Original Article

The Association between the PRECISE-DAPT Score and New-Onset Atrial Fibrillation in Patients with ST-Elevation Myocardial Infarction

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Abstract

Background: Atrial fibrillation (AF) is associated with increased morbidity in myocardial infarction (MI), especially thromboembolic risk increases. The PRECISE-DAPT (The PREdicting bleeding Complications In patients undergoing Stent implantation and subsEquent Dual Anti-Platelet Therapy) score was created to predict the bleeding risk of dual antiplatelet therapy. The purpose of this study was to evaluate the association between new-onset AF and the PRECISE-DAPT score in ST-segment-elevation myocardial infarction (STEMI).

Methods: This retrospective study enrolled patients who developed STEMI within 12 hours of the onset of symptoms and underwent primary percutaneous coronary intervention. The study population was divided into 2 groups of PRECISE-DAPT scores of 25 or greater and PRECISE-DAPT scores of below 25 and their baseline characteristics, as well as laboratory and echocardiography results, were compared. In-hospital new AF and related events were compared between the 2 PRECISE-DAPT score groups.

Results: From February 2015 to December 2017, this study enrolled 2234 patients with STEMI at a mean age of 54.4 years. The new-onset AF incidence rate was higher in the higher PRECISE-DAPT group than in the lower PRECISE-DAPT group (62 [28.7 %] vs 58 [2.9%]; P<0.001). According to the multivariate logistic regression analysis, the factors associated with new-onset AF were the left atrial diameter (OR=1.98, 95% confidence interval=1.34–2.93; P=0.001) and the PRECISE-DAPT score (OR=1.04, 95% confidence interval=1.10–1.18; P<0.001).

Conclusion: The PRECISE-DAPT score was associated with the development of new-onset AF in our patients with STEMI. Further follow-up of these patients will provide clearer information.

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Keywords: Atrial fibrillation; ST elevation myocardial infarction; Coronary artery disease

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Introduction

Atrial fibrillation (AF) is a common comorbidity in patients with myocardial infarction (MI). The incidence of new-onset AF after ST-segment elevation myocardial infarction (STEMI) ranges from 4% to 21%.[1] AF in MI involves increased rates of heart failure, stroke, and death.[2] The increased morbidity and mortality associated with AF can be reduced with anticoagulant therapy. Dual antiplatelet (DAPT) and anticoagulant agents are the leading medical approaches in STEMI.[3] All patients with STEMI receive DAPT treatment, and some of them are also indicated for long-term anticoagulants against AF.[4] Adding oral anticoagulant therapy to DAPT increases the risk of bleeding complications at least 2 to 3-fold.[5, 6]

Risk scores have been developed for bleeding and ischemic risk assessment to determine the optimal duration of DAPT and anticoagulant therapy. The PRECISE-DAPT (The PREdicting bleeding Complications In patients undergoing Stent implantation and subsEquent Dual Anti-Platelet Therapy) score is one of the new risk scores created to predict the bleeding risk of DAPT therapy after coronary intervention.[4] The PRECISE-DAPT study included patients with coronary artery disease who underwent primary percutaneous coronary intervention (PCI) and received DAPT treatment. The score is composed of 5 parameters-namely age, creatinine clearance, the hemoglobin level, the white blood cell count, and prior spontaneous bleeding-mainly to predict out-of-hospital bleeding.[4] Recent trials have found the PRECISE-DAPT score to be associated with different ischemic and nonischemic outcomes in STEMI.[7, 8] In a previous study, the PRECISE-DAPT score was associated with in-hospital mortality in patients with STEMI.[7]

Predicting new-onset AF, which increases morbidity in patients after MI, may be clinically important. The PRECISE-DAPT score, comprising components known to be associated with AF such as age and creatinine clearance, is likely associated with post-MI AF. The purpose of this study was to evaluate the association between new-onset AF and the PRECISE-DAPT score in STEMI.

Methods

From February 2015 to December 2017, the present retrospective study enrolled 2234 patients with STEMI who were admitted to Dr. Siyami Ersek Thoracic and Cardiovascular Surgery Training and Research Hospital. The diagnosis of STEMI was established according to the latest STEMI guidelines.[9] All the patients enrolled were within 12 hours of the onset of symptoms, and they underwent primary PCI and received appropriate medical treatment for STEMI. The exclusion criteria were severe valvular heart disease, mechanical heart valves, known previous AF, undergoing chemotherapy, pregnancy or breastfeeding, being admitted to the hospital 12 hours after the onset of chest pain, cardiogenic shock, undergoing cardiopulmonary resuscitation due to cardiorespiratory arrest, receiving treatment with thrombolytic agents, and undergoing an emergent coronary artery bypass grafting. Also excluded were patients with AF due to ischemia, notably before revascularization.

The PRECISE-DAPT (http://www.precisedaptscore.com) and CHA2DS2-VASc (https://bit.ly/2RTn60g) scores were calculated for each patient by using web calculators. This study is compliant with the Declaration of Helsinki, and it received approval from the institutional ethics committee. The need for written informed consent was waived because of the retrospective design of the study.

Variables included in the calculation of the PRECISE-DAPT risk score are age, creatinine clearance, the white blood cell count, the hemoglobin level, and prior spontaneous bleeding.[10]

The study population was divided into 2 groups of PRECISE-DAPT scores of 25 or greater and PRECISE-DAPT scores of below 25. The cutoff value was chosen to be 25 during the grouping of the patients because the accepted cutoff value is 25 for defining the increased bleeding risk in guidelines.[4]

The CHA2DS2-VASc score is calculated with the values of congestive heart failure (1 point); hypertension (1 point); age 75 years or over (2 points); diabetes (1 point); stroke/transient ischemic attack/thromboembolism (2 points); vascular diseases such as prior MI, peripheral artery disease, and aortic plaque (1 point); age between 65 and 75 years (1 point); and the female sex (1 point).[11]

Hypertension was described as undergoing antihypertensive treatment or having a systolic pressure level of 140 mm Hg and a diastolic pressure of 90 mm Hg on at least 2 separate measurements during hospitalization.[12] Diabetes mellitus was described as taking oral antidiabetic agents or insulin or follow-up fasting blood glucose levels meeting the criteria of the American Diabetes Association.[13] New-onset AF was defined according to the guideline and was diagnosed with electrocardiography monitoring during the hospitalization.[14]

The patients' echocardiographic parameters such as the left ventricular (LV) end-diastolic diameter, the LV end-systolic diameter, the left atrial (LA) diameter, and the LV ejection fraction were also recorded.

Categorical data were presented as numbers and percentages. Continuous variables were presented as the mean±the standard deviation upon normal distribution and as medians and interquartile ranges otherwise.

Differences between the groups were evaluated by using the Student *t* test for variables with normal distribution and the Mann–Whitney *U* test for variables without normal distribution. The χ^2 test was used to compare categorical variables as appropriate.

Univariable logistic regression analysis was used to

evaluate the relationship between variables and new-onset AF. Variables that were statistically significant in the univariable analysis were further subjected to multivariable logistic regression models. The results of the regression models were presented as the odds ratio (OR) and the 95% confidence interval (95% CI). A P value of less than 0.05 was considered statistically significant. The statistical analyses were performed using the statistical software SPSS, version 23 (IBM Corp; Armonk, NY, USA).

Results

The study population was divided into 2 groups of patients above and below the PRECISE-DAPT score of 25. The patients' baseline characteristics, as well as laboratory and echocardiography results, were compared between the 2 groups (Table 1). Concerning echocardiographic parameters, the LV ejection fraction was lower and the LA diameter was larger in the higher PRECISE-DAPT score group than

Table 1. The baseline characteristics, as well as laboratory and echocardiography results, of all the patients and the PRECISE-DAPT score groups*

Parameters	Study Population (n=2234)	PRECISE-DAPT Score <25 (n=2018)	PRECISE-DAPT Score ≥25 (n=216)	P
Age (y)	54.41±10.60	52.80±9.20	69.11±10.20	<0.001
Female sex	273 (12.7)	206 (10.2)	67 (31.0)	<0.001
Hypertension	717 (32.1)	606 (30.0)	111 (51.4)	<0.001
Diabetes mellitus	520 (23.3)	429 (21.3)	91 (42.1)	<0.001
Hyperlipidemia	616 (27.6)	570 (28.2)	46 (21.3)	0.031
Heart failure	83 (3.7)	66 (3.3)	17 (7.9)	0.002
Smoking	1058 (47.4)	1001(49.6)	57 (26.4)	<0.001
Prior bleeding	14 (0.6)	6 (0.3)	8 (3.7)	<0.001
Anterior MI	982 (44.0)	889 (44.1)	93 (43.1)	0.418
Echocardiography Parameters				
LVEDD (mm)	47.01±8.01	47.02±7.61	48.10±10.70	0.089
LVESD (mm)	31.02±8.02	31.21±7.80	33.51±9.60	<0.001
LA diameter (mm)	32.90±7.01	32.50±6.71	36.01±8.81	<0.001
LVEF (%)	48.12±9.79	48.61±9.50	43.60±11.42	<0.001
Laboratory Parameters				
Fasting glucose (mg/dL)	127 (109-162)	126 (109-159)	148.5 (120.7-219)	<0.001
BUN (mg/dL)	15 (12-18)	15 (12-17)	20 (16-27)	<0.001
Creatinine (mg/dL)	0.8 (0.7-0.9)	0.8 (0.7-0.9)	1.0 (0.8-1.2)	<0.001
Glomerular filtration rate (mL/m)	98.5 (88.1-106.8)	99.9 (80.3-107.7)	66.3 (50.6-83.7)	<0.001
Sodium (mEq/L)	136 (131-138)	136 (131-139)	135 (132-138)	0.510
AST (U/L)	39 (18-95)	38 (17-94)	42 (21.7-116.5)	0.020
ALT (U/L)	30 (21-45)	31 (21-25)	28.5 (19-43)	0.234
Hemoglobin (g/dL)	14 (13-14.9)	14.1 (13.1-15)	12.5 (10.8-13.9)	<0.001
WBC (cells/mL)	11.5 (9.3-13.8)	11.5 (9.4-13.7)	11.8 (8.9-14.8)	0.002
Platelet count (cells/mL)	230 (195-272)	229 (195-271)	238 (196.7-289.5)	0.033
Peak troponin I (ng/dL)	39.1 (13.8-50)	37.9 (12.9-50)	50 (21.5-50)	0.004
Peak CK-MB (ng/dL)	102 (49-191)	102 (49-193)	99 (48-178)	0.802
Total cholesterol (mg/dL)	181 (152-211)	181 (153-211)	171 (141.5-204.2)	0.001
Triglyceride (mg/dL)	138 (100-190)	140 (101-193)	116 (86.7-156)	<0.001
HDL cholesterol (mg/dL)	37 (31-43)	37 (31-43)	39 (31-46.5)	0.024
LDL cholesterol (mg/dL)	110 (86-138)	111(87-139)	104.5 (81-134)	0.025
Angiographic Data				
LAD lesion	982 (44.0)	889 (44.1)	93 (43.1)	0.829
Unsuccessful PCI	141 (6.3)	94 (4.2)	47 (2.1)	<0.001
Multi-vessel stenosis (>50%)	508 (22.7)	422 (20.9)	86 (39.8)	<0.001
Total stent length (mm)	20 (15-24)	20 (15-24)	18 (16-24)	<0.001
Stent diameter (mm)	3 (2.75-3.5)	3 (2.75-3.5)	3 (2.5-3)	0.859

*Data are presented as n (%), mean±SD, or median (IQ1-IQ3)
PRECISE-DAPT score, The PREdicting bleeding Complications In patients undergoing Stent implantation and subsEquent Dual Anti-Platelet Therapy score; MI, Myocardial infarction, LVEDD, Left ventricular end-diastolic diameter; LVESD, Left ventricular end-systolic diameter; LA, Left atrium; LVEF, Left ventricular ejection fraction; BUN, Blood urea nitrogen; AST, Aspartate aminotransferase; ALT, Alanine aminotransferase; WBC, White blood cell; CK-MB, Creatine kinase-MB; HDL, High-density lipoprotein; LDL, Low-density lipoprotein, LAD; Left anterior descending artery; PCI, Percutaneous coronary intervention

Table 2. In-hospital AF and related events for all the patients and the PRECISE-DAPT score groups

Parameters	Study Population (N=2234)	PRECISE-DAPT Score <25 (n=2018)	PRECISE-DAPT Score ≥25 (n=216)	P
New-onset AF	120 (5.4%)	58 (2.9 %)	62 (28.7 %)	<0.001
In-hospital ischemic stroke	21 (0.9 %)	18 (0.9%)	3 (1.5 %)	0.307
Any in-hospital bleeding	31 (1.4 %)	19 (0.9%)	12 (5.6%)	<0.001
In-hospital gastrointestinal bleeding	5 (0.2%)	4 (0.2 %)	1 (0.5 %)	0.399
In-hospital mortality	33 (1.5 %)	13 (0.6%)	20 (9.3 %)	<0.001
Risk Scores				
CHA2DS2-VASc score	1 (0-2)	1 (0-1)	3 (1-4)	<0.001

AF, Atrial fibrillation; PRECISE-DAPT score, The PREdicting bleeding Complications In patients undergoing Stent implantation and subsEquent Dual Anti-Platelet Therapy score

The CHA2DS2-VASc score is calculated with the values of congestive heart failure (1 point), hypertension (1 point), age≥75 (2 points), diabetes (1 point), stroke/transient ischemic attack/thromboembolism (2 points), vascular disease (prior myocardial infarction, peripheral artery disease, and aortic plaque: 1 point), age between 65 and 75 (1 point), and the female sex (1 point).

Table 3. Univariable and multivariable logistic regression analysis of new-onset AF-related clinical parameters

	Univariable Analysis			Multivariable Regression Analysis		
	OR	CI	P value	OR	CI	P
Age (y)	1.12	1.10-1.15	<0.001	1.03	0.99-1.06	0.059
Diabetes mellitus	2.59	1.78-3.78	<0.001	1.37	0.79-2.36	0.256
Hypertension	1.99	1.38-2.88	<0.001	0.75	0.42-1.34	0.326
Hyperlipidemia	0.54	0.33-0.88	0.012	0.70	0.40-1.24	0.223
Smoking status	1.06	0.69-1.45	0.975			
LV ejection fraction	0.94	0.92-0.95	<0.001	0.98	0.96-1.00	0.069
LA diameter	5.07	3.62-7.10	<0.001	1.98	1.34-2.93	0.001
Anterior MI	0.80	0.55-1.16	0.238			
CHA2DS2-VASc score	2.02	1.79-2.28	<0.001	1.08	0.85-1.39	0.502
PRECISE-DAPT score	1.19	1.16-1.22	<0.001	1.14	1.10-1.18	<0.001

AF, Atrial fibrillation; CI, Confidence interval; OR, Odds ratio; LV, Left ventricle; LA, Left atrium; PRECISE-DAPT score, The PREdicting bleeding Complications In patients undergoing Stent implantation and subsEquent Dual Anti-Platelet Therapy score

The CHA2DS2-VASc score is calculated with the values of congestive heart failure (1 point), hypertension (1 point), age≥75 (2 points), diabetes (1 point), stroke/transient ischemic attack/thromboembolism (2 points), vascular disease (prior myocardial infarction, peripheral artery disease, and aortic plaque: 1 point), age between 65 and 75 (1 point), and the female sex (1 point).

in the lower PRECISE-DAPT score group. Multi-vessel involvement was more frequent in the higher PRECISE-DAPT score group (86 [39.8%] vs 422 [20.9%]; P<0.001). Major bleeding events were reported in 36 patients, and 33 deaths occurred among 2234 patients (1.5%) during in-hospital stays (Table 2). In-hospital mortality was significantly higher in the higher PRECISE-DAPT score group than in the lower PRECISE-DAPT score group (20 [9.3%] vs 13 [0.6%]; P<0.001). New-onset AF was significantly more frequent in the higher PRECISE-DAPT score group (62 [28.7%] vs 58 [2.9%]; P<0.001). Any type of in-hospital bleeding was significantly more frequent in the patients with higher PRECISE-DAPT scores than in those with lower PRECISE-DAPT scores (12 [5.6%] vs 19 [0.9%]; P<0.001) (Table 2).

According to the multivariable logistic regression analysis, the factors associated with the new-onset AF were the LA diameter (OR=1.98, 95% CI=1.34–2.93; P=0.001) and the PRECISE-DAPT score (OR=1.04, 95% CI=1.10–1.18;

P<0.001) (Table 3).

Discussion

Our study is the first study to evaluate the association between the admission PRECISE-DAPT score and new-onset AF in patients with STEMI who undergo primary PCI. We revealed that the PRECISE-DAPT score was associated with the development of new-onset AF in patients with STEMI.

Known or new-onset AF is a relatively common comorbid condition in patients with acute coronary syndromes insofar as it is observed in 4% to 12% of this group of patients.[15, 16] The impact of new-onset AF on post-MI patients is associated with not only worse prognosis in the long term due to increased prothrombotic and deteriorated hemodynamic mechanisms but also mortality.[17-20]

The PRECISE-DAPT score was developed to guide the

determination of the optimal duration of DAPT therapy in patients after PCI.[10] In patients with acute coronary syndromes, DAPT treatment is generally recommended for 12 months. According to the guidelines, the risk of bleeding is high in patients with PRECISE-DAPT scores of 25 or greater, favoring shorter durations of DAPT treatment among these patients.[4]

In our study, after the grouping of patients based on a cutoff value of 25 for the PRECISE-DAPT score, we observed higher rates of in-hospital bleeding and in-hospital mortality in the higher PRECISE-DAPT score group than in the lower PRECISE-DAPT score group. The higher mortality in the higher PRECISE-DAPT score group may have been caused by a higher incidence of AF and related thromboembolic events as well as increased bleeding events due to anticoagulant therapy given in addition to DAPT therapy. The higher mortality rate in our patients with higher PRECISE-DAPT scores is compatible with the previous information in the literature.[7]

The CHA2DS2-VASc score is an effective and approved scoring system for the risk evaluation of ischemic stroke in patients with AF.[14] Previous studies have reported the ineffectiveness of this scoring system in predicting AF in post-MI patients.[21] In our study, the CHA2DS2-VASc score was associated with new-onset AF in STEMI in univariable logistic regression analysis. Still, in multivariable logistic regression analysis, it was found to be ineffective for the prediction of new-onset AF.

Our results demonstrated that the LA diameter was associated with new-onset AF in STEMI. This finding is consistent with investigations showing that the LA diameter and volume predict AF.[22, 23]

Advanced age and low creatinine clearance, which are the components of the PRECISE-DAPT score, also increase the risk of AF development.[24-26] A proven contribution of the other components of the scoring system in the development of AF is unknown.

In this present study, the PRECISE-DAPT score was the most independent predictor of new-onset AF in STEMI: This is the novel finding of our study.

We could state that the clinical importance of the PRECISE-DAPT score in patients with STEMI depends on predicting both increased bleeding risks and AF risks. This result may create a challenge in planning the optimal antithrombotic and antiplatelet medical therapy in optimal duration to these patients. Generally, recommendations aim to advise shorter DAPT and triple therapy duration to patients with PRECISE-DAPT scores of 25 or greater. Further, if anticoagulant therapy must be initiated due to AF, clopidogrel should be added to aspirin as a component of DAPT therapy. It is essential to note that ticagrelor and prasugrel cannot be used.[4]

In light of our present work, the PRECISE-DAPT score in STEMI leads to a dilemma inasmuch as it predicts the risk of both bleeding and AF, which requires permanent anticoagulation. Further monitoring of these patients, especially in terms of clinical outcomes, will confer information that is more precise. Additionally, besides in-hospital AF, patients with higher PRECISE-DAPT scores should be closely monitored for possible AF risks in the long term.

Conclusion

To the best of our knowledge, this study is the first to show the relationship between the PRECISE-DAPT score and new-onset AF in STEMI. The PRECISE-DAPT is a simple, easily calculated score. The management of antiplatelet and anticoagulant therapy in patients with higher PRECISE-DAPT scores is a challenge, and their clinical follow-up should be performed with more caution.

Acknowledgments

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