



Original Contribution

Does cardiac catheterization laboratory activation by electrocardiography machine auto-interpretation reduce door-to-balloon time?



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ABSTRACT

Objectives: In an attempt to begin ST-segment elevation myocardial infarction (STEMI) treatment more quickly (referred to as door-to-balloon [DTB] time) by minimizing preventable delays in electrocardiogram (ECG) interpretation, cardiac catheterization laboratory (CCL) activation was changed from activation by the emergency physician (code heart I) to activation by a single page if the ECG is interpreted as STEMI by the ECG machine (ECG machine auto-interpretation) (code heart II). We sought to determine the impact of ECG machine auto-interpretation on CCL activation.

Methods: The study period was from June 2010 to May 2012 (from June to November 2011, code heart I; from December 2011 to May 2012, code heart II). All patients aged 18 years or older who were diagnosed with STEMI were evaluated for enrolment. Patients who experienced the code heart system were also included. Door-to-balloon time before and after code heart system were compared with a retrospective chart review. In addition, to determine the appropriateness of the activation, we compared coronary angiography performance rate and percentage of STEMI between code heart I and II.

Results: After the code heart system, the mean DTB time was significantly decreased (before, 96.51 ± 65.60 minutes; after, 65.40 ± 26.40 minutes; $P = .043$).

The STEMI diagnosis and the coronary angiography performance rates were significantly lower in the code heart II group than in the code heart I group without difference in DTB time.

Conclusion: Cardiac catheterization laboratory activation by ECG machine auto-interpretation does not reduce DTB time and often unnecessarily activates the code heart system compared with emergency physician-initiated activation. This system therefore decreases the appropriateness of CCL activation.

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1. Introduction

Acute myocardial infarction is a common disease with a high mortality in the emergency department (ED). Early intervention is fundamental to the successful treatment of ST-segment elevation myocardial infarction (STEMI), as the timely restoration of coronary blood flow can reduce mortality [1,2]. The American College of Cardiology, the American Heart Association, and the European Society of Cardiology guidelines recommend that a patient presenting to the ED with STEMI should receive fibrinolytics within 30 minutes of arrival or percutaneous coronary intervention (PCI) within 90 minutes of arrival (door-to-balloon time [DTB] time) [3–5].

Recently, many studies have proposed different strategies to reduce DTB time in patients presenting with STEMI. Currently, the most widely used strategy is to activate the cardiac catheterization laboratory (CCL) through a single page. Several studies report that this system significantly reduced the DTB time [6–19]. Based on this strategy, our institution implemented a 1-call “code heart I” protocol, CCL activation through a single page by emergency physician (EP).

ST-segment elevation myocardial infarction should be diagnosed quickly for prompt reperfusion. Accurate and quick reading of the electrocardiogram (ECG) is essential for proper diagnosis of STEMI. The ECG is the most immediately accessible and widely used diagnostic tool guiding emergency treatment strategies. However, physicians in charge of the primary medical examination in the ED may be inexperienced in reading ECGs. For this reason, it is thought that if the ECG is interpreted incorrectly, STEMI diagnosis can be delayed. In addition, if the ECG is ambiguous, it can be difficult to diagnose an STEMI. And a recent study reported on the poor accuracy

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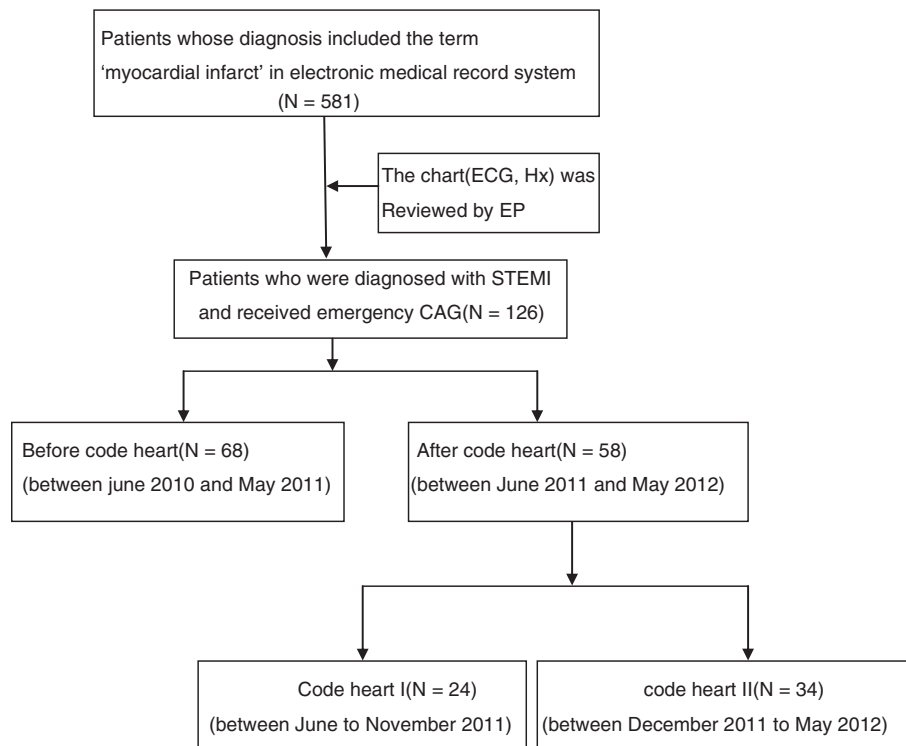


Fig. 1. Flowchart showing the enrolment of study subjects. Code heart, the cardiac catheterization laboratory activation by single page (code heart I + code heart II); code heart I, the system to activate the cardiac catheterization laboratory by EP; code heart II, the system to activate the CCL by ECG machine auto-interpretation.

of experienced physicians for interpreting STEMI based on the ECG finding [20].

In an attempt to begin STEMI treatment more quickly (to reduce DTB time) by minimizing preventable delays in ECG interpretation, CCL activation was changed from activation by the EP (code heart I) to activation by a single page if the ECG is interpreted as STEMI or ST elevation by the ECG machine (ECG machine auto-interpretation) (code heart II) in patients with symptoms of a suspected STEMI such as chest pain, dyspnea, syncope, and shortness of breath. Therefore, we investigated the effect of CCL activation by a single page and sought to compare its effect and appropriateness between EP initiating CCL activation (code heart I) and ECG machine auto-interpretation on CCL activation (code heart II).

2. Methods

2.1. Study design and patient enrolment

Our institution is a 1000-bed tertiary care university hospital located in Yangsan City, Korea. This study used a retrospective design and was approved by the institutional review board of our university.

On June 1, 2011, our institution implemented a 1-call “code heart I” protocol. As per the protocol, a single call from the EP to the central page operator triggered the simultaneous activation of the pagers of the on-call interventional cardiologist, catheterization laboratory personnel, and in-hospital cardiology fellow. If the attending EP (emergency resident or staff) suspected STEMI after reviewing the

Table 1
General characteristics of patients diagnosed with STEMI for each group, before CCL by single page

Type	Before code heart ^a	Code heart I ^b	Code heart II ^c	P
STEMI (n)	68 (54%)	24 (19%)	34 (27%)	
DM (n)	19 (27.9%)	6 (25%)	9 (26.4%)	.959
HT (n)	26 (38.2%)	9 (37.5%)	18 (52.9%)	.322
Previous CAD (n)	8 (11.7%)	5 (20.8%)	2 (5.8%)	.223
Smoking (n)	35 (51.4%)	11 (45.8%)	16 (47%)	.814
Previous CABG or PCI	6 (8.8%)	3 (12.5%)	2 (5.8%)	.714
CK (U/L)	128.0 (93.0–400.0)	224.0 (114.0–579.0)	274.0 (141.0–617.0)	.518
CK-MB (ng/mL)	3.8 (2.0–17.1)	7.8 (1.7–67.9)	13.5 (3.7–73.1)	.711
Troponin I (ng/mL)	0.15 (0.02–2.73)	0.13 (0.04–12.66)	1.27 (0.05–13.60)	.998
Symptom duration (min)	120 (60–420)	240 (112.5–810.0)	480 (180.0–1600.0)	.350
Height (cm)	162.51 ± 9.12	164.38 ± 9.20	165.22 ± 7.04	.484
Weight (kg)	65.08 ± 11.60	64.33 ± 13.29	66.03 ± 17.38	.901
Age (y)	63.01 ± 11.55	62.38 ± 13.61	64.68 ± 13.58	.711
Male/female (n)	52/16	17/7	25/9	.699

Abbreviations: CAD, coronary artery disease; DM, diabetes mellitus; HT, hypertension.

^a Cardiac catheterization laboratory activation by single page.

^b Cardiac catheterization laboratory activation by EP.

^c Cardiac catheterization laboratory activation by the ECG machine auto-interpretation.

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