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Original article

The CHA_2DS_2VASc score can be used to stratify the prognosis of acute myocardial infarction patients irrespective of presence of atrial fibrillation

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ABSTRACT

Background: The CHA_2DS_2VASc score has been used to evaluate the risk of thromboembolic events in atrial fibrillation. However, because all the components of CHA_2DS_2VASc are important cardiovascular risk factors, we decided to evaluate the effectiveness of CHA_2DS_2VASc score as a long-term predictor for prognosis in acute myocardial infarction (AMI) patients.
Methods: We enrolled 15,681 AMI patients for the Korean Working Group in Acute Myocardial Infarction (KORMI) consecutively and analyzed retrospectively. We divided the all the patients into four groups according to $CHADS_2VASc$ score (Group I: 0–1, $n = 3317$; Group II: 2–3, $n = 6794$; Group III: 4–5, $n = 4457$; Group IV: 6–9, $n = 1113$). The cardiac event was defined as the sum of all-cause mortality and recurrence of myocardial infarction.
Results: As the risk score increased, the incidence of cardiac events was higher at 1, 6, 12, and 24 months. The cardiac event-free survival rate was lower as the risk score increased (Group I vs Group II, $p < 0.001$; Group II vs Group III, $p < 0.001$; Group III vs Group IV, $p = 0.037$). After adjusting confounding variables, the Cox-regression multivariate analysis showed that the CHA_2DS_2VASc score was an independent predictor for the long-term prognosis in total AMI patients ($p < 0.001$, hazard ratio = 1.414 per scale).
Conclusion: The AMI patients with higher CHA_2DS_2VASc score had worse cardiovascular outcome. Therefore, $CHADS_2VASc$ score can be used to stratify AMI patients according to long-term prognosis irrespective of presence of atrial fibrillation.
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Introduction

As the incidence of acute myocardial infarction (AMI) increased and the survival rate from acute coronary events improved, the risk-stratification system for long-term prognosis after acute myocardial infarction became important. There are several risk-stratification systems that were developed in different study populations and included different contributing factors.

The thrombolysis in myocardial infarction (TIMI) risk score, based on results from ST-segment elevation myocardial infarction (STEMI) patients eligible for thrombolytic therapy, suggested that 30-day mortality had a positive relationship with the risk score [1]. The Global Registry of Acute Coronary Events (GRACE) risk score including eight contributing factors predicted in-hospital and 6-month mortality independently among all the patients with an acute coronary syndrome [2,3]. A recent study reported that $CHADS_2$ score, which was developed as a well-validated tool for predicting risk of stroke in atrial fibrillation patients, has strong association with an all-cause mortality at 10 years in acute coronary syndrome patients [4].

The CHA_2DS_2VASc score, a refinement form of $CHADS_2$ score, was developed as a risk-stratification tool for thromboembolic events in patients with non-valvular atrial fibrillation [5].

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However, there were few studies that evaluated the prognostic value of CHA_2DS_2VASc score in AMI. Therefore, we evaluated the effectiveness of CHA_2DS_2VASc score as a risk-stratification tool for long-term clinical outcome in AMI patients.

Methods

Study population

This study enrolled 15,681 patients diagnosed as having AMI consecutively from August 2008 to December 2011 and analyzed the data retrospectively. These data are derived from the Korean Working Group in Acute Myocardial Infarction (KORMI) registry, which is a multi-centered and ongoing observational study designed to collect and evaluate demographic, clinical, treatment, and outcome data of patients with ACI. Because the KORMI is an anonymous observational study, no informed consent of the participating patients is required for the institutional boards at any of the participating institutions.

Among the total enrolled patients, 8970 were diagnosed as having ST-segment elevation myocardial infarction (STEMI) and 6711 patients were diagnosed as having non-ST-segment elevation myocardial infarction (NSTEMI). The diagnostic criteria for AMI were defined as typical rise and fall of cardiac biomarker values and at least one of the following: (1) symptoms of ischemia; (2) development of pathologic Q wave in the electrocardiogram; (3) new significant ST segment or T wave change or new-onset left bundle branch block; (4) identification of intracoronary lesion by angiography [6].

Unlike TIMI risk score or GRACE risk model which were developed using populations treated by thrombolysis, our study included all the patients with AMI irrespective of the method of treatment. Among STEMI patients, 8055 (89.8%) underwent primary percutaneous coronary intervention (PCI), 323 patients (3.6%) were treated for thrombolysis, and 592 patients (6.6%) were treated by conservative treatment. Among NSTEMI patients, 4973 (74.1%) were treated by early invasive therapy and 1738 patients were treated by early conservative strategy. We excluded the patients diagnosed as having unstable angina or stable angina pectoris.

The number of patients with atrial fibrillation in AMI was 639 (3.9%) and this percentage is lower than the value suggested by previous other studies [7].

Study protocol

We used CHA_2DS_2VASc score as a parameter to predict the long-term outcome after AMI. CHA_2DS_2VASc score is a refinement from $CHADS_2$ score which was developed to predict the possibility of stroke and guide antithrombotic therapy. The components of $CHADS_2$ score are as follows: congestive heart failure, hypertension, age >75 years, diabetes mellitus, and history of stroke (2 points). CHA_2DS_2VASc score has several additional components: age >65 years (1 point), age >75 years (2 points), history of vascular disease, sex (female; 1 point). The history of myocardial infarction was regarded as "vascular disease" and AMI was counted as 1 point.

We divided all the enrolled patients into four groups according to CHA_2DS_2VASc score: low-risk group (Group I: 0–1 point); moderate-risk group (Group II: 2–3 points); high-risk group (Group III: 4–5 points); and very high-risk group (Group IV: 6–9 points). We compared the in-hospital mortality and incidence of cardiac event at 1, 6, 12, and 24 months and cumulative cardiac event-free survival among the four groups irrespective of presence

Table 1
Comparison of baseline characteristics among the four groups according to CHA_2DS_2VASc score (Group I: CHA_2DS_2VASc 0–1, Group II: CHA_2DS_2VASc 2–3, Group III: CHA_2DS_2VASc 4–5, Group IV: CHA_2DS_2VASc 6–9).

	Low-risk Group I $n=3317$	Moderate-risk Group II $n=6794$	High-risk Group III $n=4457$	Very-high risk Group IV $n=1113$	*p*-value
Age	50.5 ± 8.2	61.5 ± 11.3	73.8 ± 9.3	77.6 ± 7.5	<0.001
Sex (male%)	3317 (100%)	5689 (83.7%)	1828 (41.0%)	288 (25.9%)	<0.001
SBP	127.2 ± 26.6	128.5 ± 29.2	127.8 ± 31.0	129.3 ± 32.7	0.092
DBP	80.5 ± 29.4	79.2 ± 26.7	76.1 ± 17.6	76.6 ± 18.4	<0.001
LVEF	53.8 ± 10.8	52.9 ± 11.9	50.8 ± 12.8	49.2 ± 13.7	<0.001
Max CK-MB	140 ± 278	123 ± 229	99 ± 209	78 ± 145	<0.001
Max troponin-I	42 ± 95	41 ± 93	38 ± 148	31 ± 128	0.032
Total cholesterol (mg/dL)	193 ± 42	180 ± 45	176 ± 48	173 ± 47	<0.001
Triglyceride (mg/dL)	147 ± 111	133 ± 108	115 ± 84	114 ± 66	<0.001
HDL cholesterol (mg/dL)	43 ± 13	43 ± 15	43 ± 16	43 ± 15	0.065
LDL cholesterol (mg/dL)	124 ± 37	114 ± 41	110 ± 41	106 ± 41	<0.001
Creatinine (mg/dL)	1.0 ± 1.4	1.1 ± 2.0	1.3 ± 2.2	1.4 ± 1.4	<0.001
Hs CRP	4.2 ± 15.9	5.4 ± 19.9	7.9 ± 25.1	10.8 ± 32.5	<0.001
NT pro-BNP	637 ± 1800	1755 ± 4619	4689 ± 8221	7586 ± 10,309	<0.001
Glycated hemoglobin (%)	6.1 ± 2.6	6.6 ± 2.0	6.8 ± 2.0	7.0 ± 1.4	<0.001
Previous IHD	290 (8.8%)	1020 (15.1%)	865 (19.5%)	260 (23.4%)	<0.001
Hypertension	0 (0.0%)	3584 (52.2%)	3512 (78.8%)	1054 (94.7%)	<0.001
Diabetes mellitus	0 (0.0%)	1728 (25.4%)	1870 (42.0%)	790 (71.0%)	<0.001
Dyslipidemia	351 (11.0%)	920 (14.2%)	526 (12.5%)	155 (15.1%)	<0.001
Old CVA	0 (0.0%)	54 (0.8%)	453 (10.2%)	587 (52.7%)	<0.001
Atrial fibrillation	76 (2.3%)	223 (3.3%)	251 (5.6%)	73 (6.6%)	<0.001
Smoking	2805 (85.4%)	4454 (66.3%)	1472 (33.6%)	266 (24.3%)	<0.001
Aspirin	3240 (98.1%)	6641 (98.5%)	4315 (97.7%)	1068 (96.7%)	<0.001
Clopidogrel	3175 (96.4%)	6500 (96.6%)	4210 (95.7%)	1045 (94.6%)	0.002
Beta blocker	2705 (83.6%)	5315 (80.6%)	3377 (78.2%)	831 (76.7%)	<0.001
ACE inhibitor	2129 (66.4%)	4213 (64.6%)	2579 (60.5%)	610 (57.2%)	<0.001
Angiotensin receptor blocker	623 (20.2%)	1537 (24.1%)	1185 (28.2%)	336 (31.4%)	<0.001
Statin	2593 (80.0%)	5113 (76.9%)	3124 (72.2%)	777 (71.5%)	<0.001

SBP, systolic blood pressure; DBP, diastolic blood pressure; LVEF, left ventricular ejection fraction; CK-MB, creatine kinase-MB; HDL, high-density lipoprotein; LDL, low-density lipoprotein; hs-CRP, high sensitivity C-reactive protein; NT pro-BNP, N-terminal pro-brain type natriuretic peptide; IHD, ischemic heart disease; CVA, cerebrovascular accident; ACE inhibitor, angiotensin-converting enzyme inhibitor.

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