Original Article

Effect of Timing of Coronary Invasive Procedure to Clinical Outcomes in Patients with Non-ST-Segment Elevation Acute Coronary Syndrome

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Objective: Patients with Non-ST elevation-acute coronary syndrome (NSTE-ACS) should be treated with a coronary invasive strategy. Whether the timing of invasive procedure will affect the outcome of patients with NSTE-ACS is controversial and varied among centers. This study examined the effect of timing of coronary invasive strategy to clinical outcomes in patients with NSTE-ACS.

Materials and Methods: The study was conducted NSTE-ACS patients who were treated at Thammasat University Hospital between January 1, 2015 and December 31, 2016 and underwent coronary invasive procedures during hospitalization. Patients were classified into three groups according to the time interval from admission to angiography. Patients in group I underwent coronary angiography (CAG) within 24 hours; in group II between 24 and 72 hours; and in group III after 72 hours. The composite outcomes included all-cause mortality and myocardial infarction (MI) at one-year. The secondary outcomes were the occurrence rate of all-cause mortality, in-hospital death, myocardial infarction, repeat revascularization and major bleeding.

Results: 202 patients with NSTE-ACS, 52 (25.7%) were assigned to group I, 61 (30.2%) to group II and 89 (44.1%) to group III. The composite outcomes occurred in 38 (18.8%) patients, 11 (21.2%) to group I, 9 (14.8%) to group II and 18 (20.2%) to group III (p = 0.619).

Conclusion: The differences in timing of coronary invasive strategy in NSTE-ACS patients had no effect to the composite outcomes of all cause death and MI at one-year.

Keywords: Timing of Angiography, Non-ST-Segment, Elevation myocardial infarction

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According to the data from the Ministry of Public Health (Thailand) from 2012 to 2015[1,2], the mortality rate of coronary artery disease per 100,000 population in Thailand was increasing. The European Society of Cardiology (ESC) guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation[3] recommended on the timing for invasive strategy for NSTE-ACS patients. All moderate- or high-risk patients with NSTE-ACS should undergo coronary angiography (CAG) within 72 hours of admission.

In Thailand, the capability of cardiac catheterization centers are varied among healthcare areas and centers. If the patients presented to non-percutaneous coronary intervention (PCI) capable center, the patients received a fibrinolysis as the initial treatment[1]. Then, patients would be transferred to PCI capable cardiac center for coronary procedures. If the patients presented directly to the PCI capable center, the timing of invasive procedure is different among hospitals. Although the large hospitals and health care centers have cardiac catheterization labs, availability It is still difficult for all NSTE-ACS patients to receive coronary procedures according to the timing recommended by the guidelines owing to the increasing workload and number of patients. This study sought to determine the treatment outcomes in NSTE-ACS patients according to different timing of invasive coronary procedures.

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Materials and Methods

This is a single center experience study. The study gathered data from patients with NSTE-ACS who were treated at Thammasat University Hospital and underwent CAG during admission between January 1, 2015 and December 31, 2016. Patients who were included were older than 18 years and had the diagnosis of NSTE-ACS confirmed (by criteria of symptoms of ACS ≥20 minutes, the

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electrocardiogram (ECG) did not show ST segment elevation, and the rise of high sensitivity cardiac troponin T level[4]. Patients with bleeding disorder , patients who had contraindication to antiplatelet medication, ineligible for PCI and those who had life expectancy less than 1 year were excluded from the study.

The patients were classified into three groups according to their time duration from admission to initiation of coronary angiography procedure. Group I was patients who underwent CAG within 24 hours. Patients in Group II underwent CAG between 24 and 72 hours and those in Group III underwent CAG after 72 hours after admission to the hospital. The baseline characteristics, initial clinical data (Killip Class, bleeding risk, the Global Registry of Acute Coronary Events (GRACE) risk score, TIMI risk score), initial laboratory data and initial diagnosis of patients were compiled (Table 1 to 3).

The details of CAG and treatment of each patient were recorded. The follow-up for endpoints were performed at 1 year. The occurrence rates of all cause of death, myocardial infarction, repeat revascularization and major bleeding were gathered. The primary outcome was a composite outcome of all-cause mortality and myocardial infarction at 1 year.

Statistical analysis

The data and statistical analysis was done by using Statistical Package for Social Sciences (SPSS) software version 23.0.

1) Descriptive Statistics were the number of the samples, percentages, the mean, the standard deviation, the median, the 25th percentile and the 75th percentile (IQR).

2) Inferential Statistics inferred properties of a population. The probability value (P-value) helped to determine the significance of the result. The *p*-value was assigned to less than 0.05.

The correlation between categorical variables (such as gender, age groups, smoking, underlying diseases, diagnosis and death or MI) was analyzed using Chi-squared test. The Fisher Exact test would be used when the expected number were small.

The analysis of continuous data (such as age, BMI and clinical information) with normal distributions was expressed as means $\pm$ standard deviation between 3 groups by using One-Way ANOVA. Kruskal Wallis test was used for continuous data with non-normal distributions.

Results

The present study was based on the cardiac

Table 1. Baseline characteristics of patients

Characteristics	Total (n = 202)		Time interval to CAG						*p*-value
			<24 hours (n = 52)		24 to 72 hours (n = 61)		>72 hours (n = 89)		
	n	%	n	%	n	%	n	%	
Gender									0.149
Male	117	57.9	35	67.3	30	49.2	52	58.4	
Female	85	42.1	17	32.7	31	50.8	37	41.6	
Age (years)									
Mean $\pm$ SD	69.12$\pm$11.48		65.24$\pm$13.08^{A}		70.31$\pm$11.02^{B}		70.58$\pm$10.34^{B}		0.017*^{O}
BMI									
Mean $\pm$ SD	24.52$\pm$4.26		24.88$\pm$3.58		25.10$\pm$4.59		23.91$\pm$4.36		0.193^{O}
Smoking									0.033*
Yes	101	50.0	34	65.4	26	42.6	41	46.1	
No	101	50.0	18	34.6	35	57.4	48	53.9	
Underlying disease									
Diabetes mellitus	94	46.5	20	38.5	26	42.6	48	53.9	0.158
Hypertension	152	75.2	35	67.3	48	78.7	69	77.5	0.302
Cardiovascular disease	10	5.0	2	3.8	4	6.6	4	4.5	0.775
Dyslipidemia	107	53.0	22	42.3	36	59.0	49	55.1	0.181
Chronic kidney disease	43	21.3	7	13.5	18	29.5	18	20.2	0.110
Previous MI	38	18.8	12	23.1	16	26.2	10	11.2	0.046*
Previous PCI	29	14.4	7	13.5	13	21.3	9	10.1	0.154
Previous stroke	16	7.9	2	3.8	5	8.2	9	10.1	0.404^{F}
Chronic obstructive pulmonary disease	6	3.0	0	0	2	3.3	4	4.5	0.431^{F}
Atrial fibrillation	14	6.9	3	5.8	2	3.3	9	10.1	0.292^{F}
Other	33	16.3	9	17.3	9	14.8	15	16.9	0.941^{F}

The *p*-value from Chi-square test, ^{F} = The *p*-value from Fisher's exact test, ^{O} = The *p*-value from one-way ANOVA
* Significant at the 0.05 level

Table 2. Initial clinical data of patients

	Total (n = 202)		Time interval to CAG						*p*-value
			<24 hours (n = 52)		24 to 72 hours (n = 61)		>72 hours (n = 89)		
	n	%	n	%	n	%	n	%	
SBP (mmHg)									0.240
≥140	90	44.6	18	34.6	30	49.2	42	47.2	
<140	112	55.4	34	65.4	31	50.8	47	52.8	
Mean ± SD	137.43±24.40		131.46±29.83		136.93±24.07		141.25±20.31		0.069[O]
DBP (mmHg)									0.395
≥90	43	21.3	14	26.9	10	16.4	19	21.3	
<90	159	78.7	38	73.1	51	83.6	70	78.7	
Mean ± SD	77.69±14.10		76.67±17.22		75.75±13.39		79.62±12.36		0.214[O]
MAP (mmHg)									
Median (IQR)	97.50 (86.0 to 108.0)		93.5 (80.5 to 112.0)		94.0 (85.0 to 106.0)		100.0 (90.0 to 109.0)		0.116[K]
HR (bpm)									
Mean ± SD	82.54±17.60		83.02±20.15		80.59±16.85		83.61±16.58		0.575[O]
Killip class									0.051[F]
I	106	52.5	32	61.5	34	55.7	40	44.9	
II	31	15.3	3	5.8	11	18.0	17	19.1	
III	61	30.2	14	26.9	16	26.2	31	34.8	
IV	4	2.0	3	5.8	0	0	1	1.1	
GRACE risk score									0.179[F]
High	131	64.9	34	65.4	39	63.9	58	65.2	
Intermediate	58	28.7	11	21.2	19	31.1	28	31.5	
Low	13	6.4	7	13.5	3	4.9	3	3.4	
Mean ± SD	160.46±39.12		160.19±49.99		158.62±36.98		161.87±33.33		0.883[o]
TIMI									0.658[F]
1	1	0.5	0	0	1	1.6	0	0	
2	19	9.4	5	9.6	3	4.9	11	12.4	
3	62	30.7	16	30.8	20	32.8	26	29.2	
4	81	40.1	20	38.5	22	36.1	39	43.8	
5	30	14.9	8	15.4	11	18.0	11	12.4	
6	9	4.5	3	5.8	4	6.6	2	2.2	
Duration from onset (hr)									
Median (IQR)	12.0 (4.0 to 24.0)		8.0 (4.0 to 24.0)		12.0 (4.0 to 48.0)		12.0 (6.0 to 24.0)		0.481[K]
Diagnosis									0.707[F]
NSTE-ACS	192	95.0	50	96.2	59	96.7	83	93.3	
Unstable angina	10	5.0	2	3.8	2	3.3	6	6.7	

The *p*-value from Chi-square test, F = *p*-value from Fisher's exact test, O = *p*-value from One-way ANOVA, K=Kruskal Wallis Test, * Significant at the 0.05 level

catheterization data that was gathered at Thammasat University Hospital between January 1, 2015 and December 31, 2016. 202 patients with NSTE-ACS underwent invasive coronary angiography and revascularization. The patients were classified into three groups according to the time interval from admission to the time of angiography as following:

Group I, 52 patients (25.7%) underwent CAG within 24 hours (the mean time was 11.43 hours).

Group II, 61 patients (30.2%) patients underwent CAG between 24 and 72 hours (the mean time was 47.15 hours).

Group III, 89 patients (44.1%) patients underwent CAG after 72 hours (the mean time was 133.33 hours).

The shortest time from admission to CAG was 37 minutes and the longest interval time was 430.18 hours.

Based on the baseline characteristics of the patients (Table 1), the majority of patients were male (57.9%). The mean age was 69.12 years (±11.48). The three major underlying diseases were hypertension (75.2%), diabetes (53.0%) and dyslipidemia (46.5%). Half of the patients had smoking history. 38 patients (18.8%) had prior diagnosis of ischemic heart disease. 29 patients (14.4%) had previous CAG and PCI.

In Table 2, the initial clinical data of 192 patients (95%) who were diagnosed NSTE-ACS and 10 patients were diagnosed unstable angina. The majority of the patients (52.5%) had Killip Class 1. The risk assessment with mean GRACE risk score was calculated at 160.46±39.12. Most of

Table 3. Initial laboratory data of patients

	Total (n = 202)		Time interval to CAG						*p*-value
			<24 hours (n = 52)		24 to 72 hours (n = 61)		>72 hours (n = 89)		
	n	%	n	%	n	%	n	%	
Peak high sensitivity troponin T									0.344
Normal 0.0 to 0.014	3	1.5%	2	3.8%	0	0%	1	1.1%	
Abnormal	199	98.5%	50	96.2%	61	100%	88	98.9%	
Median (IQR)	0.23 (0.08 to 0.67)		0.27 (0.11 to 1.01)		0.28 (0.09 to 0.69)		0.18 (0.06 to 0.48)		0.142 [K]
BS									
Median (IQR)	138.00 (98.00 to 278.50)		143.50 (107.50 to 307.75)		136.25 (96.00 to 301.00)		131.00 (95.90 to 233.00)		0.770 [K]
sCr (mg/dl)									
Median (IQR)	1.27 (0.97 to 1.78)		1.27 (1.03 to 1.66)		1.29 (0.97 to 2.19)		1.24 (0.96 to 1.85)		0.934 [K]
eGFR									0.601
Mean ± SD	52.63±27.15		55.93±27.89		51.15±28.73		51.70±25.72		
Hct									
Mean ± SD	36.90±6.10		38.58±5.29		36.17±6.36		36.42±6.24		0.067[O]
WBC									
Median (IQR)	8.40 (6.80 to 10.63)		8.75 (7.70 to 10.70)		8.40 (6.75 to 10.10)		8.10 (6.60 to 11.15)		0.319 [K]
PTT									
Median (IQR)	1.08 (0.96 to 1.20)		1.08 (0.95 to 1.21)		1.08 (0.96 to 1.18)		1.04 (0.96 to 1.22)		0.912 [K]
LDL									
Median (IQR)	88.00 (68.00 to 127.00)		92.00 (63.00 to 131.75)		98.00 (69.00 to 143.00)		88.00 (71.00 to 113.00)		0.496 [K]
LVEF									
Median (IQR)	48.50 (34.00 to 61.00)		41.00 (30.75 to 59.00)		53.00 (43.50 to 64.50)		48.00 (31.00 to62.00)		0.023*[K]
Ischemic EKG change									
ST segment depression	81	40.1%	20	38.5%	19	31.1%	42	47.2%	0.138
T wave inversion	59	29.2%	19	36.5%	23	37.7%	17	19.1%	0.019*
No change	55	27.2%	11	21.2%	20	32.8%	24	27.0%	0.382
Other	13	6.4%	4	7.7%	2	3.3%	7	7.9%	0.541[F]

The *p*-value from Chi-square test, [F] = The *p*-value from Fisher's exact test, [O] = The *p*-value from one-way ANOVA, [K] = Kruskal Wallis test * Significant at the 0.05 level

the patients were classified as high-risk NSTE-ACS according to the guidelines.

From the initial laboratory data (Table 3), 98.5% of patients had abnormal troponin T levels. The serum creatinine levels of all three groups were not different. The other laboratory results were no difference among the three groups. The left ventricular ejection fraction (LVEF) were significantly different between the three groups, Group I had the average LVEF of 41%, Group II was 53% and Group III was 48%.

Based on the patients' current medications data (Table 4), all patients received aspirin and 98% of the patients received treatment with a P2Y12 receptor inhibitor; almost 90% of the patients received clopidogrel. 95.5% of the patients received statins. The patients in Group III received Angiotensin-converting enzyme inhibitors (ACEI) and beta-blocker drugs more than the other groups. The use of anti-diabetic medication both oral tablets, and insulin injections in patients among three groups were no difference.

The diagnosis after angiography (Table 5) showed that 10% of the patients had minor coronary artery disease; 6 patients (3.3%) had normal coronary artery disease; almost 50% of the patients had triple vessel disease and 4 patients had previous coronary artery bypass grafting (CABG). Group I had more left main coronary artery disease and more triple vessel disease when compare to the others.

69% of patients received coronary revascularization. Most of them were revascularized by PCI. 21 patients (10%) underwent CABG and 40 patients were treated with medications (Table 6).

The primary composite outcome (all-cause death myocardial infarction (MI)) at 1 year (Figure 1) occurred in 38 patients (18.8%) (in this study, the causes of death in patients were known in 18 patients; infectious diseases in 13 patients, acute coronary syndrome in 1 patient, ischemic stroke in 2 patients, acute aortic dissection in 1 patient and cerebrovascular accident in 1 patient) and there were no differences between all three groups. The secondary clinical outcomes; re-intervention and major bleeding occurred in 4.5% and 7.9% respectively and there were no differences among all three groups.

According to the composite outcome based on the

Table 4. Patients' current medications data

	Total (n = 202)		Time interval to CAG						*p*-value
			<24 hours (n = 52)		24 to 72 hours (n = 61)		>72 hours (n = 89)		
	n	%	n	%	n	%	n	%	
Current medication									
Clopidogrel	181	89.6%	47	90.4%	51	83.6%	83	93.3%	0.160
Ticagrelor	14	6.9%	3	5.8%	6	9.8%	5	5.6%	0.565[F]
Prasugrel	5	2.5%	2	3.8%	2	3.3%	1	1.1%	0.606
Warfarin	13	6.4%	3	5.8%	1	1.6%	9	10.1%	0.106[F]
UFH	34	16.8%	6	11.5%	14	23.0%	14	15.7%	0.253
LMWH	131	64.9%	29	55.8%	38	62.3%	64	71.9%	0.135
Fondaparinux	17	8.4%	3	5.8%	7	11.5%	7	7.9%	0.536
Statin	193	95.5%	48	92.3%	60	98.4%	85	95.5%	0.310[F]
Beta blocker	166	82.2%	39	75.0%	47	77.0%	80	89.9%	0.038*
ACEI	86	42.6%	18	34.6%	19	31.1%	49	55.1%	0.006*
ARB	20	9.9%	7	13.5%	8	13.1%	5	5.6%	0.194
Nitrate	88	43.6%	17	32.7%	28	45.9%	43	48.3%	0.178
Metformin	22	10.9%	5	9.6%	6	9.8%	11	12.4%	0.837
Lasix	21	10.4%	6	11.5%	6	9.8%	9	10.1%	0.951
Insulin	30	14.9%	5	9.6%	10	16.4%	15	16.9%	0.467
Glipizide	18	8.9%	3	5.8%	5	8.2%	10	11.2%	0.532
Other	14	6.9%	5	9.6%	3	4.9%	6	6.7%	0.644[F]

The *p*-value from Chi-square test, [F] = The *p*-value from Fisher's exact test, [O] = The *p*-value from one-way ANOVA, [K] = Kruskal Wallis test, * Significant at the 0.05 level

Table 5. Coronary angiographic characteristics of patients

	Total (n = 202)		Time interval to CAG						*p*-value
			<24 hours (n = 52)		24 to 72 hours (n = 61)		>72 hours (n = 89)		
	n	%	n	%	n	%	n	%	
CAG finding									
Left main disase	33	16.3	12	23.1	7	11.5	14	15.7	0.246
Single vessel disease	36	17.8	8	15.4	12	19.7	16	18.0	0.837
Double vessel disease	45	22.3	14	26.9	15	24.6	16	18.0	0.409
Triple vessel disease	92	45.5	30	57.7	22	36.1	40	44.9	0.070
S/P CABG	4	2.0	2	3.8	1	1.6	1	1.1	0.690
Minor CAD	20	9.9	1	1.9	8	13.1	11	12.4	0.081
Normal coronary	6	3.0	0	0	2	3.3	4	4.5	0.431[F]

survival analysis, in 3 different time periods as mentioned above; there was no statistical significance at 1-year follow-up.

Discussion

The European Society of Cardiology (ESC)[3] and the American College of Cardiology/American Heart Association (ACC/AHA)[13] recommendation for the timing of invasive strategy should be decided by the risk level of the patients. High-risk patients should undergo invasive strategy within 2 hours and early invasive strategy should be performed within 72 hours in all patients after admission.

The present study is a single center experience. It demonstrated a real life experience of the tertiary care university hospital with 2 cardiac catheterization laboratories and 4 interventional cardiologists. Nearly half (45%) of the NSTE-ACS patients received coronary angiography after 72 hours. 65% of the patients were classified as high risk and 28% were intermediate risk by GRACE score. The mean GRACE score is high in all three groups. This reflected the high risk patients in most cases that required early invasive strategy which should be performed within 72 hours after

Table 6. The type of revascularization of patients

	Total (n = 202)		Time interval to CAG						*p*-value
			< 24 hours (n = 52)		24 to 72 hours (n = 61)		>72 hours (n = 89)		
	n	%	n	%	n	%	n	%	
Revascularization									0.045*[F]
PCI	139	68.8	40	76.9	44	72.1	55	61.8	
CABG	21	10.4	8	15.4	3	4.9	10	11.2	
Medication	40	19.8	4	7.7	13	21.3	23	25.8	
Plan for CABG	2	1.0	0	0	1	1.6	1	1.1	
PCI SP PCI stent									0.818[F]
DES	134	96.4	38	95.0	42	97.7	54	96.4	
BMS	1	0.7	0	0	0	0	1	1.8	
POBA	4	2.9	2	5.0	1	2.3	1	1.8	

The *p*-value from Chi-square test, [F] = The *p*-value from Fisher's exact test, [O] = The *p*-value from one-way ANOVA, [K] = Kruskal Wallis test, * Significant at the 0.05 level
PCI = percutaneous coronary intervention, CABG = coronary artery bypass graft, DES = Drug-eluting stent, BMS = bare metal stent, POBA = plain balloon angioplasty

Table 7. The in-hospital and 1 year clinical outcomes of patients

	Total (n = 202)		Time interval to CAG						*p*-value
			<24 hours (n = 52)		24 to 72 hours (n = 61)		>72 hours (n = 89)		
	n	%	n	%	n	%	n	%	
Death or MI	38	18.8	11	21.2	9	14.8	18	20.2	0.619
Death	32	15.8	9	17.3	8	13.1	15	16.9	0.782
In-hospital death	11	5.45	2	3.84	4	6.55	5	5.62	0.858[F]
Recurrent MI	12	5.9	6	11.5	1	1.6	5	5.6	0.090[F]
Re-intervention	9	4.5	3	5.8	2	3.3	4	4.5	0.831[F]
Major bleeding	16	7.9	2	3.8	5	8.2	9	10.1	0.404[F]

The *p*-value from Chi-square test, [F] = The *p*-value from Fisher's exact test

admission as recommended by the guidelines.

The delay in receiving procedures may be explained by the workload of the 2 cardiology catheterization labs during the office hour and the availability of the team for emergency angiography that will service after hour only case of emergent ST segment elevation myocardial infarction or hemodynamic compromised unstable coronary syndrome cases. But this reflected real life situations. If a NSTE-ACS patient presented with high GRACE score but without hemodynamic compromised and could be stabilized with medical therapies, the coronary invasive procedure would be schedule during office hour.

There were differences in the baseline characteristic of the patients. The patients in group II and III were older than those of group 1. Group 1 had the least left ventricular ejection fraction and more heart failure with Killip class IV among the here groups. Group I had the average LVEF values of 41%, Group II was 53% and Group III was 48%. Regarding the severity of coronary artery disease, group I had more complex advanced coronary artery diseases including left main coronary artery disease and triple vessel disease. This might explained the more urgency and the need for early procedure than the other two groups. Nevertheless, there was no significant difference in major clinical outcomes among the three groups. There was a trend of more recurrent MI in group I and increased major bleeding in group II and III. The explanation for increased bleeding trend in group II and III might be more prolonged exposure to anti-thrombotics including dual antiplatelet therapy and anticoagulation, which were mostly low molecular weight heparin.

From the previous studies, the timing of routine invasive strategy and the composite outcomes in patients with NSTE-ACS[5-8] had no effects on the mortality rate and the recurrent rate of coronary artery disease in long follow-

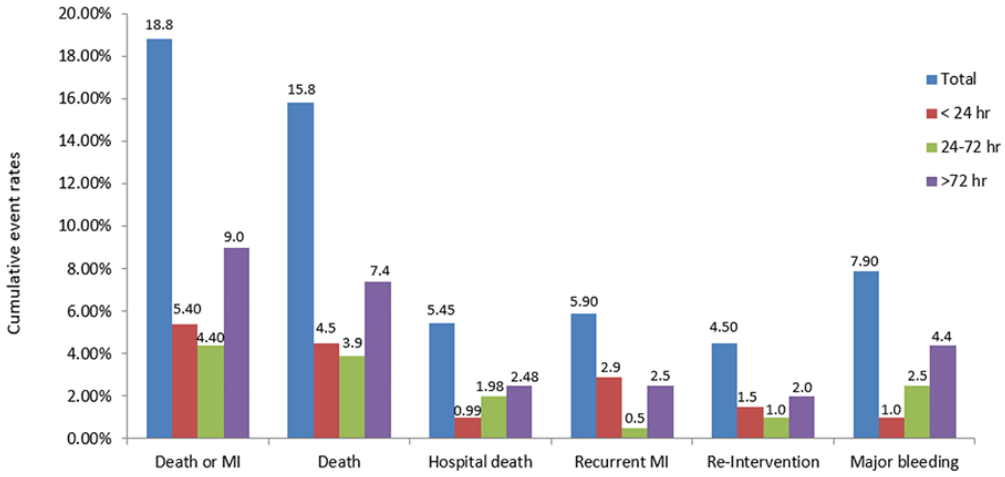

Figure 1. Clinical outcomes data of patients.

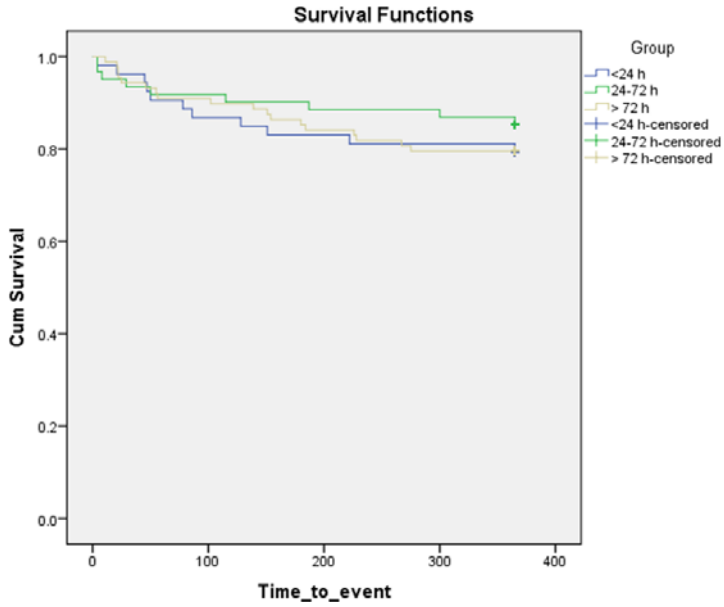

Figure 2. Kaplan-Meier curves of survival free from composite outcome.

up time. However, the meta-analyses of large randomized controlled trial (RCT) showed lower recurrent ischemic events rate in patients who underwent early invasive strategy compared to those patients who underwent delayed invasive strategy[9].

From the RIDDLE-NSTEMI study[10], the incidence of primary outcome events (death and recurrent myocardial infraction) at 30 days in patients with NSTEMI who underwent CAG was lower in patients who received procedure within 2 hours (immediate-intervention groups) than those who underwent CAG between 2 to 72 hours (delayed-intervention groups). In one year follow-up after coronary intervention, the incidence of primary outcome events of the patients in immediate-intervention groups were less than the patients in delayed-intervention groups. The mortality rate at 1-year follow-up in both groups were not different, but the recurrent myocardial infarction occurred more in delayed-intervention groups.

In our study, there was no significant difference in the composite outcomes at 90-day, 180-day and 1-year follow-up. The in-hospital mortality was 5.45% and 1-year mortality was 15.8%. Both short and long term mortality

rate were almost the same among the three groups. Outcome data of TACSR (Thai Registry in Acute Coronary Syndrome-An Extension of Thai Acute Coronary Syndrome Registry Group) showed in-hospital mortality rate of NSTE-ACS patients at 5.10% and the mortality rate of a one-year record at 25%[14]. It can also be noted that the result of this study showed a comparable rate to result from TACSR: 5.45 and 5.10 for in-hospital mortality, 15.8 and 25.0 for 1-year mortality, consecutively. The higher rate of event suggested the ongoing risk for events in patients with NSTE-ACS after discharged from the hospitals that showed concordantly in many studied include TACRS.

The early invasive strategy within 24 hours has been claimed to reduce mortality rate. This can be distinctly seen in the present study of patients with NSTE-ACS. The study has emphasized that patients who are older than 75 years with a high sensitivity cardiac troponin levels, diabetes mellitus and the GRACE risk score over 140 have a high survival rate as the strategy has claimed[9-12].

For limitations of this study, the clinical outcomes of our study were similar to the previous studies. Nonetheless, due to a small number of events in the present study, the composite outcomes could not be analyzed to find out the factors associated with an increased risk of getting the composite outcomes. Second, this is an experienced of a single university hospital center with 2 cardiac catheterization laboratories and 4 intervention cardiologists. This cannot represent other center that have different availability of cardiac catheterization labs, number of intervention cardiologists and different policies for emergent cases during after hour.

The European Society of Cardiology (ESC)[3] and the American College of Cardiology/American Heart Association (ACC/AHA)[13] recommended the timing of invasive strategy in the high-risk patients should undergo invasive strategy within 2 hours and the early invasive strategy should be performed within 72 hours in all patients after admission. In real life situation nearly half of NSTE-ACS presented to Thammasat university hospital could not receive invasive procedure within first 72 hour after admission. The timing of the procedure did not have an effect on the outcomes of the patients in short term and 1 year duration.

Conclusion

The duration to invasive coronary procedure in patients with high risk NSTE-ACS had no effect on the occurrences of composite outcomes of all-cause mortality and myocardial infarction (MI) including the secondary outcomes.

What is already known on this topic?

The early invasive strategy within 24 hours has been claimed to reduce the mortality of high risk NSTE-ACS patients.

What is this study adds?

Nearly half of NSTE-ACS presented to Thammasat University hospital could not receive invasive procedure within first 72 hour after admission.

The timing of invasive coronary procedure did not have an effect on the composite outcome of all-cause mortallity and myocardial infarction of patients in short term and 1 year duration.

Potential conflicts of interest

The authors declare no conflict of interest

References

1. The Heart Association of Thailand under the Royal Patronage, Thai Atherosclerosis Society. Medical practice guideline for management of patients with ischemic heart disease in Thailand. 2nd ed. Bangkok: Sri Mueang Printing; 2014.
2. Ministry of Public Health , Bureau of Non-Communicable Diseases. Number and rate of death for non-communicable diseases and injuries for the year [Internet]. 2015 [cited 2019 Dec 29]. Available from: http://www.thaincd.com/informationstatistic/non-communicable-disease-data.php.
3. Roffi M, Patrono C, Collet JP, Mueller C, Valgimigli M, Andreotti F, et al. 2015 ESC Guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation. Task Force for the Management of Acute Coronary Syndromes in Patients Presenting without Persistent ST-Segment Elevation of the European Society of Cardiology (ESC). G Ital Cardiol (Rome) 2016;17:831-72.
4. Thygesen K, Alpert JS, Jaffe AS, Simoons ML, Chaitman BR, White HD. Third universal definition of myocardial infarction. Glob Heart 2012;7:275-95.
5. Riezebos RK, Ronner E, Ter Bals E, Slagboom T, Smits PC, ten Berg JM, et al. Immediate versus deferred coronary angioplasty in non-ST-segment elevation acute coronary syndromes. Heart 2009;95:807-12.
6. Fox KA, Clayton TC, Damman P, Pocock SJ, de Winter RJ, Tijssen JG, et al. Long-term outcome of a routine versus selective invasive strategy in patients with non-ST-segment elevation acute coronary syndrome a meta-analysis of individual patient data. J Am Coll Cardiol 2010;55:2435-45.
7. Damman P, van Geloven N, Wallentin L, Lagerqvist B, Fox KA, Clayton T, et al. Timing of angiography with a routine invasive strategy and long-term outcomes in non-ST-segment elevation acute coronary syndrome: a collaborative analysis of individual patient data from the FRISC II, ICTUS, and RITA-3 Trials. JACC Cardiovasc Interv 2012;5:191-9.
8. Henderson RA, Jarvis C, Clayton T, Pocock SJ, Fox KA. 10-Year mortality outcome of a routine invasive strategy versus a selective invasive strategy in non-ST-segment elevation acute coronary syndrome: The British Heart Foundation RITA-3 Randomized Trial. J Am Coll Cardiol 2015;66:511-20.

9. Bonello L, Laine M, Puymirat E, Lemesle G, Thuny F, Paganelli F, et al. Timing of coronary invasive strategy in non-ST-segment elevation acute coronary syndromes and clinical outcomes: An updated meta-analysis. JACC Cardiovasc Interv 2016;9:2267-76.
10. Milosevic A, Vasiljevic-Pokrajcic Z, Milasinovic D, Marinkovic J, Vukcevic V, Stefanovic B, et al. Immediate versus delayed invasive intervention for non-STEMI patients: The RIDDLE-NSTEMI study. JACC Cardiovasc Interv 2016;9:541-9.
11. Jobs A, Mehta SR, Montalescot G, Vicaut E, Van't Hof AWJ, Badings EA, et al. Optimal timing of an invasive strategy in patients with non-ST-elevation acute coronary syndrome: a meta-analysis of randomised trials. Lancet 2017;390:737-46.
12. Deharo P, Ducrocq G, Bode C, Cohen M, Cuisset T, Mehta SR, et al. Timing of angiography and outcomes in high-risk patients with non-ST-segment-elevation myocardial infarction managed invasively: Insights from the TAO trial (treatment of acute coronary syndrome with otamixaban). Circulation 2017;136:1895-907.
13. Amsterdam EA, Wenger NK, Brindis RG, Casey DE Jr, Ganiats TG, Holmes DR Jr, et al. 2014 AHA/ACC Guideline for the management of patients with non-ST-elevation acute coronary syndromes: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. J Am Coll Cardiol 2014;64:e139-228.
14. Srimahachota S, Boonyaratavej S, Kanjanavanit R, Sritara P, Krittayaphong R, Kunjara-Na-ayudhya 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.

ผลของระยะเวลาที่รอการฉีดสีหลอดเลือดหัวใจต่อผลการรักษาในผู้ป่วยโรคหัวใจขาดเลือดเฉียบพลันชนิดที่ไม่พบ ST segment elevation

พิสิษฐ หุตะยานนท์, นวลจันทร์ ตันติชุตินันท์, ดิลก ภิยโยทัย, เหมือนเพชร เหมือนแก้ว, คิด ภูมิเมือง

วัตถุประสงค์: ผู้ป่วยโรคหัวใจขาดเลือดเฉียบพลันชนิดที่ไม่พบ ST segment elevation ควรได้รับการรักษาโดยการฉีดสีหลอดเลือดหัวใจภายในระยะเวลา 72 ชั่วโมง เมื่อเข้ารับการรักษาในโรงพยาบาล การศึกษานี้ต้องการดูความผลของระยะเวลาการในการรอการฉีดสีหลอดเลือดหัวใจ ต่อผลทางคลินิกผู้ป่วยโรคหัวใจขาดเลือดเฉียบพลันชนิดที่ไม่พบ ST segment elevation ที่เข้ารักการรักษาในโรงพยาบาลธรรมศาตร์เฉลิมพระเกียรติ

วัสดุและวิธีการ: เก็บข้อมูลผู้ป่วยโรคหัวใจขาดเลือดเฉียบพลัน ชนิดที่ไม่พบ ST segment elevation ที่โรงพยาบาลธรรมศาสตร์เฉลิมพระเกียรติ ตั้งแต่วันที่ 1 มกราคม พ.ศ. 2558 ถึง วันที่ 31 ธันวาคม พ.ศ. 2559 และได้รับการฉีดสีหลอดเลือดหัวใจขณะนอนโรงพยาบาล โดยแบ่งผู้ป่วยเป็น 3 กลุ่มตามระยะเวลาที่ได้ทำการฉีดสีหลอดเลือดหัวใจคือ กลุ่มที่ 1 ได้ทำภายใน 24 ชั่วโมง กลุ่มที่ 2 ตั้งแต่ 24 ถึง 72 ชั่วโมง และกลุ่มที่ 3 มากกว่า 72 ชั่วโมง โดยศึกษา composite outcome อันประกอบด้วยการเสียชีวิตและกล้ามเนื้อหัวใจตาย การ revascularization ซ้ำ และการมีภาวะเลือดออก

ผลการศึกษา: มีผู้ป่วยจำนวน 202 ราย ที่มีโรคหัวใจขาดเลือดเฉียบพลันชนิดที่ไม่พบ ST segment elevation เมื่อแบ่งตามระยะเวลารอการฉีดสีหลอดเลือหัวใจ มีผู้ป่วยที่เป็นกลุ่มที่ 1 จำนวน 52 ราย (25.7%), กลุ่มที่ 2 จำนวน 61 ราย (30.2%) และกลุ่มที่ 3 จำนวน 89 ราย (44.1%) พบ composite outcomes ทั้งหมด 38 ราย (18.8%) ในจำนวนนี้ พบในผู้ป่วยกลุ่มที่ 1 จำนวน 11 ราย (21.2%) ผู้ป่วยกลุ่มที่ 2 จำนวน 9 ราย (14.8%) และผู้ป่วยกลุ่มที่ 3 จำนวน 18 ราย (20.2%) โดยไม่มีความแตกต่างอย่างมีนัยสำคัญทางสถิติ

สรุป: ระยะเวลาในการรอเข้ารับการฉีดสีหลอดเลือดหัวใจในผู้ป่วยโรคหัวใจขาดเลือดเฉียบพลันชนิดที่ไม่พบ ST segment elevation ไม่ส่งผลต่อ composite outcome อันประกอบด้วยการเสียชีวิตและกล้ามเนื้อหัวใจตายที่ระยะเวลา 1 ปี