Clinical Outcomes of Fast Track Managed Care System for Acute ST Elevation Myocardial Infarction (STEMI) Patients: Chonburi Hospital Experience

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Objective: *To evaluate the clinical outcomes of fast track managed care system for STEMI at Chonburi Hospital.*
Material and Method: *Descriptive review of clinical parameters from STEMI patients who participated in fast track managed care system.*
Results: *There were 56 STEMI consecutive cases admitted to the intensive care unit (ICU) between August 1, 2006 and January 1, 2007 in the pilot project of the fast track managed care system (43 men and 13 women). The average age was 61 years. The coronary artery disease (CAD) risk factors were smoking (66%), hypertension (41%), diabetes mellitus (44%), and dyslipidemia (46%). The atherosclerosis diseases were chronic renal disease (3.6%), cerebrovascular disease (7%), and peripheral vascular disease (3.6%). The average length of stay was 5.7 days. The median door to needle time and door to balloon time were 49.8 and 130.5 minutes respectively. Ten patients developed complications, which included gastrointestinal bleeding and ecchymosis. The mortality rate was 26.8% (15 cases). The current medications such as ACE-I, betablocker, and dopamine between survivors and non-survivors were compared and showed statistical significance. The creatinine and creatine phosphokinase (CPK) were significantly different between survivors and non-survivors. There was a decrease trend of the overall mortality rate in STEMI patients between July 2006 and January 2008 following the launch of the fast track managed care system.*
Conclusion: *When compared to a previous study, the fast track system could decrease mortality rate, door to needle time, and door to balloon time. The fast track should be included in routine hospital guideline for management of STEMI patients.*

Keywords: *STEMI, Reperfusion therapy, Door to needle, Door to balloon time, Fast track*

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Cardiovascular disease is currently the second cause of death, following motor vehicle accidents. It also is a leading cause of death in developing countries[1]. Acute myocardial infarction is not only a common disease but also an emergency cardiovascular condition. If the diagnosis and treatment were delayed, the mortality rate would be high due to cardiac arrhythmia or heart failure[2]. Pathogenesis of myocardial infarction comes from coronary artery occlusion by platelet, further cardiac muscle cell was ischemia and dead[3]. The risk factors of coronary artery disease are hypertension, dyslipidemia, diabetes mellitus, and smoking[4,5].

Antman reported that reperfusion therapy by thrombolytic agent had the same benefit as Percutaneous Coronary Intervention (PCI) if the ST elevation myocardial infarction (STEMI) patients were administrated within 3 hours after the onset of chest pain. But PCI was significantly superior to thrombolytic agent if

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onset of chest pain was longer than 3 hours[6,7]. The Guideline management recommended that the door to needle time should be within 30 minutes and the door to balloon time should be within 90 minutes[6-8]. The GRACE Study reported the door to needle time and door to balloon time from many countries were 40 and 93 minutes respectively which did not archive the standard of care. The time delayed would increase the mortality rate[9].

Thai ACS registry (TACSR) studied patients with myocardial infarction from 2002 to 2004 and reported that the mortality rate in STEMI patients was 17%. The risks that increased mortality rate were aging, Killip classification III, IV, coronary risk factors such as diabetes. The door to needle time and door to balloon time were 85 and 122 minutes respectively[10]. The time delay was longer than the current standard of care and caused increased death[9]. Thai ACS registry also studied the medications that could lower the mortality rate among STEMI patients such as aspirin, betablocker, and Angiotensin-Converting Enzyme (ACE) inhibitors[11,12].

Teyapan studied STEMI, non-STEMI, and unstable angina patients who visited Chonburi Hospital during 2001-2002, which had no Cardiac Catheterization Laboratory at that time. Fifty-eight percent of these patients received thrombolytic agents. The overall STEMI mortality rate was 27.8%. The door to needle time in the STEMI group was 5 hours, which were much longer than the acceptable time[13].

Cardiac Catheterization Laboratories were established at Chonburi Hospital in November 2005. The fast track managed care system has been initiated since July 2006 in order to reduce mortality rate and provide better care for the acute STEMI patients. The authors aimed to compare clinical outcomes before and after establishing the fast track managed care system. The quality of caring and outcome were also benchmark with Thai ACS registry study in order to improve the service and develop the fast track managed care system.

Material and Method

Descriptive review of clinical parameters from STEMI patients who consecutively participated in the fast track managed care system. Clinical parameters included demographic data, disease characteristics, baseline laboratory data, treatment information, complications, and mortality. The median of door to needle time and door to balloon time together with mortality rate were analyzed and compared with the Thai ACS registry. The survival and mortal case were analyzed by using Pearson-Chi-square continuity correction, Fisher's exact test, linear by linear and ANOVA. Statistical significance was defined as $p < 0.05$.

Definition

The STEMI patients were defined as the patient who had abnormal ECG and one of the following criteria;

1. Symptomatic chest pain within 7 days
2. Raising cardiac enzyme

The abnormal ECG was defined as presentation of Q wave or ST segment elevation more than 0.1 mV in at least two consecutive leads or new or presumed new left bundle branch block (LBBB). The raising cardiac enzyme was defined as raising Creatine Kinase (CK) more than 2 fold together with CK-MB more than 10% and/or raising troponin T (TnT) more than 0.1.

The fast track managed care system was a designed system to characterize patients' chest pain, transfer patients from the emergency room to the intensive care unit (ICU), promptly consult a cardiologist, initiate investigation, start proper medication, and record the timing of each step in the pathway protocol. The main purpose was provided reperfusion therapy by setting the door to needle time and door to balloon time less than 60 and 90 minutes respectively. Type of reperfusion therapy was selected based on indication, contraindication and suitable time for available catheterization laboratory. The initial pilot project was started from August 1, 2006 to January 1, 2007; followed with the routine use of fast track managed care system as the Chonburi Hospital standard guideline of care for STEMI patients from January 2007 to the present time.

Inclusion and exclusion criteria

Inclusion criteria included the STEMI patients who presented at Chonburi Hospital. The patients who did not have an abnormal ECG as above definition were excluded from the present study.

Results

Between August 1, 2006 and January 1, 2007, 56 patients who had STEMI based on inclusion criteria were included in the presented pilot prospective study. There were 43 men (76.8%) and 13 women (23.2%) with an average age of 61 years. The average length of stay was 5.7 days. The coronary artery disease (CAD) risk factors were smoking (66%), hypertension (41%), diabetes mellitus (16%), and dyslipidemia (48%). The

atherosclerosis diseases were chronic renal disease (3.6%), cerebrovascular disease (7%), and peripheral vascular disease (3.6%). Most patients (82%) had typical angina pain. Half of the patients (51%) were admitted after onset of 3 to 12 hours, whereas only 25% visited the hospital before 3 hours. Medications, including ASA (94.6%), clopidrogel (89.3%), statin (100%), ACEI (48.2%), betablocker (19.6%), vasodilator (1.8%), diuretic (26.8%), heparin (42.9%), nitrate (30.4%), dopamine (23.2%), and dobutamine (7.1%), were used. The mean of laboratory data was Troponin T (2.7), blood glucose (147 mg/dl), cholesterol 195 mg/dl, triglyceride (141 mg/dl), HDL (36mg/dl), LDL (136 mg/dl), and creatinine (1.6mg/dl) (Table 1).

All 56 patients were registered in the fast track managed care system. Thirty-five patients received the reperfusion therapy. Thirteen patients had primary PCI (23%) and 22 patients received thrombolytic agent (39.3%). Twenty-six patients, who did not receive reperfusion therapy, had one of the following reasons, onset of chest pain longer than 12 hours (12 cases), contraindication for thrombolytic agent (3 cases),

Table 1. The correlation between survival and mortal cases from 56 patients registered in the fast track system

	Survival group (cases)	Mortal group (cases)	p-value
Demographic data			
Total	41	15	
Male, Female	32, 9	11, 4	0.73
Mean age	57.44	71.6	0.005*
Risk factor			
Smoking	30	7	0.064
Hypertension	17	6	0.585
DM	5	4	0.183
Dyslipidemia	26	1	0.305
CKD	2	-	0.532
Stroke	3	1	0.711
Current medication			
ASA	40	13	0.172
Clopidrogel	39	11	0.056
ACEI	27	-	<0.001*
Betablocker	11	-	<0.001*
Diuretic	12	3	0.371
Statin	41	15	
Heparin	17	7	0.48
Dopamine	4	9	<0.001*
Dobutamine	2	2	0.289
Nitrate	15	2	0.085
Baseline laboratory data			
Hematocrit	37.20%	37.11%	0.553
Creatinine	1.33 (0.6-4.9)	1.63 (0.6-9.7)	0.025*
Troponin T	1.96 (0.01-22.33)	2.69 (0.01-22.33)	0.02
CPK	1,595.11 (69-14,179)	2,334.50 (69-20,866)	0.011*
CPK-MB	126.00 (7-699)	167.71 (7-821)	0.005*
Blood glucose	143.22 (86-423)	147.00 (86-423)	0.321
Cardiac complication			
Killip class I,II,III	34	4	
Killip class IV	7	11	0.003*
CHF	11	4	0.637
Serious arrhythmia	5	8	0.003*
Shock	5	11	0.001*
Cardiac arrest	2	14	0.001*
Time			
Door to needle time	18-125 min (median 36)	29-97 min (median 35)	0.892
Door to balloon time	39-422 min (median 131.5)	43-170 min (median 65)	0.489

previously receiving thrombolytic agent (2 cases), poor prognosis (2 cases), self resolution of ECG (1 case), and improper physician judgment (1 case). The median of door to needle time and door to balloon time was 49.8 and 130.5 minutes, respectively (Table 2).

The disease complications included 15 heart failures (26%), 13 cardiac arrhythmias (23%), 16 cardiogenic shocks (28%), and 16 cardiac arrests (28%). The treatment complications included seven gastrointestinal bleeding (12.5%), two ecchymosis(3.6%), and one hypotension(1.8%). There were six and nine deaths in the reperfusion therapy and non-reperfusion therapy group, respectively. The correlation between survivor and non-survivors was analyzed as shown in Table 1. The mean age between survivors and non-survivors was compared and showed statistical significance. The current medications such as ACE-I, betablocker, and dopamine between survivors and non-survivors were compared and showed statistical significance. The creatinine and creatine phosphokinase (CPK) were significantly different between survivors and non-survivors.

After January 1, 2007, the fast track managed care system for STEMI patients was routinely used at Chonburi Hospital. Although the same inclusion and exclusion criteria were continuously used until the present time, only the number of cases, reperfusion therapy type, door to needle, door to balloon time, and mortality rate were recorded. There were case conferences and continuous development of the step of care of the fast track managed care system each month and every time there were problem cases. There was a decreased trend of the overall mortality rate in STEMI patients between July 2006 and January 2008 as shown in Table 2.

Discussion

Although the mortality rate from the present study was 26.8%, which was higher than the GRACE study and the Thai ACS registry study (TACSR), it was lower than the previous study from Chonburi Hospital[9,10,13]. After implement of the pilot project (from August 1, 2006 to January 1, 2007), the fast track managed care system has been continuously used in Chonburi Hospital. There was a decrease trend of the overall mortality rate in STEMI patients between July 2006 and January 2008. This decrease trend may be from better attention to selected chest pain patients in OPD and ER, prompt use of the diagnostic parameter and initiation of the early treatment. In the past, general routine care for all STEMI patients would take longer. The door to needle time in the past study was 5 hours, which was much longer than the acceptable time[13].

The door to needle time was 49.8 minutes, which was less than the door to needle time in TACSR (85 min)[10] and more than the door to needle time standard of care (30 min)[6,7]. Only eight from 22 (36%) patients received thrombolysis within 30 minutes. The reason for this success was the implementation of the thrombolytic agent in the emergency room before transferring patients to the CCU. The door to balloon time was 130.5 minutes, which was longer than the Thai ACS registry study and standard of care (90 minutes). The reason for the delay timing was the limitation of the availability of the catheterization laboratory. The main reason for the delay timing was the ongoing operated case in the catheterization laboratory. Thus, the door to balloon time would improve if the management of the time system supported primary PCI cases were better. The managed condition was the first priority for primary PCI and quickly finished elective case.

Table 2. The fast track of STEMI patients during July 2006 to January 2008 (19 months) in chonburi hospital

	Duration months	Total	Death	SK < 60 min	Door to needle (min, median)	Primary PCI	Door to balloon (min, median)
July 2006 to September 2006	3	21	9 (42.8%)	no data	68 (18-130)	1 (4.7%)	80
October 2006 to September 2007	12	134	27 (21.1%)	44 (78.57%)	52.54 (31-80)	21 (15%)	78 (63-422)
October 2007 to January 2008	4	51	10 (19.6%)	18 (50%)	59 (33-95)	15 (24 %)	101 (77-130)
August 2006 to January 2007*	6	56	15 (26.8%)	22 (39.3%)	49.8 (18-125)	13 (23.2%)	130.5 (39-422)

* Pilot study 56 STEMI patients in fast track during August 2006 to January 2007

From the TACSR, the primary PCI was performed in 22.24% and the thrombolytic was given in 30.37%[9], for the present study, it was 23% and 39.3% respectively. The ratio of reperfusion method was nearly the same in number because the nature of the service time of the catheterization laboratories in Thai public hospitals was the same since they were not operated all the time.

The survivor and non-survivors characteristics are compared in Table 1. The non-survivor group showed more severity of the disease condition, more serious complications than the survival group. Furthermore, the non-survivor group was older than the survivor group. The statistically significant clinical parameters were cardiac complications, the use of betablocker, ACE-I and dopamine.

From the TACSR, the patients who used aspirin, betablocker, and ACE inhibitors were 95.2%, 58.3%, and 59.4%, respectively[10]. From the GRACE study, the patients who used aspirin, betablocker, and ACE inhibitors were 93%, 82%, and 74%, respectively[9]. From the present study, the patients who used aspirin, betablocker, and ACE inhibitors were 94.6%, 19.6%, and 48.2% respectively. The present study had a lower rate of using these beneficial medications in comparison to the GRACE study and the Thai ACS registry study but all the patients used statin (100%).

The care for the STEMI patients in Chonburi Hospital during 2001-2002 did not have the fast track managed care system, there was a delay of the door to needle time and a high mortality rate. The pilot project of the fast track managed care system in the first six months had a trend to improve the mortality rate and improvement of standard care of acute MI including statin and beneficial medications as well as door to treatment time. After the pilot project, the fast track managed care system was routinely used in the hospital. The cumulative skill and experience of the fast track managed care system has improved overall Chonburi Hospital's outcome. The main reason of the improvement is the routine case conference and continuous development of the step of care of the fast track managed care system every month and every time when there are problem cases.

Conclusion

Acute myocardial infarction is a common disease and an emergency cardiovascular condition. The quick accurate diagnosis and prompt proper management will decrease the mortality rate. The setup of the fast track managed care system for this condition can improve the door to treatment time and may lower the mortality rate. The continuous improvement of the outcome of the fast track managed care system can be predicted if routine practice with quality assessment process is monitored.

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ผลทางคลินิกของผู้ป่วยกล้ามเนื้อหัวใจตายแบบเฉียบพลันที่เข้าร่วมระบบเร่งด่วนในการดูแล: ประสบการณ์ของโรงพยาบาลชลบุรี

วรวิทย์ ตันติศิริวัฒน์, วิวรรธน์ เจี่ย, หทัยชนก งามเกษม, สุวิมล ตันติศิริวัฒน์

วัตถุประสงค์*: เพื่อประเมินผลทางคลินิกของผู้ป่วยกล้ามเนื้อหัวใจตายแบบเฉียบพลันที่เข้าร่วมระบบเร่งด่วนในการดูแลของโรงพยาบาลชลบุรี*

วิธีการศึกษา*: รวบรวมข้อมูลทางคลินิกของผู้ป่วยกลุ่มเป้าหมายที่เข้าร่วมการรักษาด้วยระบบเร่งด่วน*

ผลการศึกษา*: มีผู้ป่วยจำนวน 56 รายที่เข้ารับรักษาตัวในหอผู้ป่วยระยะวิกฤต เข้าร่วมโครงการนำร่องของระบบเร่งด่วนในการดูแลผู้ป่วยกล้ามเนื้อหัวใจตายแบบเฉียบพลัน ตั้งแต่ 1 สิงหาคม พ.ศ. 2549 ถึง 1 มกราคม พ.ศ. 2550 โดยเป็นชาย 43 รายและหญิง 13 ราย มีอายุเฉลี่ย 61 ปี พบปัจจัยเสี่ยงต่อการเกิดโรคหลอดเลือดหัวใจดังต่อไปนี้ สูบบุหรี่ (ร้อยละ 66) ความดันโลหิตสูง (ร้อยละ 41) เบาหวาน (ร้อยละ 44) และระดับไขมันสูงผิดปรกติในเลือด (ร้อยละ 46) พบโรคที่เกิด ความผิดปรกติของหลอดเลือดได้แก่ โรคหลอดเลือดสมอง (ร้อยละ 7) โรคไตเรื้อรัง (ร้อยละ 3.6) และโรคความผิดปรกติของหลอดเลือดส่วนปลาย (ร้อยละ 3.6) ระยะเวลาการนอนพักในโรงพยาบาลโดยเฉลี่ยเท่ากับ 5.7 วัน มีระยะเวลาเฉลี่ยในการรอรับการรักษาด้วยยาสลายลิ่มเลือด และการถ่างขยายหลอดเลือดหัวใจ คิดเป็น 49.8 และ130.5 นาที มีผู้ป่วย 10 รายที่เกิดภาวะแทรกซ้อนเช่นเลือดออกในทางเดินอาหาร, จ้ำเลือด มีอัตราการเสียชีวิตคิดเป็นร้อยละ 26.8 เมื่อเปรียบเทียบระหว่างผู้รอดชีวิตและผู้เสียชีวิตในกลุ่มเป้าหมายพบว่ามีความแตกต่างอย่างมีนัยสำคัญทางสถิติในเรื่องของยาที่ผู้ป่วยใช้ในปัจจุบันซึ่งได้แก่ ACE-I, beta blocker และ dopamine นอกจากนี้ยังพบความแตกต่างอย่างมีนัยสำคัญทางสถิติของค่า creatinine และ creatine phosphokinase (CPK) ระหว่างผู้รอดชีวิตและผู้เสียชีวิต ภายหลังการนำระบบเร่งด่วนในการดูแลผู้ป่วยกล้ามเนื้อหัวใจตายแบบเฉียบพลันมาใช้ในการดูแลผู้ป่วยของโรงพยาบาล พบแนวโน้มที่ลดลงของอัตราการเสียชีวิตในผู้ป่วย STEMI ที่มาโรงพยาบาลในช่วงระหว่างกรกฎาคม พ.ศ. 2549 ถึงมกราคม พ.ศ. 2551*

สรุป*: เมื่อเปรียบเทียบกับผลการศึกษาในอดีตพบว่าระบบเร่งด่วนสามารถลดอัตราการเสียชีวิตและย่นเวลาการรอรับการรักษาเปิดหลอดเลือดด้วยยาสลายลิ่มเลือดและการถ่างขยายหลอดเลือดหัวใจ โรงพยาบาลควรจะนำระบบเร่งด่วนดังกล่าวมาใช้ในมาตรฐานการดูแลผู้ป่วยกล้ามเนื้อหัวใจตายแบบเฉียบพลัน*