Evaluation of the predictive value of CHA2DS2-VASc Score for no-reflow phenomenon in patients with ST-segment elevation myocardial infarction who underwent Primary Percutaneous Coronary Intervention

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Abstract

Objective: The study aimed to evaluate CHA2DS2-VASc score predictive clinical value for no-reflow phenomena in ST-segment elevation myocardial infarction (STEMI) patients who submitted to primary percutaneous coronary intervention (PCI).

Subjects and Methods: Three-hundred STEMI patients underwent primary PCI. They were classified into: group (1) included 27 patients with no-reflow and group (2) included 273 patients without no-reflow (control). CHA2DS2-VASc risk score was computed for each patient.

Results: This study found statistically significant difference (p < 0.05) in multivariate analysis of the association between CHA2DS2-VASc score and no-reflow phenomenon. The predictive power of individual components in CHA2DS2-VASc score for no-reflow was statistically significant difference (p < 0.05). So, significantly higher CHA2DS2-VASc score is connected with higher risk of no-reflow and in-hospital mortality rate.

Conclusion: Higher CHA2DS2-VASc score is significantly associated with no-reflow phenomenon higher risk and high mortality rates in hospital in STEMI patients who underwent primary PCI.

Introduction

In patients with STEMI, the reason of primary PCI is prompt typical blood stream revert within the infarct-related artery [1]. Moreover, phenomenon of no-reflow could be a huge challenging drawback of this way. It is characterized as insufficient myocardial flow in spite of physical reviving of the offender injury with PCI. This marvel is associated to more frequent of impacts, brief- and long-term mortality rate in patients with STEMI [2].

No-reflow phenomenon happens in 0.6% to 5% of elective PCIs, but a more frequency has been detailed in experienced primary PCI patients [3]. A complex and multifactorial pathophysiology has been directed to component of the phenomenon [4]. Tragically, there’s no broadly acknowledged hazard stratification strategy for the forecast of this complication [5].

The phenomenon of no-reflow occurs since of different components counting flotsam and jetsam distal immobilization correlating to atherosclerotic areas with ulcers, microvascular defect, vasoconstriction, insuperable oxidative stretch, and reflow damage [6]. Thus, a dependable hazard stratification device is required, which legitimately predicts the rate of no-reflow with respect to its multifactorial pathogenesis [7].

CHA2DS2-VASc score is considered a clinical indicator of thromboembolic diseases and was suggested for anticoagulant...
treatment in patients with nonvalvular atrial fibrillation in clinical rules [8]. The components of this score are common hazard variables of atherosclerosis, microvascular injury as well as no-reflow and stroke. Moreover, utilize of this score is exceptionally basic and makes it a speedy apparatus to predict no-reflow phenomenon, comparative to common chance variables of the no-reflow [5].

**Aim of the work**

The study aimed to assess CHA2DS2-VASc score in predicting no-reflow phenomenon and in-hospital mortality in patients with STEMI who underwent primary PCI.

**Subjects and Methods**

**Study design and population**

This study was done within two years from August 2017 to August 2019 and it was performed in Cardiology Department, Faculty of Medicine, University of Benha, Egypt on three-hundred patients had STEMI who subjected to primary PCI. They were divided into two main groups; group (1) included 27 patients with no-reflow complication after PCI and group (2) included 273 patients without no-reflow used as control group figure 1.

Inclusion criteria included STEMI patients subjected to primary PCI next to diagnostic coronary angiography.

Exclusion criteria included STEMI patients with late diagnosis or postponed arrival who had manifestations continued more than twelve hours. Moreover, patients who had stenosis non-significantly in the culprit vessel or who had coronary artery anatomy wasn’t suitable to do PCI. Patients who had suitable criteria for coronary artery bypass grafting (CABG), saphenous vein grafts (SVGs) stenosis as culprit lesions, and dissection of coronary artery were also excluded. An informed consent and protocol had been taken from every patient and confirmed by The ethics Committee of the hospital.

In this study, all included subjects were submitted to:

- Informed consent: each participant has to perform written consent
- Full history taking: including family history, history of hypertension, diabetes mellitus and smoking habit, onset and duration of the disease.
- General and local examinations of the heart.
- 12 leads ECG
- Routine laboratory tests including: complete blood picture, liver functions, renal functions, serum calcium and lipid profile.
- Conventional echocardiography was done for all patients.
- Coronary angiography & primary PCI were performed for all patients.

**Diagnosis of STEMI**

According to typical chest pain history associated with elevation of ST-segment of 1 mm or more at the J point in two contiguous leads at least with the following cut points, diagnosis was established.

Elevation of ST segment ≥ 0.1 mV in all leads except V2-V3. In V2 and V3 leads, these cut off values is ≥ 0.2 mV for men more than 40 years, ≥ 0.25 mV in men less than 40 years, ≥ 0.15 mV in women. Moreover, Left bundle branch block is newly discovered [10].

**Staging of TIMI**

Thrombolysis in myocardial infarction (TIMI) stream was reported next to primary PCI, divided into 4 stages; TIMI-0 exhibits no stream in coronary angiography after the impediment or stenosis site, TIMI-1 shows a poor distal antegrade stream leading to filling defect in the supplying origin, TIMI-2 demonstrates suitable forward stream that fills the total distal location, TIMI-3 lines coronary stream typically [6].

**CHA2DS2-VASc score**

CHA2DS2-VASc risk score was calculated for every subject according to the definition suggested by LüP, et al. [8]. This evaluation tool of risk is a gathered combining eight ingredients with specific score. The abbreviation symbolize as cardiac failure (C), hypertension (H), age ≥ 75 years (A2), diabetes mellitus (D), stroke (S2), vascular disease (V), age 65 to 74 years (A), and female gender (as a sex category). Age more than 75 and stroke are specified with two points while one point was set to each variable remained [8]. CHA2DS2-VASc risk score cut off value ≥ 2 was considered as no-reflow predictor with 66% sensitivity and 59% specificity.

**Myocardial blush grades**

Myocardial blush grades (MBG) were grouped according to
the previous classifications. Contrast density or myocardial blush absence refers to Grade 0. Grade 1 means the least contrast density. Grade 2 is recognized as moderate myocardial blush remark but less than the value reported within ipsilateral or contralateral infarct-related artery during coronary artery angiography and Grade 3 demonstrates normal contrast density or myocardial blush compared to the angiography obtained from ipsilateral non-infarct-related or contralateral coronary artery [11]. Angiography sine films were revised to assess slow/no-reflow occurrence using a combined MBG and TIMI flow. TIMI flow < 3 with any MBG grade or TIMI flow 3 with MBG 0 or 1 were believed to be suboptimal reperfusion while optimal reperfusion was demonstrated as TIMI low 3 with MBG 2 or 3.

**Statistical analysis**

Cruel ± standard deviation communicated with persistent factors whereas categorical factors were appeared by rates. Cessate factors with and without typical dispersion individually were compared by using Two-tailed Student's t-test and Mann–Whitney U test. Chi-square test was used to demonstrate the categorical factors variation. Moreover, we have demonstrated separated and complex interaction-mediated influences of no-reflow marvel indicators. By this way, multivariate and univariate relapse examinations were done to evaluate balanced and unadjusted affiliation of potential chance components extraordinarily CHA2DS2-VASc and imperfect coronary stream. We decided the prescient CHA2DS2-VASc score utility for ensuing results counting no-reflow and mortality rates in hospital utilizing collector working properties bends. Measurable importance was affirmed with a p - value < 0.05. All investigations were performed utilizing SPSS form 22 (SPSS Inc., Chicago, IL, USA).

**Results**

The study was a comparison between patients of group (1), 27 patients with no-reflow phenomenon and group (2) that includes 273 patients without no-reflow complications in STEMI patients who undergone primary PCI (Table 1).

Assessment of cardiovascular risk factors, clinical, laboratory & echocardiographic Characteristics of the patients

Hypertension, diabetes mellitus, anemia, Body Mass Index (BMI), serum creatinine, left ventricular ejection fraction (LVEF), systolic blood pressure (SBP), diastolic blood pressure (DBP), calcium scoring, anterior MI, vascular disease and in- hospital mortality showed a statistically significant difference (p < 0.05) between the two groups as presented in table 2

**PCI characteristics**

Higher stent length&lower stent diameter were associated with no-reflow phenomenon (p<0.05) as found in table 3.

**Evaluation of CHA2DS2-VASc score**

Analysis of CHA2DS2-VASc score and its different components revealed that they were statistically significant in comparison between patients with no-reflow group and patients without no-reflow. In multivariate analysis (Table 3), there is statistically significant difference (p < 0.05) between the two groups as regard CHA2DS2-VASc score, BMI, hypertension, systolic ,diastolic blood pressure, and initial TIMI flow rate ≥ 1. In univariate analysis; there is statistically significant difference (p < 0.05) between the two groups as regard congestive heart failure, hypertension, old age, diabetes mellitus, transient ischemic attacks or stroke, vascular diseases and female gender as shown in tables 4, 5.

**Discussion**

Primary percutaneous coronary intervention is the favored method of revascularization in patients with acute STEMI,
but use of this technique leads to acute drop in blood flow in myocardium despite a patent epicardial coronary artery, it is called “no-reflow phenomenon”, which leads to multiple complicati
cations in these patients [2]. So, some studies prefer delaying stent technique to decrease no-reflow phenomena after PCI [12].

This study proved the clinical effect of high CHA2DS2-VASc score which having an extra role in expecting the adverse results after primary PCI in patients with STEMI. We can use the risk score to identify no reflow higher risk STEMI patients after PCI. Increased CHA2DS2-VASc score is an independent predictor of mortality rather than a surrogate measure only. This was in agreement with other studies [6-8].

There are many risk stratification modules for prognosis evaluation after acute coronary syndrome. However, some modules are not ready during presentation data as being complex. As a result of limited time which is marked for STEMI revascularization, workable assists of a simple usual risk score like CHA2DS2-VASc becomes more dominant [13].

This study revealed a dual prognostic use of the CHA2DS2VASc for both incomplete reperfusion and short term mortality rate. This corresponds with a lot of researches [5,12,14-18].

Reperfusion failure is related to the extent of necrosis in myocardium and also poor clinical results independent on size of infract. [19,20].

Ndrepepa G, et al. [19], had noticed that no-reflow increased one-year mortality risk after primary PCI 3-times than normal, thus, early recognition of patients with STEMI vulnerable to no-reflow is useful to the danger of ineffective reperfusion minimization or prevention.

Diabetes mellitus is an ingredient of CHA2DS2-VASc score leads to normal endothelial cells function impairment and participating in ischemic reperfusion injury [3,21]. In contrast to these findings Iwakura, et al. [22] found that diabetes couldn’t be a predictor although they demonstrated a relation between hyperglycemia and no-reflow.

This study also discussed previously a lot of risk factors which are associated with no-reflow like diabetes, female sex and hypertension [23]. The study found a relation between stroke and abnormal vascular function that was determined by Kim, et al. [24], although, opposing these results, Mirbolouk, et al. [5] cohort reported that there was no significant association between female gender, stroke and no-reflow.

This study also determined many factors with a great significance that corresponded to Ashoori, et al., as hypertension, female sex, renal failure, inflammatory markers high levels, LAD territory involvement and atherosclerosis. [6].

This study also found that there was independent correlation between no-reflow and higher systolic blood pressure. In agree with these results, mirbolouk, et al. [5], it might be due to decrease of coronary artery flow results from swolled cells of myocardium associated with edema of interstitium which may result in compression of small arteries.

Primary stenting, short stents with adjusted lower pressure, thrombus aspiration in some patients, intra-coronary vasodilators applied as a prophylaxis and occasionally distal protection devices may be useful [25-27].

As regards, CHA2DS2-VASc module grants a tool which save time for risk stratification.

So, in agree with other studies [28], there was no surprise to find a significant relation between the score and mortality rate inside hospitals.

The study reported a higher mortality rate with age >70 years in STEMI patients and also between heart failure patients. Significant correlation of age has been reported by previous studies and decreased EF with MACE in patients of ACS. Nevertheless, it wasn’t noticed previously recognized effect of sex on mortality rate or no-reflow [5]. Mortality and morbidity had been increased in the presence of no-reflow phenomena by this study. Other studies [5,6,16] showed predictive role of diabetes independently, which was similar to the results of this study.
Nevertheless, it was reported that there was a borderline statistically significance for this relationship. Generally, the issue about if the increased CHA2DS2-VASc has an independent additional impact beyond its parts stills controversial [29].

Past investigations [5,6,16] found different suboptimal reperfusion determinants after primary PCI. Cardiogenic shock, high thrombus impact and heart failure (reported in CHA2DS2-VASc score) were also determined in this study in line with former reports.

This study found that lower stent diameter & higher stent length can predict no-reflow. Based on these results grade 0 TIMI at initial angiography also was an independent predictor of no-reflow like another previous study [5].

Bayramoğlu, et al. [14] announced the long stent effects (> 20 mm) and thrombus grade on no-reflow danger. Ratios difference 3.607 (1.932–6.734), and 3.139 (1.081–9.113), respectively. High thrombus burden had a significant correlation with no-reflow incidence was reported by this study.

In line with this study, Mirbolouk, et al. [5] declared that initial TIMI flow greater than 1 had a significant correlation with lower likelihood of final suboptimal flow (OR: 0.06 (0.02–0.20)).

Conclusion

Higher CHA2DS2-VASc score is significantly linked with increased risk of no-reflow phenomenon and in-hospital mortality rates in STEMI patients who underwent primary PCI.

Limitations

Many restrictions were noticed in this study, no-reflow incidence was low according to the previous design done on a single center registry data in this study.

Blood gas mixture, PH state, anticoagulant types and dose, balloon dilation technique, and pain time to balloon interval are other factors that were not determined in this study.

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