Open Access Emergency Medicine

Dovepress
open access to scientific and medical research

Open Access Full Text Article

ORIGINAL RESEARCH

Acute chest pain fast track at the emergency department: who was misdiagnosed for acute coronary syndrome?

This article was published in the following Dove Press journal:
Open Access Emergency Medicine
2 December 2016
Number of times this article has been viewed

Thidathit Prachanukool[1]
Kasamon Aramvanitch[1]
Kittisak Sawanyawisuth[2–4]
Yuwares Sitthichanbuncha[1]

[1]Department of Emergency Medicine, Faculty of Medicine, Ramathibodi Hospital Mahidol University, Bangkok, [2]Department of Medicine, Faculty of Medicine, [3]Research Center in Back, Neck, Other Joint Pain and Human Performance (BNOJPH), [4]Internal Medicine Research Group, Faculty of Medicine, Khon Kean University, Khon Kaen, Thailand

Background: Acute coronary syndrome (ACS) is a commonly treated disease in the emergency department (ED). Acute chest pain is a common presenting symptom of ACS. Acute chest pain fast track (ACPFT) is a triage to cover patients presenting with chest pain with the aims of early detection and treatment for ACS. This study aimed to assess the quality of the ACPFT with the aim of improving the quality of care for ACS patients.

Methods: This study was conducted at the ED in Mahidol University, Bangkok, Thailand. The inclusion criterion was patients presenting with acute chest pain at the ED. We retrospectively reviewed the medical records of all eligible patients. The primary outcomes of this study were to determine time from door to electrocardiogram and time from door to treatment (coronary angiogram with percutaneous coronary intervention or thrombolytic therapy in the case of ST elevation myocardial infarction). The outcome was compared between those who were in and not in the ACPFT.

Results: During the study period, there were 616 eligible patients who were divided into ACPFT (n=352 patients; 57.1%) and non-ACPFT (n=264 patients; 42.9%) groups. In the ACPFT group (n=352), 315 patients (89.5%) received an electrocardiogram within 10 minutes. The final diagnosis of ACS was made in 80 patients (22.7%) in the ACPFT group and 13 patients (4.9%) in the non-ACPFT group (P-value <0.01). After adjustment using multivariate logistic regression analysis, only epigastric pain was independently associated with being in the ACPFT group (adjusted odds ratio of 0.11; 95% confidence interval of 0.02, 0.56).

Conclusion: The ACPFT at the ED facilitated the prompt work-ups and intervention for ACS.

Keywords: triage, myocardial infarction, unstable angina, outcomes

Introduction

Acute coronary syndrome (ACS) is a common disease. Acute chest pain is a common presenting symptom of ACS. There are two classifications of ACS: ST elevation ACS or ST elevation myocardial infarction (STEMI) and non-ST elevation ACS or non-ST elevation myocardial infarction/unstable angina.[1] ACS is a major cause of death worldwide and is also a leading cause of death in people >35 years of age in the US;[2,3] one in every six deaths is caused by coronary artery disease (CAD).[4]

Due to the high morbidity and mortality rate of ACS, there are several procedures that should be implemented for patients presenting with acute chest pain at the emergency department (ED), with time goals for each procedure. If ACS is suspected, an electrocardiogram (EKG) test should be performed within 10 minutes. For STEMI, thrombolytic therapy should be administered within 30 minutes (door to drug), or

Correspondence: Yuwares Sitthichanbuncha
Department of Emergency Medicine, Faculty of Medicine, Ramathibodi Hospital, Mahidol University, Bangkok 10120, Thailand
Email yuwares.sit@mahidol.ac.th

submit your manuscript | www.dovepress.com
Dovepress
http://dx.doi.org/10.2147/OAEM.S112903

primary percutaneous coronary intervention should be performed within 90 minutes (door to balloon).[5] A study was conducted in eleven hospitals in California, USA, to assess whether or not they reached the treatment goals for ACS.[6] All hospitals had door to balloon times <90 minutes.

In 2010, the ED at Ramathibodi Hospital adopted a guideline for patients presenting with acute chest pain called acute chest pain fast track (ACPFT). ACPFT begins with a triage evaluation by a nurse at the ED. If ACS is suspected, the patients will be sent immediately to the resuscitation room and placed under the care of the emergency physicians. This study aimed to assess the quality of the ACPFT with the aim of improving the quality of care for ACS patients.

Methods

This study was conducted at the ED of Mahidol University's Ramathibodi Hospital in Bangkok, Thailand. The study period was between January 2013 and June 2013. The inclusion criterion was patients presenting with acute chest pain to the ED. We excluded patients <20 years of age (in accordance with ACPFT criteria), patients suffering from chest pain related to trauma, patients who had been previously diagnosed/treated as ACS and referred from other hospitals, patients who were referred to other hospitals, or patients whose medical records were incomplete. The study protocol was approved by the ethical clearance committee on human right related to research involving human subjects, Faculty of Medicine, Ramathibodi Hospital, Mahidol University (MURA2014/396). The ethical committee waived the need for patient written informed consent to participate in this study due to the retrospective study design.

We retrospectively reviewed the medical records of all eligible patients. Data were extracted, including age, sex, risk factors for CAD (ie, history of hypertension, diabetes, dyslipidemia, smoking history, history of CAD/coronary angiogram/coronary artery bypass graft), vital signs at presentation, and symptoms at presentation. Time of presentation was also recorded as AM shift, PM shift, and night shift. The final diagnosis of each patient was based on the final diagnosis before discharge.

The primary outcomes of this study were to determine time from door to EKG and time from door to treatment (coronary angiogram with percutaneous coronary intervention or thrombolytic therapy in the case of STEMI). The door to needle time is the time between presenting to the emergency room to receiving intravenous thrombolytic therapy, while the door to balloon time is the time between presenting to the emergency room to receiving percutaneous coronary intervention. These two times were evaluated only if the patients received these treatments. The secondary outcome was to evaluate the instances of major cardiovascular events (MACE) at 1 month after the presentation. MACE included death, recurrent myocardial infarction, and urgent revascularization.

Sample size calculation

There are two main primary outcomes of ACPFT evaluation; time from door to EKG in 10 minutes and door to balloon in 90 minutes. The sample size was calculated using the following formula:[7] n=[DEFF*Np(1-p)]/ [$(d^2/Z^2_{1-\alpha/2}$*(N-1)+p*(1-p)]; DEFF or design effect for cluster surveys equals 1; N or population size equals 1,000,000; p or prevalence of patients with chest pain who received the EKG test within 10 minutes equals 52.4%;[8] and d or confidence limit equals 10%. The estimated sample size was 96 with a confidence interval (CI) of 95%. Door to balloon in 90 minutes had a sample size of 94, calculated by the same formula. Therefore, the appropriate sample size was 96 patients.

Statistical analysis

Each patient was placed into one of two groups based on whether or not they were in the ACPFT. Clinical features and outcomes between both groups were compared. Factors associated with being in the ACPFT group and having a time from door to EKG test of 10 minutes or less were evaluated using univariate and multivariate logistic regression analysis. Analytical results were presented as unadjusted odds ratios (ORs), adjusted ORs, and 95% CIs. All analyses were performed using Stata software (StataCorp LP, College Station, TX, USA).

Results

During the study period, there were 723 patients presenting with acute chest pain. Of those, 107 patients were excluded due to traumatic chest pain (n=35), being <20 years of age (n=26), having been previously treated (n=4), and having incomplete data (n=42). In total, there were 616 eligible patients in the study, who were divided into the ACPFT (n=352 patients; 57.1%) and non-ACPFT (n=264 patients; 42.9%) groups.

The final diagnosis of ACS was made in 80 patients (22.7%) in the ACPFT group and 13 patients (4.9%) in the non-ACPFT group (P-value <0.01). Non-STEMI/unstable angina was more common than STEMI in both groups, with 68 patients (85.0%) and ten patients (76.9%) in the ACPFT and non-ACPFT groups, respectively. The summary of patients enrolled in each category is shown in Figure 1.

There were two significant factors that differed between patients who were diagnosed with ACS in the ACPFT and non-ACPFT groups: sex and symptoms. The ACPFT group had a higher proportion of male patients (60.0% vs 30.8%) and a lower proportion of patients with epigastric pain (5.0% vs 30.8%) as shown in Table 1. After adjustment using

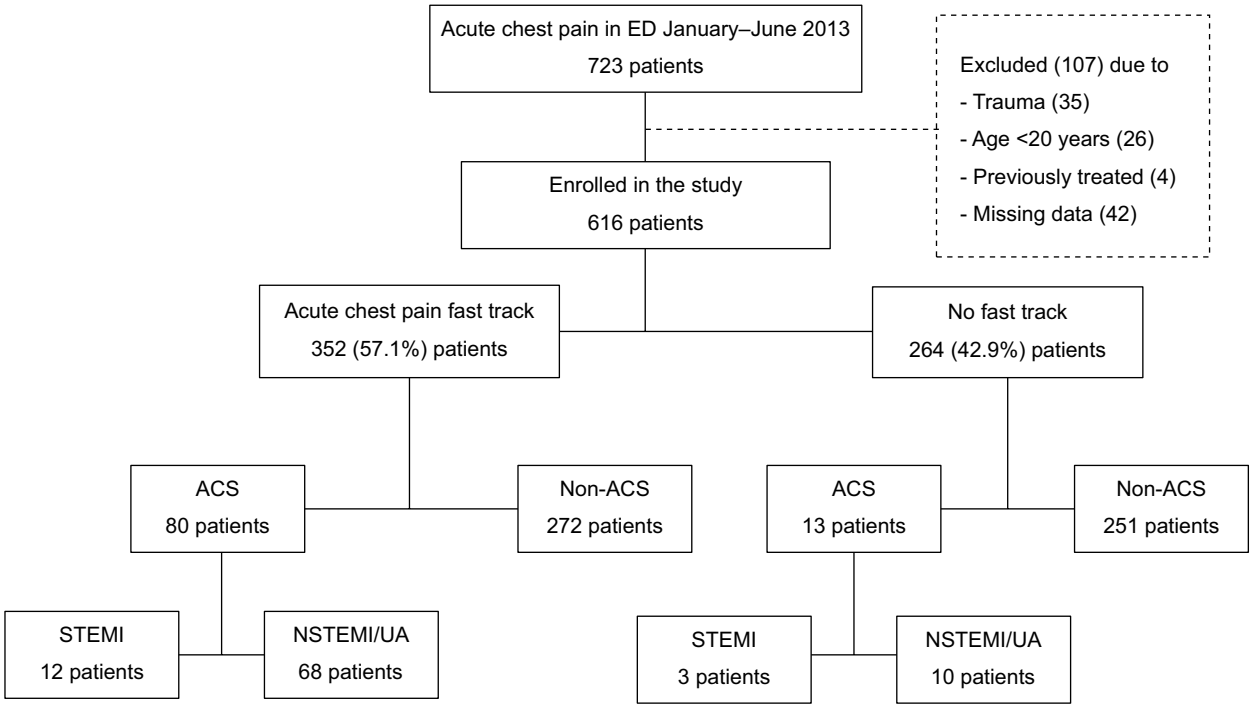

Figure 1 Study enrollment and numbers of patients in each category.
Abbreviations: ACS, acute coronary syndrome; Non-ACS, non-acute coronary syndrome; NSTEMI, non-ST-elevation myocardial infarction; STEMI, ST-elevation myocardial infarction; UA, unstable angina.

Table 1 Clinical factors of patients who were diagnosed as ACS in the ACPFT and those in the non-ACPFT group

Factors	ACS		*P*-value
	ACPFT (n=80)	non-ACPFT (n=13)	
Mean age (years), n (SD)	66.24 (13.09)	66 (12.51)	0.950
Sex			0.049
Male	48 (60)	4 (30.77)	
Female	32 (40)	9 (69.23)	
Smoking	6 (7.50)	0 (0)	0.590
Hypertension	6 (7.5)	0 (0)	0.590
Diabetes mellitus	34 (42.50)	4 (30.77)	0.550
ASA used in 7 days	41 (51.25)	3 (23.08)	0.076
Previous CAD	35 (43.75)	3 (23.08)	0.227
Previous CAG	31 (38.75)	3 (23.08)	0.361
Previous CABG	7 (8.75)	0 (0)	0.588
Symptoms			
Chest pain	78 (97.50)	11 (84.62)	0.092
Epigastric pain	4 (5)	4 (30.77)	0.012
Dyspnea	32 (40)	4 (30.77)	0.526
Palpitation	26 (32.5)	3 (23.08)	0.740
Mean systolic blood pressure (mmHg), n (SD)	146.91 (33.19)	140.31 (24.34)	0.49
Mean heart rate (bpm), n (SD)	83.15 (19.29)	75.85 (16.58)	0.201
Shift work			0.092
Morning	25 (31.25)	4 (30.77)	
Evening	27 (33.75)	1 (7.69)	
Night	28 (35.00)	8 (61.54)	

Note: Data presented as number (percentage) unless indicated otherwise.
Abbreviations: ACS, acute coronary syndrome; ACPFT, acute chest pain fast track; ASA, aspirin; CAD, coronary artery disease; CAG, coronary angiogram; CABG, coronary artery bypass graft; SD, standard deviation.

multivariate logistic regression analysis, only epigastric pain was independently associated with being in the ACPFT group (adjusted OR of 0.11; 95% CI of 0.02, 0.56).

Three significant factors were found when comparing ACS treatment goals between the ACPFT and non-ACPFT groups, including time to EKG, time to EKG <10 minutes, and time from door to balloon in cases of STEMI (Table 2). The median time to EKG was 2 minutes in the ACPFT group and 58 minutes in the non-ACPFT group (*P*-value <0.01), while the median time from door to balloon was 53 minutes in the ACPFT group and 534 minutes in the non-ACPFT group (*P*-value 0.02). There was no significant difference in MACE between the two groups (*P*-value 0.99).

For the ACPFT group (n=352), 315 patients (89.5%) received an EKG within 10 minutes. There were two significant factors that differed between these two groups (Table 3), including having hypertension and previous history of CAD (*P*-value <0.01 for both factors). After adjustment using multivariate logistic regression analysis, only hypertension was significantly associated with time to EKG of more than 10 minutes. The adjusted OR was 4.68 (95% CI of 1.35, 16.31).

Discussion

The prevalence of ACS in cases of ACPFT was 22.7%, most of which were non-STEMI/unstable angina (85%). Out of 616 patients presenting with acute chest pain, 57.1% of all

Table 2 Clinical factors in terms of diagnosis and management of patients who were diagnosed as ACS in the ACPFT and non-ACPFT groups

Factors	ACS		*P*-value
	ACPFT (n=80)	non-ACPFT (n=13)	
Median (range) time to EKG, minutes	2 (0, 36)	58 (5, 77)	<0.001
Time to EKG <10 min, n (%)	75 (93.75)	3 (23.08)	<0.001
Diagnosis, n			
STEMI	12	3	0.463
NSTEMI/UA	68	10	
Door to balloon (STEMI)			0.024
Number	11	3	
Median (range)	53 (34, 776)	534 (161, 1527)*	
Door to balloon in 90 min, n (%)	10 (90.91)	0	
Door to needle			–
Number	1	0	
Time (min)	43	–	
MACE, n (%)	4 (5)	0 (0)	0.999
STEMI, n			
Death	0	0	
Recurrent MI	1**	0	
Urgent revascularization	1**	0	
NSTEMI/UA, n			
Death	2	0	
Recurrent MI	1	0	
Urgent revascularization	0	0	

Notes: *Delayed percutaneous coronary intervention due to chest pain onset more than 24 hours (one patient) ago and progression to STEMI from NSTEMI (one patient); **Indicates the same patient.
Abbreviations: ACS, acute coronary syndrome; ACPFT, acute chest pain fast track; ACS, acute coronary syndrome; MACE, major cardiovascular events; EKG, electrocardiogram; MI, myocardial infarction; NSTEMI, non-ST elevation myocardial infarction; STEMI, ST elevation myocardial infarction; UA, unstable angina.

Table 3 Characteristics of patients who presented with acute chest pain and were in the ACPFT group; categorized by time to EKG procedure

Factors	Time to EKG in 10 minutes (n=315)	Time to EKG >10 minutes (n=37)	*P*-value
Median age (range), years	68 (20, 93)	71 (39, 90)	0.605
Sex			0.102
Female	151 (47.94)	23 (62.16)	
Male	164 (52.06)	14 (37.84)	
Smoking	9 (2.86)	1 (2.7)	0.999
Hypertension	207 (65.71)	34 (91.89)	0.001
Diabetes mellitus	98 (31.11)	17 (45.95)	0.069
ASA used in 7 days	137 (43.49)	20 (54.05)	0.221
Previous CAD	115 (36.51)	22 (59.46)	0.007
Previous CAG	107 (33.97)	18 (48.65)	0.078
Previous CABG	23 (7.3)	6 (16.2)	0.103
Symptoms			
Chest pain	273 (86.67)	28 (75.68)	0.072
Epigastric pain	31 (9.84)	5 (13.51)	0.563
Dyspnea	114 (36.19)	17 (45.95)	0.246
Palpitation	87 (27.62)	10 (27.03)	0.939
Median systolic blood pressure (range), mmHg	145 (66, 240)	148 (98, 227)	0.352
Median heart rate (rate), bpm	80 (40, 180)	79 (40, 157)	0.783
Shift work			0.849
Morning	133 (42.22)	15 (40.54)	
Evening	110 (34.92)	12 (32.43)	
Night	72 (22.86)	10 (27.03)	

Note: Data presented as number (percentage) unless indicated otherwise.
Abbreviations: ACPFT, acute chest pain fast track; ASA, aspirin; CAD, coronary artery disease; CAG, coronary angiogram; CABG, coronary artery bypass graft; EKG, electrocardiogram.

patients with acute chest pain were enrolled in the ACPFT. In other words, 42.9% of patients presenting with acute chest pain were not in the ACPFT. These findings indicated that the criteria for the ACPFT might be too strict. However, this would be a trade-off. If the ACPFT criteria were less rigid, it would mean higher monetary costs due to the necessity for further investigations, such as those involving EKG or biomarkers. Only 16.3% of the non-ACPFT group had ACS, a figure which differed significantly from that of the ACPFT group (30.3% vs 16.3%). It may be worthwhile to be aware of atypical presentation of ACS in the ACPFT.

Currently, the nurse triage is the first station for patients with acute chest pain. Patients who have one of the following criteria will be enrolled in the ACPFT: history of CAD, dull-aching chest pain, epigastric pain, dyspnea, palpitation, orthopnea, paroxysmal nocturnal dyspnea, abnormal systolic blood pressure, or abnormal heart rate. Note that epigastric pain is one of the inclusion criteria for the ACPFT. However, it was the only independent factor for being in the non-ACPFT group with adjusted OR of 0.11. This result indicated that 90% of patients with epigastric pain were not enrolled in the ACPFT. Nurses at the triage should pay more attention to epigastric pain or other atypical manifestations of ACS. In a study involving 721 patients with myocardial infarction, only 53% presented with chest pain.[9] Another study found that 17.5% of myocardial infarction patients had epigastric pain as a presenting symptom.[10]

With regard to the outcomes, the ACPFT met ACS management goals significantly more than the non-ACPFT treatment, both in terms of time to EKG and time from door to balloon (Table 2). Time to balloon was shorter than in previous reports (53 minutes vs 90 minutes).[6,8,11] However the differences in MACE outcomes at 1 month were not statistically significant. The total number of patients in this study was quite small.

The previous study from Taiwan showed that the average time until the EKG was performed in patients with ACS was

20.6 minutes, which was longer than in this study (a median of 2 minutes in the ACPFT group).[8] This is another advantage of ACPFT. Diabetes was previously named as a strong risk factor for ACS or a coronary heart disease equivalent. Hypertension is a strong risk factor for stroke, particularly in the Chinese population. The association between hypertension and occurrence of ACS is still being debated.[12] The results of this study indicated that the time for EKG test depends on clinical factors suggestive for ACS.

There are some limitations of this study. First, the number of ACS events was quite small. However, this is not the primary outcome of this study. Further prospective study to evaluate the ACS outcomes in the ACPFT is required. Second, due to the retrospective study design, some variables were missing. Third, some risk factors were not studied, such as family history of CAD or obstructive sleep apnea.[13]

Conclusion

The ACPFT at the ED facilitated the prompt work-ups and intervention for ACS.

Acknowledgments

The authors would like to thank Mr Dylan Southard for his kind manuscript English editing via Research Affair, Faculty of Medicine, Khon Kaen University, Thailand; the Thailand Research Fund (TRF): IRG 5780016, and the Higher Education Research Promotion National Research University Project of Thailand, Office of the Higher Education Commission through the Health Cluster (SHeP-GMS), Thailand; the Faculty of Medicine, Khon Kaen University grant number TR57201; and the TRF Senior Research Scholar Grant, Thailand Research Fund grant number RTA5880001.

Disclosure

The authors report no conflicts of interest in this work.

References

1. Cayla G, Silvain J, Collet JP, Montalescot G. Updates and current recommendations for the management of patients with non-ST-elevation acute coronary syndromes: what it means for clinical practice. *Am J Cardiol*. 2015;115(5):10A–22A.
2. Rosamond W, Flegal K, Furie K, et al. Heart disease and stroke statistics – 2008 update: a report from the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. *Circulation.* 2008;117(4):e25–e146.
3. Lloyd-Jones D, Adams RJ, Brown TM, et al. Executive summary: heart disease and stroke statistics – 2010 update: a report from the American Heart Association. *Circulation*. 2010;121(7):948–954.
4. Go AS, Mozaffarian D, Roger VL, et al. Heart disease and stroke statistics – 2014 update: a report from the American heart association. *Circulation*. 2013;129(3):e28–e292.
5. O'Connor RE, Brady W, Brooks SC, et al. Part 10: acute coronary syndromes 2010 American heart association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*. 2010;122(18):787–817.
6. Bradley EH, Roumanis SA, Radford MJ, Webster TR, McNamara RL, Mattera JA. Achieving door-to-balloon times that meet quality guidelines how do successful hospitals do it?. *J Am Coll Cardiol*. 2005;46(7):1236–1241.
7. Kevin M. Sullivan. Sample size for a proportion or descriptive study. Available from: http://www.openepi.com/Menu/OE_Menu.html. Accessed 22 September, 2014.
8. Hsieh DJ, Chen WK. Quality of care of patients presenting with acute coronary syndrome in emergency departments in Taiwan. *J Acute Med.* 2011;1(2):33–40.
9. Gupta M, Tabas JA, Kohn MA. Presenting complaint among patients with myocardial infarction who present to an urban, public hospital emergency department. *Ann Emerg Med*. 2002;40(2):180–186.
10. Malik MA, Alam Khan S, Safdar S, Taseer IU. Chest Pain as a presenting complaint in patients with acute myocardial infarction (AMI). *Pak J Med Sci*. 2013;29(2):565–568.
11. Ting HH, Krumholz HM, Bradley EH, et al. Implementation and integration of prehospital ECGs into systems of care for acute coronary syndrome: a scientific statement from the American Heart Association Interdisciplinary Council on Quality of Care And Outcomes Research, Emergency Cardiovascular Care Committee, Council on Cardiovascular Nursing, and Council on Clinical Cardiology. *Circulation*. 2008;118(10):1066–1079.
12. Picariello C, Lazzeri C, Attanà P, Chiostri M, Gensini GF, Valente S. The impact of hypertension on patients with acute coronary syndromes. *Int J Hypertens*. 2011;2011:563657.
13. Leão S, Conde B, Fontes P, Calvo T, Afonso A, Moreira I. Effect of obstructive sleep apnea in acute coronary syndrome. *Am J Cardiol*. 2016;117(7):1084–1087.