Original Article

Treatment Outcome Study for Acute ST–Segment Elevation Myocardial Infarction in Prapokklao Hospital

Jitti Kositchaiwat M.D., F.R.C.P.(T)*

Abstract **Treatment Outcome Study for Acute ST–Segment Elevation Myocardial Infarction in Prapokklao Hospital**
Jitti Kositchaiwat M.D., F.R.C.P.(T)*
* Department of Medicine, Prapokklao Hospital, Chanthaburi Province, Thailand.
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Objectives : **1. To demonstrate the patient profile and standard management with fibrinolytic therapy in Acute ST– Elevation Myocardial Infarction (STEMI).**
2. To analyze the effectiveness of referral system and clinical pathway use in Prapokklao Hospital.

Background : **STEMI remains the major leading cause of morbidity and mortality in our country. The wide spread use of fibrinolytic agent contribute to the expanding number of patients with more favorable prognosis. Little has been known about clinical outcome in fibrinolytic therapy in upcountry hospital.**

 We therefore retrospectively collect data in STEMI patients who were admitted to cardiac care unit (CCU) of Prapokklao Hospital during the fiscal year 2005.

Methods : **All consecutive STEMI patients admitted to department of medicine, Prapokklao Hospital from October 1st, 2004 to September 30th, 2005 were retrospectively reviewed.**

Results : **Ninty five patients were included in the study with 40 of them received Streptokinase (SK group) while others not receiving Streptokinase (Non–SK group). We found more patients at $\geq$ 75 years of age in Non–SK group (p = 0.025). There was considerable number of Non–SK patients who had prior CPR. Different in number occurred between 2 subjects (p = .02) who had impaired LV function (Killip class II–IV). About half of the patients had anterior wall or LBBB; which showed no correlation with mortality. Main reasons for streptokinase (SK) not applicable were delay time to hospitalization and any contraindications for fibrinolytic therapy. Non–SK groups had longer duration from pain onset to hospitalization (mean 853.19 minutes VS 204.51 minutes respectively; p = 0.051). Mean duration from CCU to SK administration was 49.67 minutes. SK patients spent 1 day longer in CCU and in hospital. Minor bleeding episodes occurred in 7 Non–SK and 6 SK patients and only one had intracerebral hemorrhage after SK. The total expense during hospital stay was also higher in SK group (40,368.11 and 42,900.90 baht respectively). In–hospital mortality rate was 10.0 percent for SK as compare to alternative 38.2 percent (p = 0.002).**

* Department of Medicine, Prapokklao Hospital, Chanthaburi Province

Conclusion : Early arrival within 12 hours is found to be benefit from fibrinolytic therapy in STEMI patients. It is safe when compare to outcome. Myocardium damage and mortality rate is considerable lower than conservative method. Process improvement should be encouraged to shorten time transfer to CCU to give the medication as soon as possible.

Background :

AMI presented by electrocardiogram (ECG) as acute STEMI remains the major leading cause of morbidity and mortality in the patients who were admitted to the hospital in many countries including Thailand[1–5].

The most significant advance in the management of AMI during the past 10 years is the introduction of fibrinolysis in routinely clinical practice. Fibrinolytic treatment has been shown to reduce infarct size and improve left ventricular function and survival rate by reopening the infarct–related coronary artery[6–13].

The wide spread use and convenience for combine administration of aspirin and intravenous fibrinolytic agent contribute to the expanding number of patients with favorable prognosis. Little has been known about clinical outcome in patient survival from fibrinolytic therapy in upcountry hospital in the angiographic era. Most of the studies in this agent were from the western world. Few data has been available in Thai population[1–5].

The objective of the study is to demonstrate patient profile and standard management in STEMI by using fibrinolytic therapy. Other is to analyze the effectiveness of referral system and clinical pathway use in Pra Pokklao Hospital. We therefore retrospectively collect data in STEMI patients who were admitted to CCU of Prapokklao Hospital during the fiscal year 2005.

Methods :

Prapokklao Hospital is a regional hospital of 733 beds situated in Chantaburi, the eastern part of Thailand, 245 kilometers from Bangkok. The department of medicine comprises of 8 CCU beds and 8 medical ICU beds.

All consecutive patients included in the study were admitted to department of medicine at CCU and/or medical wards, Prapokklao Hospital from October 1st, 2004 to September 30th, 2005.

Each patient should meet the following criteria

1. Diagnosis of acute STEMI according to European Society of Cardiology/American College of Cardiology Committee14: typical rise and gradual fall (troponin) or more rapid rise and fall (CK–MB) with at least 1 of the following: ischemic symptoms, development of pathological Q on the ECG, New or presumed new ST–segment elevation at the J point in 2 or more contiguous leads with the cutoff points $\geq$ to 0.2 mV in leads V_1, V_2, or V_3, or $\geq$ to .01 mV in other leads or coronary artery intervention.

2. All patients must be admitted directly to our department with presumptive diagnosis of acute coronary syndrome (ACS). Prior cardiopulmonary resuscitation was also included.

3. The medical records and ECG records of the patients must be available.

The clinical exclusion criteria were

1. Patient referred from other departments with admission diagnosis of non–ACS.

2. Patient already received Streptokinase from other hospital prior to admission with ACS.

On arrival, any patient with acute chest pain

would be urgently triaged and cared. at emergency department (ED) according to our standard guideline protocol for chest pain fast track approach. Afterward, if diagnosed as ACS with suspected ST-segment elevation, he would be sent to CCU to confirm diagnosis of acute STEMI. SK, as fibrinolytic therapy, was initiated as soon as possible if no any contraindication and consent form had been completed.

Single dose of Streptokinase (Streptase[TM] 1,500,000 i.u. by Sanofi Aventis) was given intravenously via infusion drip in 60 minutes in eligible patient with or without adjunctive therapy to prevent allergic reaction such as intravenous chlorpheniramine and/or dexamethasone in standard dosage. Any essential therapy was given at the discretion of attending physicians as standard protocol at the time of admission.

In patients who were not eligible for SK and no any bleeding contraindication, subcutaneous low molecular weight heparin or infusion drip of unfractionated heparin were given instead together with bleeding precaution. Time onset in step therapy and any complication of the particularly bleeding episode was recorded.

Data Collection :

The recommended guideline for chest pain pathway with standard protocol form with standing order at admission and time from onset to ED, and from ED to CCU (ED time), and from CCU to SK given (CCU time) were recorded and approved by research physician. Physicians and nurses respon-sible for the medical care completed all relevant data.

All data to be analyzed in the study were then collected from patient medical record form using principal diagnosis as AMI (International Classification of Diseases-ICD 10: I210-I213, I219). The patient baseline characteristics, cardiovascular risk factors, ECG findings, cardiac markers as creatine kinase MB (CK-MB) and cardiac troponin T, Killip Classification, MI regional wall by ECG, complications of STEMI, therapeutic modalities including fibrinolytic agent and its complication were included[14,15].

Patients were separate into SK eligible (SK group) and no SK administration (Non-SK group). Reasons for SK not applicable was categorized as 1)Duration from onset of pain to hospital was longer than 12 hours 2)Any contraindication to SK administration including elderly, prior cardiac arrest and other bleeding tendency 3)History of SK received within the past 5 days to 2 years or known sensitivity to the drug 4)Patient or close relatives did not consent to give such medication 5)Others, reason must be specified[6,16].

All variables were recorded as database collection and summarized using application program, Microsoft Access version 2003.

Statistical Analysis :

The distribution of baseline characteristics in the two groups of patients with or without SK were included in the model: age, gender, a history of diabetes, hypertension, dyslipidemia, current cigarette smoking, previous coronary artery disease (CAD) including previous MI and revascularization (percutaneous transluminal coronary angioplasty and coronary artery bypass graft), the time from the onset of symptoms to ED and fibrinolytic therapy, Killip classification at the time of admission, systolic blood pressure and heart rate at entry, the regional myocardial wall involvement shown by serial evolution

of ST–T changes in ECG. Comparison between outcome such as mortality rate and total expense was also studied.

Continuous variables were presented as mean value and +/– standard deviation. Comparison between SK group and Non–SK group were made using unpaired student t–test for continuous variables and Chi–square test for discrete variables. Variables that were not normal distribution, tested by Kolmogorov–Smirnov statistic, were made for comparison using Nonparametric technique (Mann–Whitney U test) instead.

The Statistical Package for the Social Science (SPSS) version 14 was used for all statistical analysis. All significant tests were two sided, with a value of p <0.05 considered to indicate the clinical significance.

Results :

A total of 98 charts diagnosed as STEMI were reviewed. Of the 1 ineligible patient due to expired with 30 minutes of CCU admission and the other 2 patients with medical record not available and not given SK were not included in the study. The remaining 95 patients with 40 for SK groups and 55 for Non–SK groups were extensively analyzed.

Baseline Characteristics

The baseline characteristics are described in **Table 1**. There appeared no statistical difference regarding to gender, body weight and major risk factors as diabetes, hypertension, dyslipidemia, current smoker, previous CAD between the 2 groups. Male patients were found predominately than female in both groups. Male to female ratio was 2.23 and 4.71 in Non–SK and SK patients respectively. The mean and median ages of the patients were 64.57 and 66 years respectively. The age ranged from 31 to 89 years. The youngest one was a man with survival from cardiac arrest before hospitalization

Table 1 Baseline Characteristics in Non–SK group versus SK group

Variables	Non–SK	SK	p – value
Male (%)	38/55 (69.1)	33/40 (82.5)	ns
Age (years)	65.71 (15.04	63.00 (11.59	ns*
Age ≥ 75 (%)	16/55 (29.1)	4/40 (10.0)	P=0.025
Body weight (Kg)	59.85 (14.17	60.98 (8.97	ns
Risk Factors (%)			
–Diabetes	10/55 (18.2)	5/40 (12.5)	ns
–Hypertension	22/55 (40.0)	9/40 (22.5)	ns
–Dyslipidemia	13/55 (23.6)	14/40 (35.0)	ns
–Current Smoker	15/55 (27.3)	16/40 (40.0)	ns
–Previous CAD	7/55 (12.7)	3/40 (7.50)	ns
–≥ 3 Risk Factors	7/55 (12.7)	3/40 (7.5)	ns

ns = no statistical significance

* denotes independent samples t–test

and found to be acute anterior STEMI. Unfortunately clinical consequence during CCU was stormy and died 11 days later. Despite no different in age, however elderly patients (≥ 75 years of age) were found in Non–SK group significantly (*p* =0.025). Nevertheless 3 out of 4 patients in SK group who had been given the medication with age range from 78 to 81 were successfully discharged alive. Only minority of the patients (7 in 55 Non–SK and 3 in 44 SK groups) gave a history of previous CAD and also had 3 or more major risk factors for atherosclerosis.

Severity of Illness :

Regarding the severity of illness of the patients, major findings described as predictors for the patients were studied and shown in **Table 2**. Out

Table 2 Severity of Illness in Non–SK group versus SK group

Variables	Non–SK	SK	*p – value*
Prior CPR *(percent)*	11/55 *(20.0)*	1/40 *(2.5)*	*p=0.012*
Systolic BP *(mmHg)*	120.47 ± 38.53	114.38 ± 27.55	*ns**
Heart rate *(/min)*	84.98 ± 27.02	79.70 ± 23.26	*ns**
Dysrhythmia *(percent)*	17/55 *(30.9)*	11/40 *(27.5)*	*ns*
Killip classification *(percent)*			
–Class I	18/54 *(33.3)*	23/40 *(57.5)*	
–Class II	7/54 *(12.9)*	6/40 *(15.0)*	
–Class III	9/54 *(16.7)*	4/40 *(10.0)*	
–Class IV	20/54 *(37.1)*	7/40 *(17.5)*	
–Class II–IV	36/54 *(66.7)*	17/40 *(42.5)*	*p=.02*
ECG *(percent)*			
–Anterior wall	26/53 *(47.3)*	14/40 *(35.0)*	*ns*
–Anterior wall extensive	3/53 *(5.5)*	6/40 *(15.0)*	
–Inferior	9/53 *(16.4)*	11/40 *(27.5)*	
–Inferior w/RV/Posterior	10/53 *(18.2)*	7/40 *(17.5)*	
–Lateral	2/53 *(3.6)*	1/40 *(2.5)*	
–LBBB	3/53 *(5.5)*	1/40 *(2.5)*	
Laboratory			
–CK–MB *(IU/L)*	103.82 ± 66.00	174.08 ± 161.46	*p=0.015*
–Troponin T > 1.0ng/ml *(percent)*	26/55 *(47.3)*	22/40 *(55.0)*	*ns*

ns = no statistical significance

* denotes independent samples t–test

of hospital arrest and at ED were defined as prior CPR in the study. There was statistical different (*p =0.012*) between Non–SK (11 out of 55) and SK (1 out of 40) groups. For Non–SK 2 of them had 30 and 50 minutes of duration of chest pain before arrival. The other 4 had mean duration of pain to hospital for 28.71 hours. The only one SK patient who had prior CPR arrived after 5 hours of pain onset and discharged alive.

No any statistical difference in systolic blood pressure, heart rate and dysrhythmia at entry to CCU or medical wards. The range of the blood pressure was between 50 to 230 mmHg in Non–SK group and 69 to 201 mmHg in SK patients. 6 out of 55 patients in Non–SK group and 2 out of 40 patients in SK group had systolic blood pressure higher than 160 mmHg. Heart rate was in the range of 32 and 160 per minute in Non–SK group and from 36 to 120 per minute in SK group. The arrhythmia was defined as tachyarrhythmia such as atrial fibrillation, ventricular arrhythmia and needed prompt medication and/or electric shock during the first 24 hour of admission. Arrhythmia was also found in patients with high grade AV block that indicated temporary transvenous pacemaker insertion. Nearly one–third to one–fourth (30.9 percent in Non–SK and 27.5 percent in SK patients) of the cases had arrhythmia as mentioned above.

According to left ventricular function in STEMI, Killip classification has been studied. About one–third of the patients had Killip class I (33.3%) and class IV in Non–SK group (37.1 percent). Majority of the patients (57.5) in SK–group presented with Killip class I on arrival. The other remaining 3 classes shared the similar figure of patients in SK group (class II–15 percent, class III–10.0 percent

and class IV–17.5 percent). Hence, different frequency occurred between 2 subjects (*p = .02*) who had abnormal LV function (Killip class II to IV).

Regional wall involvement of the infarct area, recognized by standard 12 leads of ECG was studied. About half of the patients (58.2 percent in Non–SK and 52.5 percent in SK group) had anterior wall or LBBB. The others ECG findings were inferior wall, lateral wall, posterior wall and right ventricular involvement or combination from any of them. This prevalence showed no statistical difference between the two groups. Moreover, there is no significant correlation between anterior STEMI and in–hospital mortality.

Study of cardiac markers for myocardial necrosis as CKMB and cardiac troponin T was analyzed. Mean CK–MB level of Non–SK patients (103.82 IU/L, range from 14 to 812 IU/L) and SK patients (174.08 IU/L, range from 15 to 689 IU/L) were shown. This revealed statistical difference of CK–MB level between the 2 groups (*p = 0.015*). Further study in cases who had CPR prior to CCU showed that mean CK–MB level were not higher (133.9 IU/L in Non–SK, 229 IU/L in SK) in this subgroup. According to semi–quantitative study of troponin T, only serum level higher than 1.0 ng/ml that could definitely determine myocardial infarction had been studied. There was no difference in prevalence of troponin T level higher than 1.0 ng/ml between Non–SK and SK patients (26 in 55 and 22 in 40 patients respectively). 14.73 percent (14 out of 95 patients) also had renal insufficiency.

Clinical Pathway and In–Hospital Outcome :

On arrival, the treatment was followed from standard protocol. Fifty five patients were not

eligible for administration of SK. Several reasons had been recorded for such patients as shown in **Table** 3. Most of the patients fell in the upper two categories as delay time to hospitalization and any contraindication for fibrinolytic therapy. Nineteen of them had time delay from onset to hospital or uncertain for its accuracy. Twenty five patients had one or several contraindications for medication usage such as elderly, active GI hemorrhage or post cardiac arrest before or at the time of admission. Two reinfarction patients had history of previous SK administration, 6 and 12 months ago. Patients and/ or their relatives did not consent for the medication in 4 cases. The other reasons were 1 with SK given before arrival, 1 with cardiogenic shock and expired 3 hours later. Three cases had clinical subside

Table 3 Reasons for Non–Streptokinase Admi–
nistration

Reasons	Number (percent)
Onset > 12 hours	19 (34.54)
Contraindications	25 (45.46)
–Elderly	9
–Post arrest	12
–Bleeding tendency	3
–Previous stroke	1
Previous Streptokinase	2 (3.64)
Patient not consent	4 (7.27)
Others	5 (9.09)
–Clinical subsided	3
–Streptokinase from other	1
–Shock	1
Total	**55 (100)**

with ECG resolution and considered not appropriate for drug administration.

45.5 percent in Non–SK patients and 55.0 percent in SK patients were referred from other hospitals to our department. There was no difference between mean of these two groups. The farthest distance of the patients referred was Sra Kaew province, situated 258 kilometers from Chantaburi. Majority of the patients from both groups (61.8 percent in Non–SK and 77.5 percent in SK group) were admitted directly to CCU according to fast track pathway protocol that showed no any different statistically. Subsequently, all of the patients in SK group (40 patients) and most of Non–SK group (49 patients) were transferred and treated in CCU according to admission criteria. The difference in CCU care between 2 groups was significant (*p=0.032*). The remaining patients had been treated in medical wards until discharge. Only 4 cases of the patient studied were revisited to CCU for proper management.

Study concerning about time onset before fibrinolytic therapy was done. Difference between the two treatment groups had been demonstrated significantly. Non–SK groups had longer duration from pain onset to hospitalization than the other one (mean 853.19 minutes VS 204.51 minutes respectively; *p= 0.051*). Interestingly, most of the SK patients (34 in 37 cases; 91.89 percent) arrived ED within 6 hours (mean and median times 176.18 minutes and 180 minutes respectively). There were only 3 patients with mean duration of 504 minutes that came later but within 12 hours.

Also it took longer time spent at ED before transferring to CCU or medical wards (mean 111.39 minutes VS 67.92 minutes; *p =0.019*). Mean duration

from CCU to SK administration was 49.67 minutes. There were only 3 cases in SK group, which was sent to medical wards before CCU admission. No time available for using any heparin as antithrombotic agents in the Non-SK patients.

Patients spent longer in CCU and in the hospital for SK group as compare to the other one (mean 6.83 VS 5.75 days and 9.45 VS 8.96 days; *p=0.019* and *p=0.039* respectively). The total expense during hospital stay was also higher in SK group but difference between mean was only 2,532.79 baht for each patient (40,368.11 ± 53,713.00 and 42,900.90 ± 27,437.75 baht respectively). But it appeared to be also statistically significant.

The overall mortality rate in the study was 26.3 percent (25 out of 95 patients). However, the highly significant between outcomes occurred. In-hospital mortality rate was only 10.0 percent for SK administration versus the alternative treatment, which was as high as 38.2 percent (*p= 0.002*). From several variables, only CCU and hospital length of stay had statistical correlation to mortality in both groups (*p value = 0.027, 0.000* in Non-SK and *0.021, 0.005* in SK respectively). Systolic blood pressure, heart rate and arrhythmia on arrival also had this relation in Non-SK group *(p value = 0.003, 0.028* and *0.037* respectively)

Considering the referred cases from other hospitals, the mortality rate was similar between the 2 treatment groups. Referred cases died 13 in 47 patients (27.6 percent), while the non-referred one died in hospital 12 in 48 (25.0 percent). The mortality increased significantly in the patients with higher Killip class. In patients presented with acute pulmonary edema (Killip III) 3 in 9 patients died (33.3 percent mortality rate) versus 1 in 4 SK patients died

(25.0 percent mortality rate). Interestingly all SK patients with cardiogenic shock (Killip IV) on arrival survived out of hospital as compare to 15 in 20 patients (75 percent mortality) who died in Non-SK group. No other different between medical complication such as pneumonia or bleeding episode from fibrinolytic or antithrombotic usage. There were minor bleeding episodes in 7 Non-SK and 6 SK patients. When bleeding occurred the medication was discontinued immediately. Only 1 patient in SK group required FFP replacement. The occurrence for intracerebral hemorrhage was seen in 1 female at 69 years of age who received fibrinolytic therapy and died after 2 days of admission. This figure caused 1 out of 40 with 2.5 percent prevalence rate. Three patients developed hypotension after SK. This was easily corrected by fluid and vasoactive therapy. SK was discontinued in 2 patients who were suspicion of hypersensitivity with no sequel. One case that received SK developed coronary reinfarction and was treated with additional heparin.

In consideration about clinical pathway effectiveness and outcome of all the patients already mentioned, the data are described in **Table 4**.

Study Limitation :

This retrospective study analyzed the available data from CCU case record forms and medical record charts in PPK hospital during fiscal year 2005. According to a total case of 98, the data collection was limited due to many reasons during the data collection process such as incomplete history taking, conflicting results between recorders, loss of record forms, inadequate laboratory testing, missing ECG records etc. The most difficult in initial

diagnosis was about onset of pain. Certain patients could not tell us for definite time. Sometimes intermittent versus continuing pain also caused the problem for judgment.

According to the study design for effectiveness of clinical pathway, few patients known as subsequent STEMI during hospitalization with other admission diagnosis were not included.

Table 4 Fast Track & Outcomes in Non–SK group versus SK group

Variables	Non–SK	SK	*p – value*
Referred *(percent)*	25/55 *(45.5)*	22/40 *(55.0)*	*ns*
Fast track *(percent)*	34/55 *(61.8)*	31/40 *(77.5)*	*ns*
CCU admission *(percent)*	49/55 *(89.1)*	40/40 *(100)*	*ns*
Readmit CCU *(percent)*	1/55 *(1.8)*	3/40 *(7.5)*	*ns*
Time onset			
–Onset to ED *(minutes)*	853.19 ± 1314.95	204.51 ± 137.34	*p=0.051*
–ED to CCU *(minutes)*	111.39 ± 164.17	67.92 ± 61.14	*p=0.019*
–CCU to SK (minutes)	N/A	49.67 ± 30.44	
Length of Stay (days)			
–CCU	5.75 ± 5.78	6.83 ± 4.58	*p=0.019*
–Hospital	8.96 ± 9.26	9.45 ± 5.37	*p=0.039*
Medication complications			
–Tube bleeding/sheath	2/55	3/40	
–GI bleeding	1/55	1/40	
–Hematuria	2/55	1/40	
–Intracerebral he	0/55	1/40	
–Drop in hematocrit	1/55	0/40	
–Bleed > 1 site	1/55	0/40	
–Hypotension	N/A	3/40	
–Hypersensitivity	N/A	2/40	
Discharge status			
–Improved	32/55 *(58.2)*	34/40 *(85.0)*	*ns*
–Refer	2/55 *(3.6)*	2/40 *(5.0)*	*ns*
–Dead *(all)*	21/55 *(38.2)*	4/40 *(10.0)*	*p=0.002*
–Dead *(referred cases)*	9/25 *(36.0)*	4/22 *(18.2)*	*ns*
Expense *(baht)*	40,368.11 ± 53,713.00	42,900.90 ± 27,437.75	*p=0.035*

ns = no statistical significance, N/A = not applicable

Therefore selection bias appeared to be a limitation to interpret the data in the general population.

The STEMI patients who were sicker at presentation or subsequent period were likely to be admitted to CCU first. The rest of the STEMI patients who came to our hospital were triaged to the general medical wards because a limitation in CCU bed availability.

Severity of illness described by ventricular function has not been studied by other method such as echocardiogram[9] and/or Swan–Ganz catheterization[17]. However Killip classification is worldwide accepted for ventricular function assessment in general practice. No angiographic findings were available for coronary study.

There was also conflicting evidence about availability of laboratory data. If conclusive diagnosis had been made, some patients were not collected blood sample for CK–MB peak level. Moreover, troponin T at the time of the study remained semi-quantitative method as already mentioned. No details about other standard medical therapy have been reviewed, as it is not our main objective in this study. Utilization study was limited for tangible expense as charge per patient. Other indirect cost and labor cost was not included. This could be another bias in the study.

Discussion :

During the past 2 decades, emphasis on the management of patients with AMI has shifted from approach focused largely on the management of malignant dysrhythmia to strategies aimed at reducing the extent of infarction, preventing reinfarction, and promoting myocardial healing.

Among patients with early clinical signs suggestive of acute trasmural infarction or STEMI,

about 80 percent have thrombotic occlusion of the coronary arteries. If the obstruction is clear early enough, some salvage of ischemic myocardium, and hence improvement in left ventricular function is likely. There is clear evidence that aspirin and fibrinolytic agent reduce mortality upto 42 percent in a large clinical trial[7].

Our study tries to answer the research question about the effectiveness of SK if there is the indication to do so. This medication has been used worldwide for more than 10 years because of its efficacy as mentioned above together with convenience to use despite no catheterization laboratory available. Few data was obtained about experience used in Thailand[2-5]. Recent large prospective collaborative trial by some centers in Thailand for Ad Hoc Committee for National Registry endorsed by Thai Heart Association are ongoing studied. The result of the study is speculating to be announced soon.

Baseline Characteristics and Clinical profile :

For our 95 patients enrolled in the study, similar findings were found between two groups regarding to gender, body weight and major risk factors. Male were predominately involved as in other studies. The prevalence of elderly in Non-treatment group was well understood that risk of major bleeding was higher in advanced age. Some recommended as relative contraindication for SK[18]. However the risk is higher in another fibrinolytic as recombinant tissue plasminogen activator (rtPA)[8-11], which is not used in our hospital. Nevertheless 3 out of 4 cases had been safety used in our study.

Prior cardiac arrest from electrical instability

was a major predictor of outcome as seen in the study. Some patients died before seeking medical care. Despite the ACC recommendation for not using fibrinolytic when cardiac arrest for more than 10 minutes[16], practically physicians were likely to withhold the medication. Up to 12 patients were found in the study as a reason not to use the medication. Any attempt should be done to help shorten duration from onset of pain to hospital before cardiac arrest occurred.

Cardiac dysrhythmia was a challenging presentation for all physicians in the immediate management. Nearly 30 percent in this study were included. Definite diagnosis is crucial. In general, for hemodynamic compromised tachyarrhythmia, electrocardioversion is the management of choice together with Amiodarone. Temporary pacemaker insertion should be done in case of bradyarrhythmia at all types. All of this management should be well performed as a life saving maneuver. For hospital with cardiologists and/or technology is not available, effective referral system is essential.

Another presentation with mechanical function of left ventricle is also important. Patient, who arrived earlier, could maintain left ventricular function as seen in Killip class I (33.3 percent in Non–SK and 57.5 percent in SK group). This ratio is higher than study at Siriraj hospital (41.8 percent)[3]. Less favorable prognosis occurred in patients who presented with severe damage of left ventricle. Moreover, we could demonstrate the difference in mortality between the two groups, which manifested as acute pulmonary edema and/or cardiogenic shock (Killip classes III and IV respectively). Hence preserved myocardium with reperfusion by any method such as fibrinolytic

therapy is also important. It help determines prognosis if successful reperfusion occurs.

Prevalence of anterior wall and/or left bundle branch was similar in both groups. It has been shown that this prevalence is also similar to United States –TIMIII study (50.6–55.9 percent)[8] and Thailand (54.4 percent[3] and 59.3 percent[4]). If anterior wall is predominately supplied by left anterior descending artery, our patients will take more risk than others from different population. Moreover a figure of 10 percent mortality rate in our cases with SK given is less than Siriraj study (16.0 percent)[4] but could not still be benchmarking with other large trials for better outcome (8.6 percent[9], 9.6 percent[13] and 10.7 percent[6]).

There is diversity in level of cardiac markers in the study. This could be explained by several reasons. Some patients arrived so early. If clinical findings were clear–cut for STEMI, no further blood study was available in some of our patients. In general, survivors from cardiac arrest will have higher level of cardiac marker from myocardium damage. However, we could not demonstrate such relationship. This could be partially explained that we select blood result obtained during rather than early of hospitalization. Unfortunately, troponin T level at the time of study remained semi–quantitative. Therefore, mean level of this marker was not available.

Time from onset of pain :

There is consensus that treatment with fibrinolytic agent in patients presenting within 6 hours of symptom onset, with ST–segment elevation on the ECG, will reduce mortality by about 25–30 percent.

The reduction in mortality observed was

approximately similar among patients starting treatment within 6–12 hours after onset of symptoms as well. Interestingly most of our SK patients arrived ED within 6 hours after onset. Only 3 of them arrived with average time of 8 hours. Our data showed longer time to hospital than Siriraj study[4] (median arrival time = 120 minutes). Fibrinolytic therapy could not be applicable in some patients who arrived late. Mean time from onset to ED in Non–SK group was 853 minutes (approximately 14 hours). Moreover late arrival took more risk for cardiac arrest from dysrhythmia. Unfortunately, we could not demonstrate this relationship in our study. Combination of late onset arrival and prior CPR, it could be postulate that this group of patient could be successful reperfusion by SK and have favorable outcome. Effective plan should be made in the future for public awareness of chest pain and improvement of referral system to our unit.

In review of time from ED to CCU and SK administration, it took longer duration as compare to standard recommendation. So called "Door to Needle" (time from arrival to medication given) should be less than 30 minutes[16]. This could be done by process improvement in every step since arrival of the patient suspected. One should be alert at ED for any patient complaint of acute chest pain. Rapid clinical and ECG diagnosis should be made and prompt transfer to CCU SK given if indicated. Delay treatment during CCU admission should also be improved. Immediate call for physician on duty should be made. Unnecessary initial intervention should be postponed before evaluation for eligible patient. Protocol should be set up and everybody must follow the recommendation. Bed should be available for 24 hours. Eventually, team for continuous improvement should revise the clinical pathway. The process should also be adequately prepared for primary percutaneous coronary intervention to further improvement of outcome in a few more years from now.

Because of limitation of CCU bed availability together with accessibility policy for every triaged case, some patients had less CCU stay as truly required. In the study, every patient who needed fibrinolytic therapy was admitted in CCU. This is comparable to Siriraj study[3]. However as for resource utilization, our patients were assumed to stay in CCU in only short duration. This could be made by caremap usage especially in non–complicated patient. Regarding to caremap, If patient no longer needs critical care, one must be transferred to medical ward. This method should be planned in the near future.

Outcome Study :

Bleeding episodes after SK occurred in 6.7 percent and resolved. Only 1 case of bleeding that needed transfusion therapy and another fatal case of intracerebral hemorrhage were found. The mortality rate of patients receiving SK was considerably lower than the other group ($P = 0.002$). This could be explained from the outstanding benefit of reperfusion by using SK as seen from worldwide study[6–13]. If jeopardized myocardium could be salvaged in time by fibrinolytic therapy and reperfusion occurs, we could save some of our patients in Non–SK group. Regarding to late arrival and prior cardiac arrest, if SK has been given, we could save life in some of them. Although late thrombolysis up to 24 hours could be used in selected patients[19]; it had not been applied in our study.

Finally, total expense was also studied. Expense per case is approximately 40,000–43,000 baht. Even though SK group spent more than the alternative one for 2532.79 baht, cost for SK is 10,000 baht had already been included. It could be summarized that if prevalence rate of major bleeding is acceptable and average stay 1 day longer in CCU, SK administration gives more cost–effectiveness and cost–benefit than traditional method. Calculated relative and absolute risk reduction in our study are 73.68 and 28percent respectively. This means that for every 100 patients enrolled in the SK treatment group, about 28 dead outcomes would be averted. The number needed to treated (NTT) is only 3.57 for discharged alive.

Clinical Implication :

We demonstrate the method and outcome from treatment the patient of STEMI in Prapokklao hospital. It has been shown that fibrinolytic therapy is effective and safe for the STEMI patients. Our result is quite consistent with other study. It is convenience to use and more cost effectiveness and cost–benefit in terms of resource utilization. Our utilization study can also be extended for administrative purpose.

Any clinical process to reduce mortality is to be highly concerned. Multidisciplinary team should review the implement process for chest pain pathway. Early recognition in public and effective referral system should be done to reduce duration from onset to hospital. In the hospital that has no CCU or no bed is available, SK given in intensive care unit is also possible.

In the near future, fibrinolytic therapy should be used earlier at ED. Moreover revascularization by percutaneous coronary intervention with or without stent is our promising alternative therapy or as first line therapy in case eligible for such therapy in our unit.

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