

# Influence of Second- and Third-Degree Heart Block on 30-Day Outcome Following Acute Myocardial Infarction in the Drug-Eluting Stent Era



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This study was conducted to investigate the prognostic value of heart block among patients with acute myocardial infarction (AMI) treated with drug-eluting stents. A total of 13,862 patients with AMI, registered in the nation-wide AMI database from January 2005 to June 2013, were analyzed. Second- (Mobitz type I or II) and third-degree atrioventricular block were considered as heart block in this study. Thirty-day major adverse cardiac events (MACE) including all causes of death, recurrent myocardial infarction, and revascularization were evaluated. Percutaneous coronary intervention with implantation of drug-eluting stent was performed in 89.8% of the patients. Heart block occurred in 378 patients (2.7%). Thirty-day MACE occurred in 1,144 patients (8.2%). Patients with heart block showed worse clinical parameters at initial admission, and the presence of heart block was associated with 30-day MACE in univariate analyses. However, the prognostic impact of heart block was not significant after adjustment of potential confounders ( $p = 0.489$ ). Among patients with heart block, patients with a culprit in the left anterior descending (LAD) coronary artery had worse clinical outcomes than those of patients with a culprit in the left circumflex or right coronary artery. LAD culprit was a significant risk factor for 30-day MACE even after controlling for confounders (odds ratio 5.28, 95% confidence interval 1.22 to 22.81,  $p = 0.026$ ). In conclusion, despite differences in clinical parameters at the initial admission, heart block was not an independent risk factor for 30-day MACE in adjusted analyses. However, a LAD culprit was an independent risk factor for 30-day MACE among patients with heart block. © 2014 Elsevier Inc. All rights reserved. (Am J Cardiol 2014;114:1658–1662)

A number of studies have reported that heart block is a common complication of acute myocardial infarction (AMI) and is associated with worse clinical outcomes.<sup>1–8</sup> However, most of these studies were conducted in the pre-thrombolytic or thrombolytic era. To date, the prognostic impacts of heart block complicating AMI have not yet been reported in the drug-eluting stent (DES) era. Therefore, the aim of this study was to investigate the clinical outcomes of patients with AMI who developed heart block in the DES era. A large series of patients with AMI from a nation-wide

AMI registry in Korea were analyzed in this study. Most of the study patients received DES implantation.

## Methods

Detailed study methods, including patient enrollment, have been described recently in previous studies.<sup>9,10</sup> In brief, the Korea Acute Myocardial Infarction Registry and the Korea Working Group on Myocardial Infarction registry were established in November 2005, with support from the Korean Society of Cardiology, for prospective, open, observational, multicenter studies of AMI, including assessment of clinical outcomes. Fifty-five cardiac centers in Korea participated in establishing the database. From January 2005 to June 2013, 16,587 patients with AMI were identified from the Korea Acute Myocardial Infarction Registry and Korea Working Group on Myocardial Infarction database. Of these patients, 679 who had a final diagnosis other than AMI, 1,700 who did not have a clinical follow-up after discharge, and 346 who had no available information on atrioventricular block (AVB) were excluded. Finally, the remaining 13,862 patients were analyzed. The flow chart for patient enrollment is shown in Figure 1. AMI was diagnosed based on patient's symptoms,

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See page 1662 for disclosure information.

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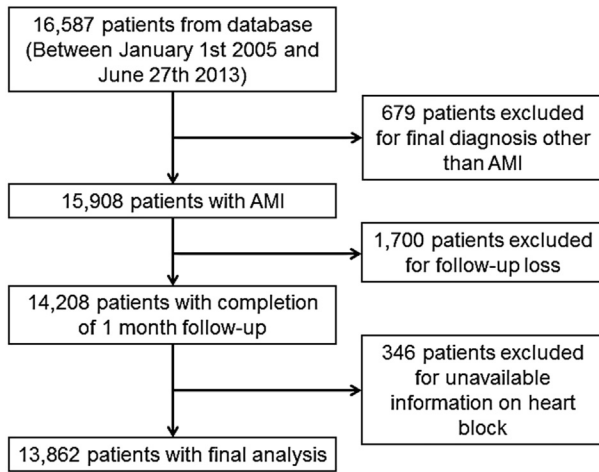


Figure 1. Study flow of patient enrollment.

cardiac enzyme elevation, and changes in the electrocardiogram. Demographic and clinical characteristics, including age, gender, body mass index, smoking status, a history of hypertension, dyslipidemia, and ischemic heart disease, were collected prospectively and stored on an electronic database. Systolic and/or diastolic blood pressure and heart rate were checked by trained nurses, and left ventricular (LV) ejection fraction was determined by 2-dimensional echocardiography. The Killip classification was applied based on the presence of heart failure, acute pulmonary edema, and shock at the initial admission.<sup>11</sup> Blood samples for baseline laboratory tests other than lipid measurement were collected at admission before initial treatment. Overnight fasting blood was also sampled for lipid levels. The initial treatment strategy for patients with AMI was determined by the attending physicians based on guideline's recommendations. Multivessel disease was defined as  $\geq 70\%$  stenosis in at least 2 major epicardial coronary arteries or  $\geq 50\%$  stenosis of the left main coronary artery. Successful percutaneous coronary intervention was defined as residual stenosis of target vessel  $< 50\%$  with Thrombolysis In Myocardial Infarction flow 2 or 3. The study protocol was approved by the institutional review board of each hospital, and informed consents were obtained from all study participants.

Heart block was diagnosed based on standard 12-lead electrocardiographic findings at the time of initial admission. Experienced cardiologists interpreted the electrocardiogram. Second-degree AVB was defined when one or more atrial pulses did not conduct to the ventricle. Third-degree AVB was defined when no atrial activity was conducted to the ventricle, and P waves were completely dissociated with QRS complexes. Second- (Mobitz type I or II) and third-degree AVB were considered as heart block in this study.

Patients were followed up after hospital discharge. The primary outcome of this study was major adverse cardiac events (MACE), including all causes of death, nonfatal myocardial infarction (MI), and revascularization (coronary bypass surgery or percutaneous coronary intervention) within 30 days of AMI. When  $\geq 2$  events were recorded at the same hospitalization, the most serious event was considered as the event of the patient in the following order: death, nonfatal MI,

Table 1  
Baseline characteristics of study patients

Characteristic	Heart block		p value
	Yes (n = 378)	No (n = 13,484)	
Age (years)	67.4 $\pm$ 11.3	63.6 $\pm$ 12.7	< 0.001
Male sex	237 (62.7%)	9,516 (70.6%)	0.001
Body mass index (kg/m <sup>2</sup> )	2.39 $\pm$ 4.0	24.0 $\pm$ 3.3	0.684
Diabetes mellitus	133 (35.4%)	3,760 (28.0%)	0.002
Hypertension	218 (58.0%)	6,560 (48.8%)	< 0.001
Smoker	193 (51.7%)	7,843 (58.5%)	0.009
Systolic blood pressure (mm Hg)	101 $\pm$ 31	128 $\pm$ 27	< 0.001
Diastolic blood pressure (mm Hg)	64.0 $\pm$ 17.9	78.9 $\pm$ 16.2	< 0.001
Heart rate (per minute)	55.5 $\pm$ 22.0	78.4 $\pm$ 19.3	< 0.001
Killip stage $\geq 2$	201 (54.3%)	3,495 (26.4%)	< 0.001
Left ventricular ejection fraction (%)	54.4 $\pm$ 10.6	52.0 $\pm$ 12.4	0.001
Maximal CK-MB (ng/mL)	132 $\pm$ 155	122 $\pm$ 211	0.368
Maximal troponin I (ng/mL)	38.8 $\pm$ 39.0	32.8 $\pm$ 40.1	0.011
Total cholesterol (mg/dL)	167 $\pm$ 43	182 $\pm$ 44	< 0.001
LDL cholesterol (mg/dL)	103 $\pm$ 36	116 $\pm$ 37	< 0.001
HDL cholesterol (mg/dL)	41.2 $\pm$ 11.0	43.9 $\pm$ 11.9	< 0.001
Triglyceride (mg/dL)	123 $\pm$ 136	127 $\pm$ 99	0.433
Glucose (mg/dL)	222 $\pm$ 113	170 $\pm$ 81	< 0.001
Estimated GFR (mL/min/ 1.73m <sup>2</sup> )	52.1 $\pm$ 25.7	68.8 $\pm$ 29.7	< 0.001
Culprit coronary artery			< 0.001
Left main	1 (0.3%)	282 (2.3%)	
Left anterior descending	28 (7.6%)	5,909 (48.4%)	
Left circumflex	30 (8.4%)	2,072 (17.0%)	
Right	298 (83.8%)	3,938 (32.3%)	
Three-vessel coronary disease	97 (26.9%)	2,759 (21.6%)	0.016
Lesion type, B2 or C	279 (83.0%)	9,331 (80.8%)	0.306
PCI with DES	270 (85.2%)	9,540 (90.1%)	0.004
Stent number	1.54 $\pm$ 0.84	1.55 $\pm$ 0.84	0.831
Stent diameter (mm)	3.24 $\pm$ 0.45	3.17 $\pm$ 0.42	0.007
Stent length (mm)	24.6 $\pm$ 6.4	24.7 $\pm$ 6.5	0.831
Post-PCI TIMI flow III	259 (89.6%)	8,345 (92.2%)	0.113
PCI success	275 (93.5%)	8,780 (96.1%)	0.028
Discharge medication			
Aspirin	314 (98.4%)	12,362 (97.8%)	0.465
Clopidogrel	311 (97.5%)	11,748 (92.9%)	0.002
Beta-blocker	227 (71.2%)	9,835 (77.8%)	0.005
ACE inhibitor or ARB	265 (83.1%)	10,383 (82.1%)	0.669
Statin	228 (71.5%)	9,502 (75.2%)	0.130

ACE = angiotensin-converting enzyme; ARB = angiotensin-receptor blocker; CK-MB = creatine kinase-MB isoenzyme; DES = drug-eluting stent; GFR = glomerular filtration rate; HDL = high-density lipoprotein; LDL = low-density lipoprotein; PCI = percutaneous coronary intervention; TIMI = Thrombolysis In Myocardial Infarction.

and revascularization. Information on MACE was collected by medical record review or telephone interviews if necessary. Only the first MACE was considered as the MACE of a patient. All data were entered in an electronic web-based case-report form.

Data are presented as mean values with SDs or percentages. Continuous variables were compared using the Student *t* test and categorical variables were compared using

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