Using Digital ECG Consultation System to Facilitate Cases for ST-Elevation MI in Saraburi Hospital

Pitha Promlikitchai MD*,
Prajak Suchatsuntorn MD*, Surachai Kobkuechaiyapong MD*,
Titaya Doungngern RN**, Paweena Doungakka RN**

** Department of Medicine, Saraburi Hospital, Saraburi, Thailand*
*** Cardiac Center, Saraburi Hospital, Saraburi, Thailand*

Objective: *To study the efficacy of fast track managed care and in-hospital outcomes after applying the Applied Digital 12 leads ECG Consultation System (ADECS) to the routine ST segment elevation myocardial infarction (STEMI) fast track guideline in Saraburi Hospital.*
Material and Method: *The data were collected from a prospective registry of all chest discomfort patients who were admitted by STEMI fast track care between January 1, 2008 and October 31, 2010.*
Results: *Two hundred forty eight STEMI patients were divided into two groups (before; n = 123 and after applying ADECS; n = 125). Mean age was 62.35 ± 12.85 years and 70.2% were male. Common atherosclerosis risk factors were dyslipidemia (80.2%), hypertension (71.8%) and smoking (40.7%). The agreement of STEMI diagnosis between emergency department (ED) and ward improved from moderate to good level (Kappa value = 0.602; p < 0.001 vs. 0.718; p < 0.001). Mean/median of door to needle time (DTNT) and percentage of STEMI patients receiving thrombolytic therapy who achieved DTNT within 30 minutes were significantly improved, showing 73.24 ± 54.78/65 vs. 46.05 ± 33.88/30 minutes; p < 0.001 and 6% vs. 50.6%; p < 0.001 respectively. Mean/median of total ischemic time (TIT) was not different, 250.13 ± 139.09/225 vs. 254.21 ± 163.12/226 minutes; p = 0.873 due to long symptom onset to hospital arrival time (SHAT), 176.90 ± 130.08/145 vs. 208.16 ± 167.38/165 minutes; p = 0.218, which corresponded to the same of all in-hospital outcomes. Only the TIT within 180 minutes could show decreasing mortality rate but statistically insignificant, 13.5% vs. 20.7%; p = 0.369. Major bleeding complication was not different between thrombolytic infusion at ward or at ED, 4.1% vs. 4.8%; p = 1.00.*
Conclusion: *ADECS should be included in routine fast track care and thrombolysis should be initiated infusion in Emergency Department for all STEMI patients. Short DTNT was not enough to improve in-hospital outcomes. The continuous improvement should be focused on the SHAT and routine practice with quality assessment process.*

Keywords: *STEMI, Fast track, Door to needle, Digital ECG, Thrombolysis*

J Med Assoc Thai 2011; 94 (8): 933-40
Full text. e-Journal: *http://www.mat.or.th/journal*

The ST segment elevation myocardial infarction (STEMI) is a common and serious medical condition that has high mortality and morbidity all over the world[1], including developing countries such as Thailand[2]. The faster the authors can open the occluded coronary artery, the lower will the mortality and morbidity be[3]. Thirty minutes is the ideal time for door to needle time (DTNT)[4]. Nowadays, there is limited data to show efficacy of fast track care in rural hospitals in Thailand[5-7]. The presented data at Saraburi Hospital in 2008 showed mean/median of DTNT were 81.12 ± 64.50/70 minutes respectively and none could achieve goal of DTNT, because all patients had to have thrombolysis at the ward that took another 32.99 ± 16.09 minutes for admission[7]. Moving the site of thrombolytic infusion from ward to the emergency department (ED) is the only way to achieve 30 minutes. Under the limitations of service condition in the real world, practice in rural hospitals can be enhanced through high communication technology that is available from the cyber world. Therefore, an ordinary 12 leads ECG papers can be easily transformed into digital ECG in PDF files, which can be transferred by electronic transmission to cardiologists for rapid consultation. After confirmed diagnosis and informed consent was obtained, the patients could be thrombolysed at ED immediately. The present study

Correspondence to:
Promlikitchai P, Department of Medicine, Saraburi Hospital, Saraburi 18000, Thailand.
Phone & Fax: 036-317-337
E-mail: pitha8133@hotmail.com

was designed to identify the improvement of the fast track managed care system and in-hospital outcomes after applying ADECS to the routine fast track STEMI guideline in Saraburi Hospital.

Material and Method

The data was collected from a prospective registry of all chest discomfort patients who were admitted to Saraburi Hospital by fast track care from January 1, 2008 to October 31, 2010. All STEMI patients were divided into two groups. First, the before applying ADECS group collected data from January 1, 2008 to May 31, 2009 for comparing clinical parameters with the second group. The after applying ADECS group collected data from June 1, 2009 to October 31, 2010. This protocol was approved by the hospital ethics committee and verbal consent was obtained from every patient.

Operational definition

STEMI patients were defined as patients with abnormal ECG, which was defined as presentation of Q wave or ST segment elevation at the J point > 0.2 mV in men or > 0.15 mV in women in leads V2-V3 and/or > 0.1 mV in other leads at least two consecutive leads or new or presumed new left bundle branch block (LBBB)[8] and one of the following criteria, symptomatic chest discomfort within 7 days or raising cardiac Troponin T (Trop T) > 0.03 ug/l[9-11].

ADECS's process included scanning ordinary 12 leads ECG papers to digital ECG in PDF files, transferring the digital ECG files over the intra-hospital local area network (LAN) system or internet network system to store in Saraburi Hospital's intranet data, calling cardiologist to interpret immediately, either in-hospital or out-hospital by any devices that can read PDF files such as cell phones by internet system via General Packet Radio Service (GPRS). After diagnosis was confirmed to ED's physicians, all patients were educated about risk and benefit of thrombolytic agent before the informed consent was obtained. The patients were thrombolysed at ED and transferred to the ward under close vital signs and ECG monitoring.

Statistical analysis

Continuous variables were expressed as mean $\pm$ SD or median when appropriate, discrete variables are expressed as percentages. Differences in the distribution of selected characteristics between patient groups were examined using the Chi-square test for categorical variables. Differences in continuous variables between the study groups were analyzed using either analysis of variance or t tests. The diagnosis STEMI at ED and final diagnosis at ward was analyzed by Kappa analysis. A p-value less than 0.05 was considered statistically significant. All statistical data was analyzed by SPSS program for windows version 11.5.

Inclusion and exclusion criteria

Inclusion criteria included all STEMI patients who were admitted by fast track guideline at Saraburi Hospital. The patients who did not have an abnormal ECG as the above definition were excluded from the present study.

Primary endpoints included DTNT, agreement of STE ACS diagnosis between ED and ward and number of patients who achieved DTNT within 30 minutes.

Secondary endpoints included total ischemic time (TIT), number of patients who achieved TIT within 180 minutes and in-hospital outcomes, which composed of mortality rate, heart failure, cardiac arrhythmia, bleeding complications, length of stay (LOS) and readmission rate within 28 days after discharge.

Results

In the before applying ADECS group, 1426 chest discomfort patients were admitted by ACS fast track care. STEMI diagnosis at ED was 161 episodes. After being admitted and having a serial ECG performed followed by cardiac biomarkers, especially Trop T[8-11], the final diagnosis of STEMI at the ward was 123 episodes; Kappa value = 0.602; $p < 0.001$. After applying ADECS group, there were 1117 chest discomfort patients. The STEMI diagnosis at ED and at the ward were 113 and 125 episodes respectively, Kappa value = 0.718; $p < 0.001$ as show in Fig. 1. The final diagnosed STEMI patients were 248. The mean age was 62.35 $\pm$ 12.85 years, male predominance was 70.2%. Most common atherosclerosis risk factor was dyslipidemia 80.2% followed by hypertension 71.8%, current smoking 40.7%, and diabetes 19%. Known cases of CAD and history of stroke were 27.4% and 6.5% respectively. The prevalence of dyslipidemia was significantly different between both groups, 72.4% vs. 88% $p = 0.002$. The majority of MI's wall distribution was anterior wall 35.9%. Mean/median of the symptom onset to hospital arrival time (SHAT) was 393.25 $\pm$ 610.87/185 minutes. The mean/median of both time to interpret ECG & take ASA 325 mg and

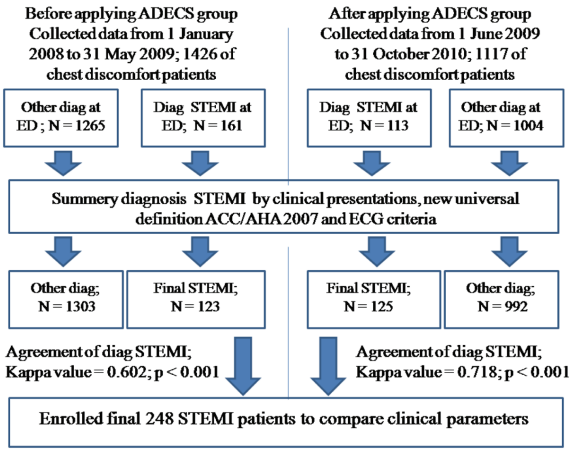

Fig. 1 All chest discomfort patients who were diagnosed STEMI at ED, after admitted by ACS fast track guideline and summarized diagnosis showed final diagnosis at ward

the transferring time was significantly longer in the after applying ADECS group, 14.85 ± 12.74/11 vs. 20.74 ± 11.93/19; p < 0.001 and 21.41 ± 10.18/19 vs. 31.93 ± 19.07/28 minutes; p < 0.001 respectively. Mortality rate was 21% and more than half of them developed heart failure in hospital, 45.6% Killip IV, 17.3% Killip I-III. In the cases, 16.1% had malignant arrythmia (VT/VF, heart block more than second degree AV block Mobits I), 19% had non-malignant arrhythmia (PAC, PVC, AF, atrial flutter, SVT, heart block less than second degree AV block Mobitz II), 4.8% had minor bleeding (hematuria, hematoma, UGIB, which did not require blood transfusion), and 4.4% had major bleeding (ICH, UPGI or bleeding, which required blood transfusion). Two cases had intracranial hemorrhage (1.38%), LOS was 6.02 ± 5.35 days, and 2% were readmitted within 28 days after discharge. No in-hospital outcomes were significantly different in both groups as shown in Table 1. The 144 STEMI patients (58.1%) were thrombolysed and had mean/median of SHAT 193.61 ± 151.47/160 minutes, which was not significantly different between groups, 176.90 ± 130.08/145 vs. 208.16 ± 167.38/165; p = 0.218. Mean/median of DTNT and the percentage of thrombolysed STEMI patients who achieved DTNT within 30 minutes improved significantly in the after applying ADECS group, 73.24 ± 54.78/65 vs. 46.05 ± 33.88/30 minutes; p < 0.001 and 6% vs. 50.6%; p = 0.001 respectively. However, mean/median of TIT and the percentage of thrombolysed STEMI patients who achieved TIT within 180 minutes were the same, 250.13 ± 139.09/225 vs. 254.21 ± 163.12/226 minutes; p = 0.873 and 36.4% vs. 35.8%; p = 1.00 as shown in Table 2. The major cause of non-thrombolysed patients was the SHAT of more than 12 hours (35.4%). The efficacy of DTNT within 30 minutes or TIT within 180 minutes in the present study could not show significant improvement of all in-hospital outcomes, but only the TIT within 180 minutes could show insignificantly decreasing mortality rate, 13.5% vs. 20.7%; p = 0.369 as show in Table 3.

Discussion

Almost all baseline demographic data, risk factors and MI's wall distribution of the patients were not significantly different between both groups and compatible with data from Thai ACS registry 2007[2] and the Western countries, GRACE registry[12]. The prevalence of dyslipidmia was similar to Thai ACS registry 2007[2]; 80.2% vs. 72.5% but much higher than data from the GRACE registry[12]. The mean time to interpret ECG & take ASA 325 mg was significantly longer in the after applying ADECS group, 14.85 ± 12.74 vs. 20.74 ± 11.93; p < 0.001 due to the ADECS needing time to complete all processes as described above. However, it could show significant improvement of the primary end points, including shorter DTNT by 37%. The results show 73.24 ± 54.78 vs. 46.05 ± 33.88 minutes; p < 0.001. The improved diagnosis of STEMI between ED and the ward were from moderate to good level of agreement, Kappa value = 0.602; p < 0.001vs. 0.718; p < 0.001. The increased percentage of thrombolysed STEMI patients who achieved DTNT within 30 minutes was about eight times from 6% to 50.6%; p = 0.001, which was much higher than the Thai ACS registry 2007, 50.6% vs. 9%[2]. It also insignificantly increased the percentage of thrombolysed STEMI patients from 54.5% to 61.6%, p = 0.303. Following this present data, ADECS should be included in routine fast track care for all STEMI patients. The mean transferring time was significantly longer in the after applying ADECS group at 21.41 ± 10.18 vs. 31.93 ± 19.07 minutes; p < 0.001 due to closed monitoring ECG and vital sign during thrombolytic infusion on the way to the ward. Major bleeding complications were not different between the before and after applying ADECS group, which the patients were thrombolysed at the ward and at ED respectively at 4.1% vs. 4.8%; p = 1.00. This percentage was the same as the GRACE registry[12], 4.8% vs. 4.8% but lower than Thai ACS registry 2007[2], 4.8% vs. 7.9% because the prescription of antithrombotic agents was

Table 1. Characteristic of final diagnosis STEMI patients who participated the fast track care

Characteristic STEMI patients	Total STEMI (n = 248)	Before applying ADECS (n = 123)	After applying ADECS (n = 125)	p-value
Demographic data				
Mean age (± SD, yrs)	62.35 ± 12.85	61.5 ± 12.47	63.18 ± 13.22	0.302
Male (%)	174 (70.2)	93 (75.6)	81 (64.8)	0.072
Risk factor				
DM (%)	47 (19)	24 (19.5)	23 (18.4)	0.872
HT (%)	178 (71.8)	86 (69.9)	92 (73.6)	0.573
Dyslipidemia (%)	199 (80.2)	89 (72.4)	110 (88)	0.002
Current smoking (%)	101 (40.7)	58 (47.2)	43 (34.4)	0.052
History of stroke (%)	16 (6.5)	9 (7.3)	7 (5.6)	0.615
History of IHD (%)	68 (27.4)	28 (22.8)	40 (32)	0.118
MI's wall distribution				
Anterior wall MI (%)	89 (35.9)	49 (39.8)	40 (32)	0.234
Anterolateral wall MI (%)	58 (23.4)	25 (20.3)	33 (26.4)	0.295
Inferior wall & RV MI (%)	38 (15.3)	18 (14.6)	20 (16)	0.860
Inferior wall MI (%)	63 (25.4)	31 (25.2)	32 (25.6)	1.00
Time to treatment				
Symptom onset to hospital arrival time				
Mean (min ± SD)	393.25 ± 610.87	380.14 ± 536.94	406.14 ± 677.73	0.738
Median (min)	185	180	192	
Time to interpret ECG & took ASA gr V				
Mean (min ± SD)	17.51 ± 12.83	14.85 ± 12.74	20.74 ± 11.93	<0.001
Median (min)	15	11	19	
Transfer time				
Mean (min ± SD)	26.71 ± 16.17	21.41 ± 10.18	31.93 ± 19.07	<0.001
Median (min)	23	19	28	
Rate of STEMI patients receiving thrombolysis (%)	144 (58.1)	67 (54.5)	77 (61.6)	0.303
In-hospital outcomes				
Death (%)	52 (21)	25 (20.3)	27 (21.6)	0.876
Killip I-III (%)	43 (17.3)	19 (15.4)	24 (19.2)	0.503
Killip IV (%)	113 (45.6)	57 (46.3)	56 (44.8)	0.899
Nonmalignant arrhythmia** (%)	47 (19)	28 (22.4)	19 (15.4)	0.195
Malignant arrhythmia*** (%)	40 (16.1)	16 (13.0)	24 (19.2)	0.227
Major bleeding# (%)	11 (4.4)	5 (4.1)	6 (4.8)	1.00
Minor bleeding## (%)	12 (4.8)	5 (4.1)	7 (5.6)	0.769
LOS### (mean ± SD; days)	6.02 ± 5.35	6.28 ± 6.20	5.77 ± 4.38	0.456
Readmission within 28 days (%)	5 (2)	3 (2.4)	2 (1.6)	0.682

Heart failure (Killip I-IV) = heart failure at index of hospitalization; ** PAC, PVC, AF, flutter, SVT, heart block less than second degree AV block Mobitz II; *** VT/VF, heart block more than second degree AV Mobitz I; # ICH, UPGI bleeding required blood transfusion; ## Hematuria, hematoma, UGIB did not require blood transfusion; ### Length of hospital stay

different. Overall, 19.5% of patients in the Thai ACS registry 2007 were administered intravenous glycoprotein IIb/IIIa inhibitor but none of patients received it in the present study. Two cases had intracranial hemorrhage (1.38%), which was one in each group. This was slightly higher than previous report of Streptokinase's complication[13,14] because the number of thrombolysed STEMI in the present study was only 144 cases and none of the patients died during transferring process. This present data showed that safety efficacy is to move the site of thrombolytic infusion from ward to ED in Thailand's rural hospitals.

The median of DTNT in the after applying ADECS group improved significantly and is closer to data from Western countries. The Mayo Clinic STEMI

Table 2. Efficacy of fast track managed care in thrombolysed STEMI patients according to before and after applying ADECS

	All thrombolysed STEMI (n = 144)	Before applying ADECS (n = 67)	After applying ADECS (n = 77)	p-value
Symptom onset to hospital arrival time				
Mean (min ± SD)	193.61 ± 151.47	176.90 ± 130.08	208.16 ± 167.38	0.218
Median (min)	160	145	165	
DTNT				
Mean (min ± SD)	58.70 ± 46.69	73.24 ± 54.78	46.05 ± 33.88	<0.001
Median (min)	47.5	65	30	
TIT				
Mean (min ± SD)	252.31 ± 151.90	250.13 ± 139.09	254.21 ± 163.12	0.873
Median (min)	228	225	226	
No. of patients; DTNT within 30 minutes (%)	43 (29.9)	4 (6)	39 (50.6)	<0.001
No. of patients TIT within 180 minutes (%)	52 (36.1)	24 (36.4)	28 (35.8)	1.00

Table 3. Effect of DTNT within 30 minutes and TIT within 180 minutes to in-hospital outcomes in 144 thrombolysed STEMI patients

	DTNT within 30 min (43)	DTNT > 30 min (101)	p-value	TIT within 180 min (52)	TIT > 180 min (92)	p-value
Mortality rate (%)	9 (20.9)	17 (16.8)	0.637	7 (13.5)	19 (20.7)	0.369
Killip I-III (%)	9 (20.9)	16 (15.8)	0.477	8 (15.4)	17 (18.5)	0.819
Killip IV (%)	20 (46.5)	51 (50.5)	0.718	25 (48.1)	46 (50.0)	0.863
Malignant arrhythmia*** (%)	10 (23.3)	11 (10.9)	0.071	9 (17.3)	12 (13.0)	0.624
Non-malignant arrhythmia** (%)	9 (20.9)	27 (26.7)	0.533	14 (26.9)	22 (23.9)	0.693
LOS### (days ± SD)	7.86 ± 5.78	5.86 ± 5.7	0.057	7.29 ± 7.00	5.99 ± 4.93	0.196

Heart failure (Killip I-IV) = heart failure at index of hospitalization; ** PAC, PVC, AF, flutter, SVT, heart block less than second degree AV block Mobitz II; *** VT/VF, Heart block more than second degree AV Mobitz I; ### Length of hospital stay

Protocol[15] was 30 vs. 25 minutes and is much shorter than Thai ACS registry 2007[2] at 30 vs. 85 minutes. However, the median of TIT was still similar to Thai ACS registry 2007[2] of 226 vs. 240 minutes and took approximately two hours longer than The Mayo Clinic STEMI Protocol[15] at 226 vs. 103 minutes. The independent factor was the SHAT which was shortest in The Mayo Clinic STEMI Protocol showing only 75 minutes[15] but approximately 180 minutes in Thai ACS registry 2007[2] and 165 minutes in the present study. Because Western countries have well established pre-hospital management to approach the patients immediately and choose the best mode of re-perfusion therapy on site, by emergency medical services (EMS). However, almost all Thai's STEMI patients were self-presentation (walk in) at the ED and that took a much longer time. In the present study, 35.4% of non-thrombolysed STEMI patients were not thrombolysed due to the SHAT being more than 12 hours. Pre-hospital patient delay was still the principal impediment to effective treatment of STEMI in Thailand. The present study showed significant improvement of primary endpoints, but the secondary endpoints could not be improved, especially the mortality rate, which as 20.3% vs. 21.6%; p = 0.876. This is because the mean of TIT, which was the true golden period of re-perfusion therapy that could improve clinical outcomes[3], was longer than 180 minutes, which is the best period of thrombolytic efficacy[16]. This was the same in both groups, 250.13 ± 139.09 vs. 254.21 ± 163.12; p = 0.873. There was the same percentage of thrombolysed STEMI patients who achieved TIT within 180 minutes, 36.4% vs. 35.8%; p = 1.00. The efficacy of DTNT within 30 minutes could not show any improvements in all in-hospital outcomes, especially mortality rate, which had an insignificant statistical increase, 20.9%

vs. 16.8%; p = 0.637. Nevertheless, the TIT within 180 minutes could show a trend to decrease the mortality rate, 13.5% vs. 20.7%; p = 0.369 due to the sample size is too small to declare improvement. Following the Western STEMI guideline of achieving DTNT within 30 minutes, the Thai STEMI guideline might not be proper. This is because the SHAT was much more different between Thai patients and Western patients. The next step of developing the Thai STEMI guideline, especially for rural hospitals, where cardiac catheterization laboratories were not available, should be the shortest time to achieve SHAT and DTNT and having the TIT within 180 minutes. Continuously collecting and analyzing data as well as routinely practicing the STEMI fast track managed care is needed to achieve the best patients' clinical outcomes.

Study limitations

There were some limitations in the present study. First, all STEMI patients in Saraburi Hospital may not have participated in the fast track care, due to mis-diagnosis or death at ED or outside of hospital. Second, in cardiogenic shock or Killip IV heart failure, clinical diagnosis did not use hemodynamic data. Third, heart failure defined by Killip classification was not identified at the initial presentation at ED.

Conclusion

The Applied Digital 12 leads ECG Consultation System should be included in routine fast track care and thrombolytic infusion should be started at ED for all STEMI patients. Short door to needle time was not enough to improve in-hospital outcomes. For continuous improvement, the symptom onset to hospital arrival time and routine practice with quality assessment process should be considered.

Acknowledgements

The authors wish to thank the personnel of the ICU/ward who patiently and diligently assisted in all aspects of patient care, the patients, and their relatives, and most of all, the ACS nurses manager who collected data for the project and entered data prospectively on to the database.

Potential conflicts of interest

None.

References

1. Thom T, Haase N, Rosamond W, Howard VJ, Rumsfeld J, Manolio T, et al. Heart disease and stroke statistics-2006 update: a report from the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. Circulation 2006; 113: e85-151.
2. Srimahachota S, Kanjanavanit R, Boonyaratavej S, Boonsom W, Veerakul G, Tresukosol D. Demographic, management practices and in-hospital outcomes of Thai Acute Coronary Syndrome Registry (TACSR): the difference from the Western world. J Med Assoc Thai 2007; 90 (Suppl 1): 1-11.
3. Fu Y, Goodman S, Chang WC, Van De Werf F, Granger CB, Armstrong PW. Time to treatment influences the impact of ST-segment resolution on one-year prognosis: insights from the assessment of the safety and efficacy of a new thrombolytic (ASSENT-2) trial. Circulation 2001; 104: 2653-9.
4. Antman EM, Hand M, Armstrong PW, Bates ER, Green LA, Halasyamani LK, et al. 2007 focused update of the ACC/AHA 2004 guidelines for the management of patients with ST-elevation myocardial infarction: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. J Am Coll Cardiol 2008; 51: 210-47.
5. Tantisiriwat W, Jiar W, Ngamkasem H, Tantisiriwat S. Clinical outcomes of fast track managed care system for acute ST elevation myocardial infarction (STEMI) patients: Chonburi Hospital experience. J Med Assoc Thai 2008; 91: 822-7.
6. Maraprasertsak M. Three years experience comparing the fast track system and patient education on ST-segment elevation myocardial infarction in Phrae Hospital. Thai Heart J 2008; 21: 52-60.
7. Promlikitchai P. Fast track guideline for patients with acute coronary syndrome at Saraburi Hospital. Thai Heart J 2009; 22: 86-97.
8. Cannon CP, Battler A, Brindis RG, Cox JL, Ellis SG, Every NR, et al. American College of Cardiology key data elements and definitions for measuring the clinical management and outcomes of patients with acute coronary syndromes. A report of the American College of Cardiology Task Force on Clinical Data Standards (Acute Coronary Syndromes Writing Committee). J Am Coll Cardiol 2001; 38: 2114-30.
9. Thygesen K, Alpert JS, White HD. Universal definition of myocardial infarction. J Am Coll Cardiol 2007; 50: 2173-95.

10. Apple FS, Quist HE, Doyle PJ, Otto AP, Murakami MM. Plasma 99th percentile reference limits for cardiac troponin and creatine kinase MB mass for use with European Society of Cardiology/ American College of Cardiology consensus recommendations. Clin Chem 2003; 49: 1331-6.
11. Apple FS, Wu AH, Jaffe AS. European Society of Cardiology and American College of Cardiology guidelines for redefinition of myocardial infarction: how to use existing assays clinically and for clinical trials. Am Heart J 2002; 144: 981-6.
12. Steg PG, Goldberg RJ, Gore JM, Fox KA, Eagle KA, Flather MD, et al. Baseline characteristics, management practices, and in-hospital outcomes of patients hospitalized with acute coronary syndromes in the Global Registry of Acute Coronary Events (GRACE). Am J Cardiol 2002; 90: 358-63.
13. White H. Thrombin-specific anticoagulation with bivalirudin versus heparin in patients receiving fibrinolytic therapy for acute myocardial infarction: the HERO-2 randomised trial. Lancet 2001; 358: 1855-63.
14. De Jaegere PP, Arnold AA, Balk AH, Simoons ML. Intracranial hemorrhage in association with thrombolytic therapy: incidence and clinical predictive factors. J Am Coll Cardiol 1992; 19: 289-94.
15. Ting HH, Rihal CS, Gersh BJ, Haro LH, Bjerke CM, Lennon RJ, et al. Regional systems of care to optimize timeliness of reperfusion therapy for ST-elevation myocardial infarction: the Mayo Clinic STEMI Protocol. Circulation 2007; 116: 729-36.
16. Antman EM, Anbe DT, Armstrong PW, Bates ER, Green LA, Hand M, et al. ACC/AHA guidelines for the management of patients with ST-elevation myocardial infarction-executive summary. A report of the American College of Cardiology/ American Heart Association Task Force on Practice Guidelines (Writing Committee to revise the 1999 guidelines for the management of patients with acute myocardial infarction). J Am Coll Cardiol 2004; 44: 671-719.

การประยุกต์ใช้คลื่นไฟฟ้าหัวใจดิจิทัลในแผนการรักษาแบบเร่งด่วนสำหรับโรคหลอดเลือดหัวใจตีบเฉียบพลัน ชนิด ST elevation ในโรงพยาบาลสระบุรี

พิธา พรหมลิขิตชัย, ประจักษ์ สุชาติสุนทร, สุรชัย กอบเกื้อชัยพงษ์, ทิติยา ด้วงเงิน, ปวีณา ดวงอัคฆะ

วัตถุประสงค์: *เพื่อศึกษาประสิทธิภาพและผลการรักษาของแผนการรักษาแบบเร่งด่วนสำหรับผู้ป่วยโรคหลอดเลือดหัวใจตีบเฉียบพลันชนิด ST elevation (STEMI) เปรียบเทียบก่อนและหลังการการประยุกต์ใช้คลื่นไฟฟ้าหัวใจดิจิทัลในโรงพยาบาลสระบุรี*

วัสดุและวิธีการ: *เก็บข้อมูลแบบไปข้างหน้าในผู้ป่วย STEMI ทุกรายที่มารับการรักษาแบบผู้ป่วยในโดยใช้แผนการรักษาแบบเร่งด่วนตั้งแต่ วันที่ 1 มกราคม พ.ศ. 2551 ถึง 31 ตุลาคม พ.ศ. 2553*

ผลการศึกษา: *พบผู้ป่วยโรค STEMI ทั้งหมด 248 ราย แบ่งออกเป็นกลุ่มก่อนการประยุกต์ใช้คลื่นไฟฟ้าหัวใจดิจิทัล 123 ราย (1 มกราคม พ.ศ. 2551 ถึง 31 พฤษภาคม พ.ศ. 2552) และหลัง 125 ราย (1 มิถุนายน พ.ศ. 2552 ถึง 31 ตุลาคม พ.ศ. 2553) อายุเฉลี่ย 62.5 $\pm$ 12.85 ปี เพศชาย 70.2% ปัจจัยเสี่ยงของโรคหลอดเลือดตีบที่พบบ่อย คือ โรคไขมันในเลือดสูง 80.2%, ความดันโลหิตสูง 71.8% และการสูบบุหรี่ 40.7% ภายหลังการประยุกต์ใช้คลื่นไฟฟ้าหัวใจดิจิทัล พบความสอดคล้องในการวินิจฉัยผู้ป่วย ระหว่างห้องฉุกเฉินและหอผู้ป่วยดีขึ้นจากระดับปานกลาง (Kappa value = 0.602, $p < 0.001$) สู่ระดับดี (Kappa value = 0.718, $p < 0.001$) ค่าเฉลี่ย/ค่ามัธยฐานของระยะเวลาในการรอรับการรักษาด้วยยาสลายลิ่มเลือดสั้นลงจาก 73.24 $\pm$ 54.78/65 เหลือ 46.05 $\pm$ 33.88/30 นาที; $p < 0.001$ และผู้ป่วยที่ได้รับการรักษาด้วยยาสลายลิ่มเลือดภายใน 30 นาทีมากขึ้นจาก 6% เป็น 50.6%; $p < 0.001$ แต่พบค่าเฉลี่ย/ค่ามัธยฐานของระยะเวลาตั้งแต่ผู้ป่วยเริ่ม แสดงอาการจนถึงได้รับยาสลายลิ่มเลือดไม่แตกต่างกัน 250.13 $\pm$ 139.09/225 เทียบกับ 254.21 $\pm$ 163.12/226 นาที $p = 0.873$ เนื่องจากทั้ง 2 กลุ่มมีระยะเวลาเฉลี่ยตั้งแต่ผู้ป่วยเริ่มแสดงอาการจนมาถึงโรงพยาบาลนาน, 176.90 $\pm$ 130.08/145 เทียบกับ 208.16 $\pm$ 167.38/165 นาที; $p = 0.218$ ส่งผลให้ผลการรักษาในช่วงนอนโรงพยาบาลไม่แตกต่างกัน พบระยะเวลาตั้งแต่ผู้ป่วยเริ่มแสดงอาการจนถึงได้รับยาสลายลิ่มเลือดภายใน 180 นาทีเท่านั้นที่ลดอัตราการเสียชีวิตจาก 20.7% เป็น 13.5% แต่ไม่มีนัยสำคัญทางสถิติ; $p = 0.369$ ไม่พบความแตกต่างของภาวะเลือดออกผิดปกติชนิดรุนแรง จากการรักษาระหว่างการให้ยาสลายลิ่มเลือดที่ห้องฉุกเฉินและที่หอผู้ป่วย 4.1% เทียบกับ 4.8%; $p = 1.00$*

สรุป: *ควรนำคลื่นไฟฟ้าหัวใจดิจิทัลมาประยุกต์ใช้ในแผนการรักษาแบบเร่งด่วนสำหรับผู้ป่วยโรคหลอดเลือดหัวใจตีบเฉียบพลันชนิด ST elevation ทุกรายร่วมกับการเริ่มให้ยาสลายลิ่มเลือดที่ห้องฉุกเฉิน การลดระยะเวลาในการรอรับการรักษาด้วยยาสลายลิ่มเลือดเพียงอย่างเดียวไม่เพียงพอต่อผลการรักษาที่ดีขึ้น ก้าวต่อไปในการพัฒนาควรพิจารณา ถึงระยะเวลาตั้งแต่ผู้ป่วยเริ่มแสดงอาการจนมาถึงโรงพยาบาล รวมถึงการเก็บวิเคราะห์ข้อมูลอย่างต่อเนื่องและเป็นระบบเพื่อนำไปสู่ผลการรักษาที่ดีที่สุด*