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Original article

Relationship between time to treatment and mortality among patients undergoing primary percutaneous coronary intervention according to Korea Acute Myocardial Infarction Registry

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ABSTRACT

Background: Despite large reductions in door-to-balloon times over the period, several studies from regional and national data showed that annual mortality rates were not decreased among patients who underwent primary percutaneous coronary intervention (PCI). However, these studies mostly focused on door-to-balloon time, and there was no consideration of total ischemic time in a trend of mortality. The aim of this study was to assess the annual trend between time to treatment and 1-month mortality among patients undergoing primary PCI.

Methods and results: The study population consisted of 8040 patients who underwent primary PCI at hospitals participating in the nationwide prospective Korea Acute Myocardial Infarction Registry (KAMIR) between January 2008 and December 2011. The primary end point of this study was 1-month all-cause mortality, and time to treatment (door-to-balloon time, symptom-to-balloon time). One-month death occurred in 452 patients (5.6%) from 2008 to 2011. Additional reductions in door-to-balloon time were not translated into parallel reductions in mortality rate and total ischemic time. After adjustment using clinical risk, shorter total ischemic time was an independent predictor of 1-month mortality [adjusted odds ratio (OR) 0.78, 95% confidential interval (CI) 0.62–0.99, $p = 0.04$]. Total ischemic time could be reduced by using emergency medical services.

Conclusion: Despite improvements in door-to-balloon time, no parallel reductions in mortality rate and total ischemic time were observed. Total ischemic time was associated with mortality. The present study

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¹ See Appendix A.

suggests that additional efforts are needed to shorten total ischemic time including patient and pre-hospital systemic delay for better prognosis after primary PCI.

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Introduction

Door-to-balloon time, time interval from hospital arrival to balloon inflation, is associated with better in-hospital and long-term survival for patients with ST-segment elevation myocardial infarction (STEMI) who received primary percutaneous coronary intervention (PCI) [1–3]. Based on these data, current guideline recommended goals of 90 min for door-to-balloon time [4]. Because of this recommendation, door-to-balloon time has been a key quality metric for primary PCI centers [5].

The previous report in Korea showed that only 51% of patients achieved this goal for reperfusion between November 2005 and January 2007 [6]. Thus, there have been institutional and national quality improvement initiatives to achieve door-to-balloon time within 90 min in Korea. But, it is unknown whether these movements are associated with better prognosis. Despite large reductions in door-to-balloon times over the period, several studies from regional and national data showed that annual mortality rates were not decreased among patients who underwent primary PCI [7,8]. However, these studies mostly focused on door-to-balloon time in Western populations, and there was no consideration of total ischemic time in a trend of mortality.

In the present study, we used large nationwide registry data from Korea to assess the annual trend between time to treatment and 1-month mortality among patients who underwent primary PCI.

Methods

Study population

The study population consisted of 8040 patients who underwent primary PCI at hospitals participating in the nationwide prospective Korea Acute Myocardial Infarction Registry (KAMIR) between January 2008 and December 2011. The KAMIR, launched in November 2005, is a prospective multi-center data collection registry reflecting real-world treatment practices and outcomes in Asian patients diagnosed with AMI. The registry consists of 50 community and teaching hospitals with facilities for primary PCI and on-site cardiac surgery. Included patients were representative of the Korean STEMI population. The first diagnosis of STEMI was established in the participating centers. Data were collected by a trained study coordinator using a standardized case report form and protocol. The study protocol was approved by the ethics committee at each participating institution. Details of the registry have been previously published in many international journals [9].

Inclusion criteria for the present study were consecutive patients aged ≥ 18 years presenting within 12 h after symptom onset, had a suggestive history with ST-segment elevation above 2 mm in two or more precordial leads, or above 1 mm in two or more limb leads, or new onset of left bundle branch block on the 12-lead electrocardiogram (ECG) with increased cardiac enzyme activity (troponin or myocardial fraction of creatine kinase), treated with primary PCI, and had completed a 1-month clinical follow-up. We excluded patients for whom time table data were not completed (symptom onset, hospital arrival, and balloon time), and the door-to-balloon times were not available due to an error value.

Interventional procedures and medical treatment

Loading doses of aspirin and clopidogrel were administered after patients consented to receiving PCI, and a minimum dose of 100 mg aspirin and a 300–600 mg loading dose of clopidogrel and unfractionated heparin (50–70 U/kg) were administered in order to maintain an activated clotting time above 250–300 s. The maintenance dose was 100 mg/day for aspirin and 75 mg/day for clopidogrel. Coronary artery stenting was performed using the standard technique. Performance of pre-dilation, direct stenting, post-adjunctive balloon inflation, mode of revascularization (staged or ad-hoc PCI), using intravascular ultrasound (IVUS), using thrombus aspiration device, stent type, and administration of a glycoprotein IIb/IIIa receptor blocker were at the discretion of the operator.

Statistical analysis

All analyses were performed using Statistical Package for the Social Sciences (SPSS) software version 21.0 (IBM software group, Chicago, IL, USA). Baseline clinical and procedural characteristics were compared with the use of chi-square test for categorical variables and the analysis-of-variance F-test for continuous variables. Continuous variables are presented as mean \pm standard deviation (SD), and categorical variables as percentages. The primary end point of this study was 1-month all-cause mortality, and time to treatment (door-to-balloon time, symptom-to-balloon time). Multi-variate logistic regression analysis was performed to assess the relation between time to treatment (door-to-balloon time, total ischemic time) and 1-month mortality. Global Registry of Acute Coronary Events (GRACE) score for in-hospital mortality was used as a co-variable to adjust the relative risk [10]. All statistical tests were two-tailed, and a *p*-value less than 0.05 was considered significant.

Results

Baseline and procedural characteristics

A total of 9154 patients with time to presentation within 12 h who underwent primary PCI between January 2008 and December 2011 were included in this study. Patients were excluded if missing data were present in time table ($n = 668$), if they had an error value of door-to-balloon time ($n = 393$), or 1-month mortality data were not available ($n = 53$). Thus, the final study cohort consisted of 8040 patients (Fig. 1). The incidence rates of STEMI in Korea were decreased compared to NSTEMI as in a previous report [11].

The mean age was 63.9 years with 74% of male patients. Table 1 shows baseline clinical and procedural characteristics for each year. Except dyslipidemia, the prevalence of risk factors such as hypertension, diabetes, and current smoking was relatively constant. The proportion of patients with a prior MI, prior revascularization, and heart failure was remarkably lower than previous Western study (MI 2.3% vs. 18.5%, PCI 4.8% vs. 20.5%, heart failure 0.9% vs. 4.0%). Left ventricular ejection fraction was also more preserved maybe due to differences of these parameters [8]. Location of culprit artery and prevalence of multi-vessel disease were similar in each year. However, procedural factors showed some tendencies over the course of the study period.

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