

**Results:** There were 130 patients in the study. Males were predominate (56.9%). More than 80% of the patients were classified as high-risk based on TIMI risk score ≥3. Most patients (64.6%) had LOS >5 days. Among various variables, coronary angiogram during admission, heart failure at presentation, and GRACE risk score >130 were associated with LOS >5 days with the odds ratio of 4.05, 4.34, and 3.23, respectively. Reimbursement policy also had impact on LOS. Using universal coverage as a reference, odds ratio for LOS >5 days for government paid policy and self paid/private insurance policy were 0.28 and 0.05, respectively.

**Conclusion:** Factors affecting LOS include CAG during admission, reimbursement policy, heart failure at presentation, and the GRACE risk score >130. Heart failure at presentation had highest impact on length of stay with an adjusted odds ratio of 4.34.

**Keywords:** Non-ST-segment elevation myocardial infarction, Length of stay, Reimbursement policy

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Acute coronary syndrome is a leading cause of hospitalization from cardiac disease. In Thailand, data from TRACS study revealed close mortality rate for ST-segment-elevation myocardial infarction (STEMI) and non-ST-segment-elevation acute coronary syndrome (NSTEMI-ACS), which was 5.5% and 5.1%, respectively<sup>(1)</sup>. Furthermore, the latter group of patients had longer length of stay (LOS), 6.7 vs. 8.8 days. These were different from most studies from the Western world<sup>(2-4)</sup>. The Siriraj NSTEMI-ACS registry was developed in 2012 as a single center registry to gather information prospectively of all patients who were admitted to Siriraj Hospital with a diagnosis of NSTEMI-ACS. The

present study sought to identify factors affecting the LOS of patients in the registry. This study was approved by Siriraj Hospital's ethic committee and was supported by Siriraj Research Development Fund (Managed by Routine to Research: R2R)

## Material and Method

### Patient population

From January 6, 2012 to March 30, 2013 130 consecutive patients with NSTEMI-ACS who were admitted to Siriraj Hospital were prospectively enrolled into the registry. The inclusion criteria include all of the following:

1. Patients age 18 years or older
2. Patients who were admitted to Siriraj Hospital with a diagnosis of NSTEMI-ACS
3. Patients who agreed to participate in the present study and signed the informed consent form.

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The exclusion criteria include:

1. Patients who had severe comorbid diseases with a life expectancy of less than one year.
2. Patients who were obviously admitted to the hospital with others diagnosis and developed NSTEMI-ACS later during the course of admission.
3. Patients who refused to participate in the study.

### **Study protocol**

The Siriraj NSTEMI-ACS registry is a prospective, non-blinded, and non-intervention study. All patients eligible for the study were identified by the research team. Diagnosis of NSTEMI-ACS was made by cardiologist base on presence of angina, abnormal electrocardiogram, and/or rising of cardiac biomarkers. Informed consent was obtained from the patients or the first degree relative in case patients were unable to communicate. Parameters of interest were recorded in the case record form and were later transferred to the database. Data from the first 130 patients in the registry were extracted and analyzed in the present study. Patients were classified into two groups: a group for which the length of stay was more than 5 days, and a group with length of stay less than or equal to 5 days. Variables of interest were analyzed to seek four factors, which significantly affected LOS using appropriate statistical methods.

### **Statistical analysis**

Categorical variables are described as frequency and percentages. Continuous variables are presented as mean  $\pm$  standard deviation or median (minimum and maximum) as appropriate. Differences between categorical variables were tested by Chi-square analysis. Differences among continuous variables were tested by the t-test for mean values and by Fisher's exact test for median values. All statistical tests were 2-tailed with  $p$ -value  $<0.05$  considered statistically significant. Variables with a  $p$ -value of  $\leq 0.1$  were included in the multivariate analysis. Logistic regression analysis was used for multivariate analysis. Effect of significant variables was reported by odds ratio and 95% confidence interval. All statistical analysis was performed using SPSS version 18.

### **Results**

There were 130 patients enrolled from January 6, 2012 to March 30, 2013. Seventy-four (56.9%) were male. The mean age was  $68.4 \pm 11.3$  years. Forty patients (30.8%) had a diagnosis of unstable

angina as determined by cardiac troponin level. Regarding to atherosclerotic risk factors, 59.2%, 83.8%, and 72.3% of the patients had diabetes, hypertension, and hyperlipidemia respectively. For chronic use of cardiovascular medication, 60.7%, 35.4%, 41.5%, 39.2%, and 61.5% of the patients were taking aspirin, clopidogrel, beta-blocker, angiotensin converting enzyme inhibitor (ACEI)/angiotensin receptor blocker (ARB), and statin respectively at enrolment. Sixty percent of the patients had normal baseline renal function as determined by a serum creatinine cut-off value of 1.3 mg/dl. Seventy three patients (56.1%) presented with diagnostic electrocardiogram (ECG), with either dynamic T wave inversion or ST change. Fifty patients (38.5%) had heart failure at presentation. The mean left ventricular ejection fraction was 52%. Median TIMI risk score was 4, while the mean GRACE risk score was 122.7. Baseline characteristics of the patients are shown in Table 1.

Most patients (67.7%) were admitted to the intensive care unit. Thirty-nine patients (30%) were treated with early invasive strategy, which was defined as an intension to performed coronary angiography by the physician taking care of the patients at first decision. Despite low initial early invasive strategy selected, 88 patients (67.7%) underwent at least one angiogram procedure during admission. Reasons to performed coronary angiography included: worsening of chest pain, uncontrolled heart failure, reevaluation/consultation by cardiology fellow/staff, etc. Details of the management are presented in Table 2.

The average length of stay was 10 days, with a median and mode of 7 days and 4 days respectively. The length of stay ranged from 2 days to 63 days. One patient, hospitalized for 200 days, was excluded from the analysis. This patient presented with heart failure, was intubated, and subsequently became ventilator dependent. Final LOS range was between 1 to 51 days. The patients were then classified into two groups, using 5 days as a cut-off point. Factors shown in Table 1 and 2 were then entered into a univariate analysis model compared between a group of patients whose LOS was less than or equal to 5 days (46, 35.4%) and the patients whose LOS was greater than 5 days. Results of univariate analysis are shown in Table 3.

From univariate analysis, coronary angiogram during admission, and heart failure at presentation were strongly related to LOS  $>5$  days. Reimbursement policy, initial admission, and GRACE risk score  $>130$  were borderline significantly related to LOS  $>5$  days.

**Table 1.** Baseline characteristic of the patients (n = 130)

Baseline characteristic	Number
Age, years (mean ± SD)	68.4±11.3
Sex: male, n (%)	76 (58.5)
Reimbursement policy, n (%)	
Universal coverage	51 (39.2)
Social security	7 (5.4)
Government paid	64 (49.2)
Self paid/insurance	8 (6.2)
Diagnosis, n (%)	
Unstable angina	40 (30.8)
NSTEMI	90 (69.2)
Atherosclerotic risk factors, n (%)	
Diabetes	77 (59.2)
Hypertension	109 (83.8)
Hyperlipidemia	94 (72.3)
Long-term medication, n (%)	
Aspirin	79 (60.8)
Clopidogrel	47 (36.2)
Beta-blocker	55 (42.3)
ACEI/ARB	50 (38.5)
Statin	81 (62.5)
Normal baseline serum creatinine (<1.3 mg/dl)	78 (60.0)
Risk stratification	
Presence of ischemic ECG, n (%)	71 (54.6)
Heart failure at presentation, n (%)	50 (38.5)
TIMI risk score, median (range)	4 (0-6)
Left ventricular ejection fraction (mean ± SD)	52.0±14.9
GRACE risk score (mean)	122.7

NSTEMI = non-ST-segment elevation myocardial infarction; ACEI = angiotensin converting enzyme inhibitor; ARB = angiotensin receptor blocker; ECG = electrocardiogram; TIMI = thrombolysis in myocardial infarction

**Table 2.** Management strategy for NSTEMI-ACS patients (n = 130)

Management	n (%)
Initial admission: intensive care unit	88 (67.7)
Early invasive strategy	39 (30.0)
Coronary angiogram during admission	88 (67.7)

ACS = acute coronary syndromes

All variables with a *p*-value of ≤0.1 were then included in the multiple logistic regression model. The results of multivariate analysis are shown in Table 4.

## Discussion

The findings indicated that patients in this cohort were high risk NSTEMI-ACS patients as more than 80% of the patients had TIMI risk score ≥3. The average LOS from this study is longer than

most studies from the Western world<sup>(5-7)</sup>. More than sixty percent (64.6%) of the patients were hospitalized for more than 5 days. The 5-day cut-off point for LOS was based on number of days for enoxaparin injection in the TIMI 11b study<sup>(8)</sup>. The authors found that factors that had impact on LOS were CAG during admission, reimbursement policy, heart failure at presentation, and the GRACE risk score >130. The Odds ratio for patients who underwent coronary angiogram during admission to have LOS >5 days was 4.05. This result concurred with previous study which shown that among patients with LOS >8 days were the least likely to receive early cardiac catheterization or PCI<sup>(9)</sup>. There were several studies indicated that early invasive strategy for patients with NSTEMI-ACS improved the outcomes in patients at high risk<sup>(10-12)</sup>. Interestingly, despite being classified as high risk patients based on TIMI risk score, only 30% of the patients were selected to be treated with early invasive strategy. This could result in prolonged hospitalization because, finally, more than 50% of the patients who were treated with early conservative strategy underwent coronary angiogram. Other reasons for delayed in coronary angiogram were ongoing heart failure, abnormal renal function, catheterization laboratory or staff availability, etc.

Reimbursement policy also had impact on LOS. Using universal coverage as a reference, the Odds ratio of patients with government paid and self paid/private insurance were 0.28 and 0.05 respectively. The impact of reimbursement policy differed from one study, which found that patients with insurance had longer LOS<sup>(13)</sup>. This could be explained by a difference in medical systems. In this study, 87.5% of self paid/private insurance patients were referred from other hospitals. There was already a plan for invasive therapy before patients arrived at the hospital. For government paid patients, the decision process is usually shorter when compared to universal coverage patients thus resulting in shorter LOS. Whether adjustment in national policy regarding to administrative process would shorten the LOS or not should be tested in other studies.

Among the four factors affecting LOS, heart failure at presentation carried the highest Odds ratio. GRACE risk score of >130 also lengthened the LOS. These patients usually had several co-morbidities and were at the highest risk of having adverse events and increase of the LOS.

A limitation of the present study includes the small number of patients enrolled. The number of

**Table 3.** Univariate analysis of effect of variables on LOS

Variable	LOS ≤5 days (n = 46)	LOS >5 days (n = 84)	p-value
Age >65 years old	30 (36.1)	53 (63.9)	0.851
Sex: female	16 (29.6)	38 (70.4)	0.270
CAG during admission: yes	25 (28.4)	63 (71.6)	0.016
Initial admission			
Intensive care	36 (40.9)	52 (59.1)	0.056
General & short stay	10 (23.8)	32 (76.2)	
Reimbursement policy			
Universal coverage	11 (21.6)	40 (78.4)	0.067
Government paid	28 (43.8)	36 (56.3)	
Social security	3 (42.9)	4 (57.1)	
Self paid	4 (50.0)	4 (50.0)	
Heart failure at presentation: yes	8 (16.0)	42 (84.0)	<0.001
Chronic ASA used: yes	27 (34.2)	52 (65.8)	0.720
Chronic clopidogrel used: yes	15 (31.9)	32 (68.1)	0.534
Chronic statin used: yes	28 (34.6)	53 (65.4)	0.802
Ischemic EKG on presentation: yes	14 (33.8)	47 (66.2)	0.679
TIMI risk score			
0	1 (100)	0 (0)	0.122
1	3 (75.0)	1 (25.0)	
2	7 (43.8)	9 (56.3)	
3	13 (48.1)	14 (51.9)	
4	10 (30.3)	23 (69.7)	
5	9 (23.1)	30 (76.9)	
6	3 (30.0)	7 (70.0)	
7	0 (0)	0 (0)	
GRACE score >130	13 (21.3)	48 (78.7)	0.104

LOS = length of stay; CAG = coronary angiogram; ASA = aspirin; EKG = electrocardiogram

**Table 4.** Multiple logistic regression analysis of factors affecting the LOS

Variable	Crude odds ratio (95% CI)	Adjusted odds ratio (95% CI)
CAG during admission	2.52 (1.18, 5.40)	4.05 (1.58, 10.37)
Reimbursement policy (reference = universal coverage)	3.22 (0.90, 5.52)	
Social security	0.37 (0.07, 1.89)	0.39 (0.06, 2.41)
Government paid	0.35 (0.15, 0.81)	0.28 (0.11, 0.74)
Self paid/private insurance	0.27 (0.06, 1.28)	0.05 (0.01, 0.35)
Initial admission	11.15 (0.49, 12.31)	2.02 (0.76, 5.34)
Heart failure at presentation	4.75 (1.98, 11.39)	4.34 (1.36, 13.89)
GRACE risk score >130	2.90 (0.97, 8.71)	3.23 (1.13, 9.27)

Initial admission = initial admission to the intensive care unit

patients classified as low risk was also low because most intermediate-low risk patients were not admitted and were treated as outpatients. The results thus might not be appropriately applied to general NSTEMI-ACS patients. The death and complication rates were also unavailable in this study.

### Conclusion

Among the high risk NSTEMI-ACS patients admitted to Siriraj Hospital, four factors that predict a long LOS include coronary angiogram during admission, reimbursement policy, heart failure at presentation, and GRACE risk score >130. Heart

failure on admission had the highest impact on length of stay with an adjusted Odds ratio of 4.34.

#### What is already known on this topic?

NSTE-ACS plays an important part in ACS patients with high risk features benefited from early invasive strategy.

#### What this study adds?

Factors associate with length of hospital stay of  $\geq 5$  days include heart failure at presentation, reimbursement policy, CAG during admission, and grace risk score  $>130$ .

#### Potential conflicts of interest

None.

#### References

1. Srimahachota S, Boonyaratavej S, Kanjanavanit R, Sritara P, Krittayaphong R, Kunjara-Nayudhya R, et al. Thai Registry in Acute Coronary Syndrome (TRACS)—an extension of Thai Acute Coronary Syndrome registry (TACS) group: lower in-hospital but still high mortality at one-year. *J Med Assoc Thai* 2012; 95: 508-18.
2. The PURSUIT Trial Investigators. Inhibition of platelet glycoprotein IIb/IIIa with eptifibatid in patients with acute coronary syndromes. Platelet glycoprotein IIb/IIIa in unstable angina: receptor suppression using integrilin therapy. *N Engl J Med* 1998; 339: 436-43.
3. CAPRIE Steering Committee. A randomised, blinded, trial of clopidogrel versus aspirin in patients at risk of ischaemic events (CAPRIE). *Lancet* 1996; 348: 1329-39.
4. Fragmin and Invasive fast revascularisation during instability in coronary artery disease investigators. Invasive compared with non-invasive treatment in unstable coronary-artery disease: FRISC II prospective randomised multicentre study. *Lancet* 1999; 354: 708-15.
5. Brilakis ES, Hernandez AF, Dai D, Peterson ED, Banerjee S, Fonarow GC, et al. Quality of care for acute coronary syndrome patients with known atherosclerotic disease: results from the get with the guidelines program. *Circulation* 2009; 120: 560-7.
6. Diercks DB, Roe MT, Chen AY, Peacock WF, Kirk JD, Pollack CV Jr, et al. Prolonged emergency department stays of non-ST-segment-elevation myocardial infarction patients are associated with worse adherence to the American College of Cardiology/American Heart Association guidelines for management and increased adverse events. *Ann Emerg Med* 2007; 50: 489-96.
7. Rymer J, Tempelhof M, Clare R, Pieper K, Lopes R, Ganger C, et al. Shorter hospital stays and outcomes after non-ST-segment elevation myocardial infarction. *J Am Coll Cardiol* 2014; 63(12\_S): doi:10.1016/S0735-1097(14)60042-5.
8. 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.
9. Vavalle JP, Lopes RD, Chen AY, Newby LK, Wang TY, Shah BR, et al. Hospital length of stay in patients with non-ST-segment elevation myocardial infarction. *Am J Med* 2012; 125: 1085-94.
10. Wallentin L, Lagerqvist B, Husted S, Kontny F, Stahle E, Swahn E. Outcome at 1 year after an invasive compared with a non-invasive strategy in unstable coronary-artery disease: the FRISC II invasive randomised trial. FRISC II investigators. Fast revascularisation during instability in coronary artery disease. *Lancet* 2000; 356: 9-16.
11. Alfredsson J, Lindback J, Wallentin L, Swahn E. Similar outcome with an invasive strategy in men and women with non-ST-elevation acute coronary syndromes: from the Swedish Web-System for Enhancement and Development of Evidence-Based Care in Heart Disease Evaluated According to Recommended Therapies (SWEDEHEART). *Eur Heart J* 2011; 32: 3128-36.
12. Cannon CP, Weintraub WS, Demopoulos LA, Vicari R, Frey MJ, Lakkis N, et al. Comparison of early invasive and conservative strategies in patients with unstable coronary syndromes treated with the glycoprotein IIb/IIIa inhibitor tirofiban. *N Engl J Med* 2001; 344: 1879-87.
13. Mainous AG, III, Diaz VA, Everett CJ, Knoll ME. Impact of insurance and hospital ownership on hospital length of stay among patients with ambulatory care-sensitive conditions. *Ann Fam Med* 2011; 9: 489-95.



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ผลของปัจจัยต่าง ๆ ต่อจำนวนวันการนอนโรงพยาบาลในผู้ป่วยกล้ามเนื้อหัวใจขาดเลือดเฉียบพลันชนิดไม่มี ST segment ยกที่โรงพยาบาลศิริราช

จิตหทัย สุขสมัย, นงคํนุช แนะแก้ว, ถนอมศรี แดงศรี, ดารณี พงศม, สัชชนะ พุ่มพฤษ

วัตถุประสงค์: เพื่อสืบหาปัจจัยที่มีผลต่อการนอนโรงพยาบาลนานเกินกว่า 5 วัน ในผู้ป่วยโรคหลอดเลือดหัวใจตีบเฉียบพลันชนิดไม่มี ST segment ยกที่เข้ารับการรักษาในโรงพยาบาลศิริราช

วัตถุประสงค์และวิธีการ: ผู้นิพนธ์นำข้อมูลของผู้ป่วยจำนวน 130 รายแรก ในฐานข้อมูลมาวิเคราะห์หาความสัมพันธ์ ระหว่างปัจจัยต่างๆ กับความเสี่ยงที่จะนอนโรงพยาบาลเกิน 5 วัน

ผลการศึกษา: ผู้ป่วยในการศึกษา 130 ราย ส่วนใหญ่เป็นเพศชาย (ร้อยละ 56.9) ผู้ป่วยมากกว่าร้อยละ 80 จัดเป็นกลุ่มผู้ป่วยความเสี่ยงสูง และผู้ป่วยมากกว่าร้อยละ 60 นอนโรงพยาบาลนานเกินกว่า 5 วัน ปัจจัยที่มีผลต่อการนอนโรงพยาบาลนานคือการได้รับการตรวจสวนหัวใจระหว่างการนอนโรงพยาบาล การมีภาวะน้ำตาลท่วมปอดตั้งแต่แรก และผู้ป่วยที่มี GRACE risk score มากกว่า 130 ขึ้นไป ส่วนผู้ป่วยที่ใช้สิทธิการรักษาเบิกจ่ายราชการหรือจ่ายเอง/ประกัน มีโอกาสนอนโรงพยาบาลสั้นกว่าหรือเท่ากับ 5 วัน

สรุป: ปัจจัยที่มีผลต่อจำนวนวันการนอนโรงพยาบาลคือ การได้รับการตรวจสวนหัวใจระหว่างการนอนโรงพยาบาล สิทธิการรักษา การมีภาวะน้ำตาลท่วมปอดตั้งแต่แรก และผู้ป่วยที่มี GRACE risk score มากกว่า 130 ขึ้นไป ภาวะน้ำตาลท่วมปอดตั้งแต่แรกได้รับผลต่อการนอนโรงพยาบาลนานกว่า 5 วันสูงสุด โดยมีค่า odds ratio 4.34

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