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Original article

CHA2DS2 VASc Score and its Correlation with TIMI Flow Count in Patients with STEMI Undergoing Primary PCI

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Abstract

Background: CHA2DS2-VASc score is used to predict the risk of thrombo-embolic events in patients with AF. In this study, CHA2DS2-VASc score was investigated to show its correlation with TIMI flow count among patients with ST elevation myocardial infarction (STEMI) undergoing primary percutaneous coronary intervention (PCI). **Patients & Methods:** A total number 106 patients with STEMI were included in this study. Patients were divided into two groups as control group (TIMI III flow) (n= 69) and no-reflow group (n= 37). CHA2DS2-VASc score was calculated and a cut off value of >2 was used as a predictor of TIMI flow count. **Results:** The no-reflow patients were significantly older with higher prevalence of DM and HTN. Multivariate regression analysis showed that CHA2DS2-VASc score is a significant independent predictor of the no-reflow. **Conclusions:** CHA2DS2-VASc score is as an easy, fast and independent predictor of TIMI flow count after primary PCI.

Keywords: STEMI, CHA2DS2-VASc score, TIMI flow count, no-reflow.

Introduction

Worldwide coronary heart disease (CAD) is considered the most common leading cause of mortality due to cardiovascular diseases with > 4.5 million deaths in the developing countries. In developing countries, both CAD mortality and prevalence continue to rise rapidly (1).

In the era of revascularization, primary coronary intervention (PCI) is considered to be the gold standard treatment of coronary artery disease (CAD), Although PCI is the mainstay of treatment of CAD, it has many complications. One of the most common complications of PCI is suboptimal reperfusion of the injured myocardium in the territory of corresponding epicardial coronary artery (2).

No-reflow phenomenon defined as inadequate myocardial perfusion through a given segment of coronary circulation without angiographic evidence of mechanical vessel obstruction in the setting of PPCI occurring in 10 % of cases of PPCI. No-reflow is a poor prognostic indicator for left ventricular function and

remodelling, and acute and long-term clinical events and survival (3).

CHA2DS2-VASc score is mainly used to predict the risk of thromboembolic events in patients with AF. It consists of (congestive heart failure "1 point", hypertension "1 point", age > 75 year "2 point", DM "1 point", stroke / TIA "2 point", vascular disease "1 point", age 65 to 74 years "1 point", female sex "1 point") (4).

CHA2DS2-VASc score had been suggested to be a useful predictor of adverse vascular events in patients without AF (5).

Therefore, the aim of the study was to investigate the correlation between CHA2DS2-VASc score and TIMI flow count in patients with STEMI undergoing Primary PCI.

Patients and Methods

This cross-sectional, single center study was conducted at National Heart Institute from December 2021 to July 2022. A total of 187 patients with acute ST segment elevation myocardial infarction who underwent primary PCI were evaluated. Eighty-one patients were excluded due to cardiogenic shock (50 patients), passed time STEMI (i.e. Onset of symptoms exceeds 24 hours) (31 patients). 106 patients were included in our study and divided into 2 groups control group (69 patients) with TIMI III flow and no-reflow group (37 patients) with TIMI 0, I, II flow.

Exclusion criteria were cardiogenic shock, onset of symptoms exceeds 24 hours as it already increases the risk of no reflow that will affect the result, and patients refused consent for enrolment.

All patients provided an informed consent and the study was approved by the ethics committee.

Coronary angiography and primary PCI: Coronary angiography was done according to the standard rules followed by primary PCI. The decision maker of using a manual thrombus aspiration device during PCI or before it was, the operator. All the used stents in our study were drug-eluting stents (DES). All patients received a bolus of unfractionated heparin (70 IU/ kg), 325 mg of aspirin. 600 mg of clopidogrel before PCI with administration of additional heparin to make the activated clotting time at 250 to 300 s. Assessment of TIMI flow was done (6). TIMI 0 (no perfusion); There is no antegrade flow beyond the point of occlusion, TIMI 1 (penetration without perfusion); The contrast material passes beyond the area of obstruction but "hangs up" and fails to opacify the entire coronary bed distal to the obstruction for the duration of the cine-angiographic filming sequence, TIMI 2 (partial perfusion); The contrast material passes across the obstruction and opacifies the coronary bed distal to the obstruction. However, the rate of entry of contrast material into the vessel distal to the obstruction or its rate of clearance from the distal bed (or both) is perceptibly slower than its entry into or clearance from comparable areas not perfused by the previously occluded vessel, and TIMI 3 (complete perfusion); Antegrade flow into the bed distal to the obstruction occurs as promptly and as rapid as clearance from an uninvolved bed in the same vessel or the opposite artery.

Transthoracic echocardiography: All patients enrolled in our study underwent transthoracic echocardiography within 48

hours of hospital admission for assessment of LV ejection fraction using modified Simpson's method. LVEF= (LVEDV – LVESV)/LVEDV.

Statistical analysis:

Statistical analysis was conducted using SPSS v27 (IBM©, Armonk, NY, USA). Certain comparison points have been defined as the CHA2DS2 VASC score and TIMI flow count. The patients were categorized based on their CHA2DS2 VASC score to patients with high and low scores. These groups were compared regarding to their TIMI flow count post primary percutaneous intervention using Kruskal Wallis test as the data was not normally distributed. Chi square fisher's exact test was used to compare between the groups when the data was normally distributed. Additionally, the odd's ratio between certain exposures was calculated in light of the incidence of no-reflow. The exposure variables were smoking, diabetes mellitus, and history of previous heart diseases. The analysis was done through stata 16 program. The level of confidence was set to be 95% with a p-value of 0.05.

Research ethics committee: Ms.6.6.2021

Results

Patients' demographic and clinical data are presented in **Table 1**. The no-reflow patients were significantly older with higher prevalence of female gender. DM, HTN, heart failure and peripheral vascular diseases history were more prevalent among the patients with no-reflow. The no-reflow patients had significantly lower SBP and DBP. Killip class III and IV were more prevalent among the patients with no-reflow. The no-reflow patients had lower mean ejection fraction with no significant statistical difference regarding LVEDV and LVESV.

There was no significant statistical difference between the 2 groups regarding the number of diseased vessel or the culprit vessel (p = 0.1 and 0.06, respectively) **Table 2**. In the no-reflow group the culprit vessel was LAD in 24 patients "64.8%", LCX in 4 patients "10.8%", and RCA in 9 patients "24.3%". However, in the control group the culprit vessel was LAD in 41 patients "59.4%", LCX in 15 patients "21.7%", and RCA in 13 patients "18.8%".

Variables with significant p value in descriptive analysis were listed into univariate and multivariate regression analysis to detect potential risk factors of no-reflow **Table 3**. We excluded the individual components of CHA2DS2 VASc score as a risk factor of no-reflow in this analysis to avoid multicollinearity. Results from the multivariate logistic regression analysis showed that CHA2DS2- VASc score is a significant independent predictor of the no-reflow (OR: 52, 95% CI: (13.4-201), P 0.000). Moreover, other independent predictors of the no-reflow in our study were SBP, DBP, Killip classification, and LVEF. We found across this analysis there is significant correlation between (lower SBP, higher DBP, higher grade of Killip classification and lower EF) and no-reflow.

Individual characteristics of the CHA2DS2 VASc score had significant predictive power as they were determined in a separate univariate and multivariate regression analysis. In multivariate analysis of the CHA2DS2 VASc score components,

congestive heart failure, hypertension, age 65 to 74, age ≥75, diabetes mellitus and vascular disease predict the no-reflow significantly with odds ratio for the congestive heart failure (OR: 10.65, CI: 7.8-22.6, P < 0.0001),hypertension (OR: 32, CI: 9.8-106, P < 0.000), age 65 to 74 (OR: 8.65, CI: 3.3-22.1, P < 0.003), age ≥75 (OR: 6.50, CI: 2.72-11.9, P < 0.007), diabetes mellitus (OR: 37, CI: 11.8-120, P < 0.0001) and vascular disease(OR: 9.8, CI: 2.9-33.1, P < 0.0001).

ROC analysis was done for evaluating the cutoff value of CHA2DS2 VASc score in predicting the no-reflow. Our study showed that CHA2DS2 VASc score ≥2 can be used as a predictor of the no-reflow in patients presented with acute ST elevation myocardial infarction with sensitivity 67 % and specificity 85 % **Figure 1**.

Patients divided to 2 groups according to admission CHA2DS2 VASc score with cut off 2 or more to high score group (41 patients (38.6%)) and low score group (65 patients (61.3%)). More patients with TIMI III flow after PCI had low CHA2DS2 VASc score. 63 patients (96.9 %) with TIMI III flow had low CHA2DS2 VASc score and 6 patients (14.6 %) had high CHA2DS2 VASc score. However, more patients with no-reflow had high CHA2DS2 VASc score

Table 1: Demographic and clinical data of the study groups.

variable	Control group (n:69) (65%)	No reflow group (n:37) (35%)	P value
Age (years) mean ±SD	59 ± 10	61 ± 10	0.003
Female gender, n (%)	5 (7.25%)	19 (51.35%)	0.0004
Hypertension, n (%)	14 (20.2%)	33 (89.1%)	0.0001
DM, n (%)	10 (14.4%)	32 (86.4%)	0.0001
Smoking, n (%)	38 (55 %)	24 (64.8 %)	0.4
History of HF, n (%)	0	11 (29.7%)	0.003
History of stroke, n (%)	2 (2.89%)	2 (5.4%)	0.6
Peripheral vascular diseases, n (%)	4 (5.7%)	14 (37.8%)	0.0002
Previous MI, n (%)	3 (4.3%)	10 (27%)	0.002
Previous CABG, n (%)	1 (1.4%)	2 (5.4%)	0.2
Peripheral arterial disease, n (%)	0	2 (5.4%)	0.0001
CHA2DS2-VASC score, Mean ±SD	1.5 ±1.2	3 ±1.4	0.001
SBP (mmHg)	120.3 ±24.7	112.5 ± 25.3	0.001
DBP (mmHg)	85.2 ± 11.8	70.4 ± 14.2	0.003
Heart rate, mean ± SD	88 ± 21.43	95 ± 22.97	0.1
EF (%)	66 ± 5.2	31 ± 9.4	0.04
LVEDV (ml)	160 ± 37	162 ± 41	0.1
LVESV (ml)	85 ± 21	86 ± 25	0.401

Table 2: Angiographic data of the study groups

variable	Control group (n:69) (65%)	No reflow group (n:37) (35%)	P value
Thrombus aspiration	20 (28.9%)	16 (43.2%)	0.4
Eptifibatide use	9 (13.0%)	27 (72.9%)	0.2
Number of vessels			
Single vessel disease	31 (44.9 %)	12 (32.4 %)	0.06
2 vessel disease	11 (15.9 %)	17 (45.9 %)	
Multi vessel disease	27 (39.1 %)	8 (21.6 %)	
Culprit artery			
LAD	41 (59.4%)	24 (64.8%)	0.1
LCX	15 (21.7 %)	4 (10.8 %)	
RCA	13 (18.8 %)	9 (24.3 %)	

Table 3: Univariate and multivariate regression analysis of no-reflow predictors

variable	Adjusted OR (95%CI)	P value	Unadjusted OR (95%CI)	P value
History of HF	10.65 (7.8 – 22.6)	0.0001	13.6 (7.2 – 34.1)	0.0006
Hypertension (1-SD)	32 (9.8 -106)	0.000	23.4 (9.0-14.0)	0.0٠1
Age (65-74) years (1-SD)	8.65 (3.3 –22.1)	0.003	8.6(3.0 – 24)	0.001
Age ≥75 years (1-SD)	6.5 (4.72 – 11.9)	0.007	6.5 (2.23 -11.63)	0.004
DM (1-SD) increase	37 (11.8 – 120)	0.000	37.7(10.6 – 147)	0.00٠
History of PVD	8.9 (2.9 – 33.1)	0.000	9.8 (2.6 – 44.3)	0.01
History of stroke	1.9 (0.2 –14.2)	0.5	1.9(0.13 – 27.2)	0.5
Female gender	0.4 (0.3 –1.2)	0.08	0.4 (0.2 – 1.5)	0.001

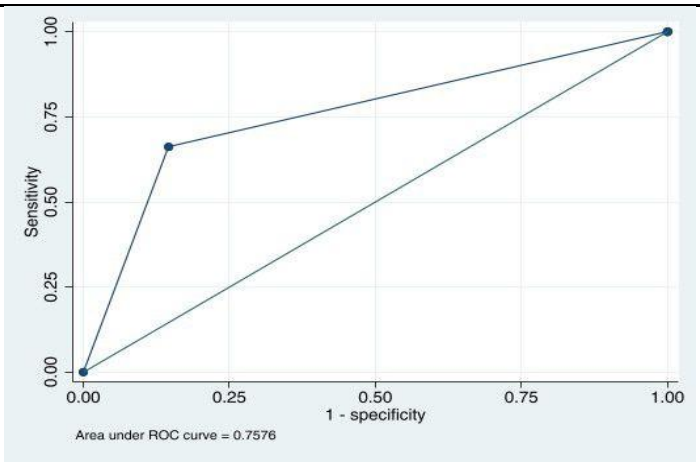

Figure 1: ROC curve of CHA2DS2 VASc score in predicting no-reflow.

Discussion

CHA2DS2 VASc score can be seen in the course of acute MI; and it is associated with increased mortality after MI. No-reflow is a serious complication of primary PCI so, we need quick scoring system for prediction of no reflow in STEMI patients that can facilitate choosing the best treatment strategy and avoiding causes that increase incidence of no reflow with STEMI patients who are candidates for primary PCI.

In the present study, no reflow occurred in 35% of patients. No-reflow patients were significantly older with higher prevalence of female gender. DM, HTN, heart failure, and peripheral vascular diseases history were more prevalent among the patients with no-reflow patients. However, there was no significant statistical difference between the 2 groups regarding the prevalence of smoking or stroke prevalence.

Similarly, a study (8) reported that the mean CHA2DS2-VASc score was higher in the no-reflow group than the control group (3 ± 1.4 versus 1.1 ± 1.1, $P < 0.001$). All components of CHA2DS2-VASc score, including history of hypertension, heart failure, diabetes mellitus, age between 65 and 74 years, age ≥75, vascular disease and female gender were significantly higher in the no-reflow group in comparison to the control group. History of peripheral arterial disease and previous MI were more common in the no-reflow group, but history of previous CABG did not differ between the two groups (2.3% versus 1.7%, P = 0.19) (8). In the current study, the no-reflow patients had lower mean ejection fraction with no significant statistical difference between the two groups regarding LVEDD and LVESD which was similar to a study found that LVEF was significantly lower in the no reflow group (p value 0.001) (9).

Multivariate logistic regression analysis showed that CHA2DS2-VASc score is a significant independent predictor of the no-reflow. Moreover, other independent predictors of the no-reflow in our study were SBP, DBP, Killip classification, and LVEF. We found across this analysis that there is a significant correlation between (lower SBP, higher DBP, and higher grade of Killip classification and lower EF) and no-reflow.

Similarly, a research reported that advanced age >75 year (OR 95% CI = 2.03 [1.01–4.06], $p < 0.008$), female gender (OR 95% CI = 2.05 [1.26–3.33], p = 0.016), diabetes mellitus (OR 95% CI = 4.54 [2.78– 7.41], p = 0.001), hypertension (OR 95% CI = 5.80 [3.52–9.56], p = 0.001), history of vascular disease (OR 95% CI = 7.50 [4.34–12.96], p = 0.001), congestive heart failure (OR 95% CI = 21.10 [7.09–62.81], $p < 0.001$), history of stroke / TIA (OR 95% CI = 4.53 [1.25–16.39], p = 0.34) were associated with the risk of no reflow (8).

We found that individual characteristics of the CHA2DS2-VASc score had significant predictive power as they were determined in a separate univariate and multivariate regression analysis. In multivariate analysis of the CHA2DS2-VASc score components, congestive heart failure, hypertension, age 65 to 74, age ≥75, diabetes mellitus and vascular disease predict the no-reflow significantly.

Similarly, a study investigated the correlation between CHA2DS2-VASc score as an independent predictor of suboptimal reperfusion and short-term mortality after primary PCI in patients with acute STEMI. They found that the prediction of "no-reflow" in patients with high CHA2DS2-VASc score of >2 is significant with (Std.Error (0.035), 95% Confidence Intervals (0.495-0.631); p <0.016) (2).

Also, a study reported that high CHA2DS2-VASc patients >2 represented 65.7% of patients with no reflow. Therefore, it could be an independent predictor of the no-reflow phenomenon (p = 0.001, odds ratio [95% confidence interval] 1.58 [1.33 to 1.88]) (10).

Conclusion

Admission CHA2DS2 VASc scores among STEMI patients were independent predictor for TIMI flow count of primary PCI. Patients with high CHA2DS2 VASc score have significant high incidence of no-reflow rate compared to low score patients

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