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Short Term Prognostic Value of CHA2DS2 -VASc Score in ST Elevation Myocardial Infarction in Patients without Atrial Fibrillation

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ABSTRACT

Background: ST elevation myocardial infarction (STEMI) is a clinical syndrome defined by characteristic symptoms of myocardial ischemia accompanied by persistent elevation the ST segment on electrocardiograph (ECG) and subsequent release of biomarkers of myocardial necrosis. **Objective:** The aim of the study was to evaluate the possibility of usefulness of CHA2DS2 -VASc Score as a predictor of short-term complications in STEMI patients without atrial fibrillation. **Patients and methods**: This prospective cohort study was carried out on 80 STEMI patients who presented to the Coronary Care Unit (CCU), Zagazig University Hospital, during the period from December 2021 to June 2022. They were divided into two equal groups: Group (A); STEMI without AF, included 40 patients, 31 (77.5%) males and 9 (22.5%) females whose age ranged from 35 to 75 years. Group (B); STEMI with AF, included 40 patients, 28 (70%) males and 12 (30%) females whose age ranged from 42 to 78 years. CHA2DS2- VASc Score, and syntax score were calculated for each patient. **Results:** The average EF% among STEMI patients without AF was higher than STEMI patients with AF (53.5 ± 7.5> 49.4 ± 10.5) ranged from (36 to 66) and from (33 to 68) respectively, this difference was statistically significant (p-value=<0.04*). CHA2DS2-VASC score with cutoff value ≥ 4 was very good predictor for high syntax score in both groups.

Conclusion: It could be concluded that CHA2DS2-VASc score could be applied to predict the risk of subsequent thromboembolic events in patient with atrial fibrillation. This score has represented ample power in estimating major adverse cardiovascular outcomes in the sitting of acute coronary syndrome.

Keywords: STEMI, Coronary artery disease, Atrial Fibrillation.

INTRODUCTION

ST elevation myocardial infarction (STEMI) is a clinical syndrome characterised by enduring ST segment elevation on the electrocardiogram (ECG) and subsequent release of biomarkers of myocardial necrosis. It is characterised by the typical symptoms of myocardial ischemia. Acute MI happens when an intra arterial thrombus spreads and totally obstructs an artery, causing ischemia and necrosis of cardiomyocytes distal to the obstruction. It significantly increases morbidity and death globally [(1)].

In affluent nations, acute coronary syndrome is the major cause of death for millions of people each year. The two kinds of acute myocardial infarction are non-ST segment elevation myocardial infarction (NSTEMI) and ST segment elevation myocardial infarction (STEMI). Myocardial infarction must be treated by reperfusion of the heart. The prognosis improves with earlier treatment [(2)].

Early ST-elevation myocardial infarction (STEMI) therapy's primary goal is to quickly restore coronary blood flow in the blocked coronary artery. The optimal reperfusion technique for acute STEMI patients who present within the first few hours of symptoms is primary percutaneous coronary intervention (p-PCI) [(3)].

Heart failure, stroke, myocardial reinfarction, and hospital readmission were among the negative outcomes. When ST elevation 0.1 mV returns, new pathognomonic Q waves appear in at least two adjacent leads, or the cardiac enzyme creatine kinase (CK), creatine kinase-MB fraction (CK-MB), is relevant and there have been ischemic symptoms for at least 20 minutes, myocardial reinfarction is taken into consideration. Heart failure was described as ranging from frank pulmonary edoema to crepts in the chest, with S3 and elevated JVP[(1)]. Adverse outcomes are complex and require acute clinical, laboratory electrocardiography (ECG) parameters, and even angiographic evaluation [(4)].

A score of 1 point is given for each of the following conditions: congestive heart failure (ejection fraction 40%), hypertension, age between 65 and 74 years, diabetes mellitus, vascular disease (myocardial infarction or peripheral arterial disease), and female gender; a score of 2 points is given for the conditions: history of stroke or transient ischemic attack (TIA), and age > 75 years. This method yields the CHA2DS2-VASc risk score, which In nonvalvular AF patients, the risk of thromboembolism is predicted using the CHA2DS2-VASc risk score [(3)].

In patients with multivessel coronary artery disease (CAD) and/or left main disease, the SYNTAX score (SS), an anatomic scoring system based on the coronary angiography, not only assesses lesion complexity but also predicts outcome after percutaneous coronary intervention (PCI). The SS permits patients with multivessel CAD undergoing PCI to be prospectively risk stratified. However, because the SS is angiography-based, it has a number of intrinsic limitations. When used to measure lesions and the complexity of coronary artery disease in patients with stable angina, SS was initially intended to help physicians decide whether to do percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG). However, it has been shown to be an

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independent predictor of adverse events such as myocardial infarction and target lesion revascularization (TLR), both in short-term and long-term follow-up among patients undergoing PCI [5].

The aim of this study was to evaluate the possibility of usefulness of CHA2DS2 -VASc Score as a predictor of short-term complication in STEMI patients without atrial fibrillation.

PATIENTS AND METHODS

This prospective cohort study included a total of 80 patients with STEMI, attending at Coronary Care Unit (CCU), Zagazig University Hospital, during the period from December 2021 to June 2022.

They were divided into two equal groups: **Group (A);** STEMI without AF, included 40 patients, 31 (77.5%) males and 9 (22.5%) females whose age ranged from 35 to 75 years. **Group (B);** STEMI with AF, included 40 patients, 28 (70%) males and 12 (30%) females whose age ranged from 42 to 78 years. CHA2DS2- VASc Score, and syntax score were calculated for each patient.

Ethical Consideration:

This study was ethically approved by Zagazig University's Research Ethics Committee (ZU-IRB#9226-4-1-2022). Written informed consent of all the participants was obtained. The study protocol conformed to the Helsinki Declaration, the ethical norm of the World Medical Association for human testing.

Inclusion criteria: Patients who had acute STEMI without atrial fibrillation underwent primary percutaneous coronary intervention (p-PCI), (as defined by history of chest pain, high cardiac enzyme, and ST elevation more than two contiguous leads in ECG). Patients who had acute STEMI with atrial fibrillation underwent primary percutaneous coronary intervention (p-PCI).

Exclusion criteria included: Significant valvular heart disease. Significant connective tissue disease. Significant (kidney, liver) disease. Significant anemia and hyperthyroidism. Arrhythmias rather than AF. Patient with cardiac muscle diseases.

All patients were subjected to **full history taking** (name, age, sex, family history of coronary artery disease and risk factors of coronary artery disease), **complete physical examination** (assessment of the general condition and vital signs as blood pressure and heart rate & manifestations of heart failure and **investigations** (CBC, urea, creatinine, troponin T, CKMB, INR, LDL, HDL, TG, cholesterol & fasting blood sugar).

Standard 12-leads ECG was done for all patients 10 minutes' maximum from first medical contact to detect ST segment elevation and T wave abnormalities for diagnosis of acute STEMI.

Standard 12-lead electrocardiograms were recorded at presentation, every 8 hours for 24 hours then daily till discharge, Presence of ST segment elevation and its distribution and Brady arrhythmias or tachy arrhythmias.

Serial ECG: site, location, abnormality of ischemia, QTC, QT dispersion., QRS wide, extend ST elevation, malignant arrhythmia (block, tachycardia).and criteria of atrial fibrillation as absence P wave and irregular QRS interval.

All examinations included standard parasternal and apical views following the recommendations of the American Society of Echocardiography. All measurements were determined as means of 3 cycles avoiding post ectopic beats. The following were calculated [6].

Left Ventricular End Systolic and End Diastolic Dimensions:

End diastole was defined as the frame with the largest cavity area that correlated with ECG at the beginning of QRS complex and end-systole as the subsequent frame with the smallest cavity area that correlated with ECG at the end of the T wave.

Follow up:

All Patients who had acute STEMI underwent primary percutaneous coronary intervention(p-PCI) followed up within (3- 5) days of hospital stay in coronary care unit (CCU) for detection short outcomes complication.

Statistical analysis

Data were checked, entered and analyzed using SPSS version 23 for data processing. The following statistical methods were used for analysis of results of the present study. Data were expressed as mean + standard deviation (SD) for quantitative one and expressed as frequencies and percentage for qualitative data. For all the above-mentioned statistical tests done, the threshold of significance was fixed at a 5% level (P-value). P value of < 0.05 indicates significant results.

RESULTS

Demographic characteristics & Risk factors:

No statistically significant difference between both groups regarding the demographic data and risk factors. The mean age of STEMI patients without AF group was (61.6 ± 11.1) ranged from (35 to 75) years and that of STEMI patients with AF was (63.3 ± 8.6) ranged from (42 to 78) years. Regarding sex distribution (77.5% and 70.0%) and (22.5% and 30.0%) of the 1st and 2nd groups were males and females respectively with no statistically significance difference (p-value 0.9 & 0.44) between both groups (matched groups). The average BMI (kg/m^2) of the STEMI patients without and with AF groups was (24.6 ± 3.4 and 24.6 ± 3.5) respectively ranged from (20 to 33 and 20 to 32) with no statistically significance difference (p-value 0.97). More than half of the 1st group was smokers (67.5%) while (50.0%) of the

2nd group was smokers, (22.5% and 12.5%) of the 1st and 2nd groups had positive family history, (47.5% and 57.5%) had dyslipidemia). regarding smoking, family history and dyslipidemia, there was no statistically significance difference (p-value 0.11, 2.3 & 3.7) between both groups as shown in table (1).

Table (1): Demographic and risk factors of the studied patients.

	STEMI Without AF (n=40)	STEMI With AF (n=40)	Statistical analysis	P Value
Age (years)	61.6 ± 11.1 (35-75)	63.3 ± 8.6 (42-78)	t= 1.1	0.9
Sex F M	9 (22.5%) 31 (77.5%)	12 (30%) 28 (70%)	X^2 =0.58	0.44
BMI (kg/m^2)	24.6 ± 3.4 (20-33)	24.6 ± 3.5 (20-32)	t=0.03	0.97
Smoking	27 (67.5%)	20 (50%)	X^2 = 2.5	0.11
Family History	9 (22.5%)	5 (12.5%)	X^2 =1.3	2.3
Dyslipidemia	19 (47.5%)	23 (57.5%)	X^2 =0.8	3.7

Data are represented as mean ± SD or Number (%). Data analyzed using independent t test or chi square test X^2

CHA2DS2-VASc score of the studied patients;

Table 2 shows that the average CHA2DS2-VASc score among STEMI patients with AF was higher than STEMI patients without AF (2.8 ± 1.5 > 1.68 ± 1.1) with a median 3 > 1, this difference was highly statistically significant (p-value=<0.001*). There was statistically significant difference between both groups regarding to CHA2DS2-VASc score that were higher in STEMI with AF than STEMI without AF.

Table (2): CHA2DS2-VASc score of the studied patients

	STEMI Without AF (n=40)	STEMI With AF (n=40)	Statistical analysis	P Value
Score	1.68 ± 1.1 1 (0-4)	2.8 ± 1.5 3 (1-6)	U=442.5	**<0.001***

Data are represented as mean ± SD or Number (%). Data analyzed using Mann Whitney test

Prevalence of short outcomes complications among the studied groups;

Most of both groups (72.5% & 65.0%) didn't have any complications, (15.0% &17.5%), (2.5% & 5%), (5.0% & 0.0%), (7.5% &20.0%) and (5%&7.5%) of the 1st and 2nd group had acute heart failure, pulmonary edema, cardiogenic shock, NYHA II and NYHA III respectively with no statistically significance difference (p-value 0.37). regarding Kilip classification, class I was the commonest in both groups (72.5% & 42.5%) followed by Class II (15% & 17.5%) then Class III (2.5%& 5%) and lastly Class IV (5% &0.0%) among STEMI without and with AF respectively with no statistically significance difference (p-value 0.35) as shown in table (3). There was no statistically significant difference between both groups regarding to complications. Also, regarding to kilip classification, there was no significant difference between both groups.

Table (3): Short outcomes Complications of study patients.

Complications	STEMI Without AF (n=40)		STEMI With AF (n=40)		Statistical analysis	P-Value
Acute heart failure	6	15%	7	17.5%	X^2= **5.3**	**0.37**
Pulmonary edema	1	2.5%	2	5%		
Cardiogenic shock	2	5%	-	-		
NYHA II	3	7.5%	8	20.0%		
NYHA III	2	5%	3	7.5%		
None	29	72.5%	26	65.0%		
Kilip classification						
Class I	29 (72.5%)		17 (42.5%)		X^2= **0.8**	**0.35**
Class II	6 (15%)		7 (17.5%)			
Class III	1 (2.5%)		2 (5%)			
Class IV	2 (5%)		0 (0%)			

Data are represented as Number (%). Data analyzed using chi-square test.

Ejection fraction of the studied patients;

The average EF% among STEMI patients without AF was higher than STEMI patients with AF (53.5 ± 7.5> 49.4 ± 10.5) ranged from (36 to 66) and from (33 to 68) respectively, this difference was statistically significant (p-value=<0.04*) as shown in table (4). There was significant difference between both groups regarding to EF that was lower in in STEMI with AF than STEMI without AF.

Table (4): EF of the studied patients

	STEMI Without AF (n=40)	STEMI With AF (n=40)	Statistical analysis	P Value
EF%	53.5 ± 7.5 (36-66)	49.4 ± 10.5 (33-68)	t=2.1	**0.04***

Data are represented as mean ± SD or Number (%). Data analyzed using independent t test.

Syntax score of the studied patients;

The average Syntax score was (18.8 ±7.5 & 18.05 ± 4.9) among STEMI patients without AF and STEMI

patients with AF groups respectively ranged from (9 to 40) and from (10 to 30), this difference was not statistically significant (p-value=<0.97) as shown in table (5). There was no statistically significant difference between both groups regarding to syntax score.

Table (5): Syntax score of the studied patients

	STEMI Without AF (n=40)	STEMI With AF (n=40)	Statistical analysis	P Value
Syntax Score	18.8 ±7.5 17 (9-40)	18.05 ± 4.9 17 (10-30)	U=796.5	0.97

Data are represented as mean ± SD. Data analyzed using Mann Whitney test

Troponin and CK-MB of the studied patients:

The average Troponin was (4536.4 ± 2961.9 & 4367.3 ± 3478.5) among STEMI patients without AF and STEMI patients with AF groups respectively ranged from (473 to10000) and from (549 to10000), this difference was not statistically significant (p-value=<0.81). Regarding CK MB, it was (120.3 ± 79.6 and123.9 ± 59.4) ranged from (39 to 300) and (40 to 247) with no statistically significant difference (p-value=<0.81) as shown in table (6). There was no significant difference between both groups regarding to troponin and CKMB.

Table (6): Troponin and CK-MB of the studied patients

	STEMI Without AF (n=40)	STEMI With AF (n=40)	Statistical analysis	P Value
Troponin T	4536.4 ± 2961.9 (473-10000)	4367.3 ± 3478.5 (549-10000)	t=0.23	0.81
CK MB	120.3 ± 79.6 (39-300)	123.9 ± 59.4 (40-247)	t=0.23	0.81

Data are represented as mean ± SD. Data analyzed using independent t test

Cut off values of CHA2DS2-VASC score for prediction of high syntax score among the both groups

Receiver operating characteristics (ROC) curve was used to define the best cut off value of CHA2DS2-VASC score for prediction of high syntax score which was ≥ 4 with sensitivity 66 %, specificity 83 %, accuracy 74 %, AUROC was 0.84(0.72 – 0.96) & P-Value=0.04 as shown in **Figure (1)**. that CHA2DS2-VASC score was very good predictor for high syntax score.

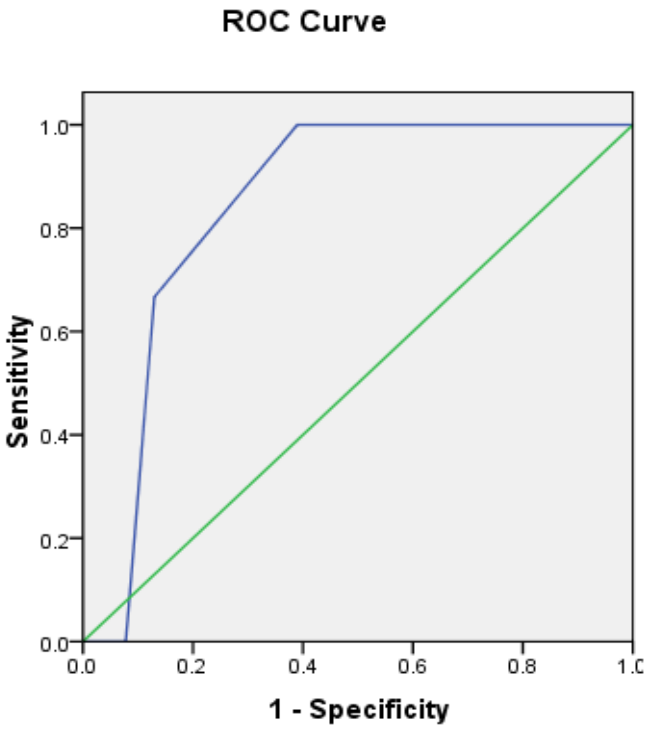

Figure (1): ROC curve of CHA2DS2-VASC score for prediction of high syntax score of both groups.

Cut off values of CHA2DS2-VASC score for prediction of short outcomes complications among STEMI without AF patients

The best cut off value of CHA2DS2-VASC score for prediction of complications among STEMI without AF patients which was ≥ 2 with sensitivity 81 %, specificity 76 %, accuracy 79 %, AUROC was 0.84 (0.69 – 0.99) & P-Value=0.001 as shown in table (7).

Table (7): Power of CHA2DS2-VASC Score in predicting of short outcomes complications among STEMI without AF patients.

Area	Std. Error[a]	P	Asymptotic 95% Confidence Interval		Cut-off	Sensitivity	Specific-ity
			Lower Bound	Upper Bound			
0.843	0.076	0.001	0.694	0.992	≥ 2.0	81%	76%

This table showed that CHA2DS2-VASC score was very good predictor of short out comes complications among STEMI without AF group.

DISCUSSION

The current study showed that there was no statistically significant difference between both groups regarding to demographic data and risk factors. Which in agreement with the study of **Chou *et al.*** [7]**,** who found that there was no statistically significant difference regarding age (53.1 ± 13.6 versus 54.9 ± 11.6), sex (70.4% males vs 70%, P > 0.05).

In contrast, these results disagreed with the study of **Aksoy *et al.*** [3] who found that regarding age and sex; the patients with AF were older, and more of them were female, compared with the patients without AF (P < 0.001 and P = 0.011, respectively). While in agreement with our results regarding Body mass index (26.7 ± 4.3 versus 27.5 ± 5.1, P = 0.154), smoking was less common among the patients with AF than among those without AF (P = 0.007) and hyperlipidemia (136 (21.7%) 15 (21.4%), P = 0.547)

In contrast with the study of **Li *et al.*** [8] who found that there was high statistically significant difference between both groups regarding age and sex. While in agreement with our results regarding dyslipidemia.

This discrepancy between the previous study and our results regarding sex and age could be due to small sample size in our study and could also be due to the fact that our study included 77.5% males & only 22.5% females.

The current study showed that there was a highly statistically significant difference between both groups regarding CHA2DS2-VASc score that were higher in STEMI with AF than STEMI without AF. Which in agreement with the study of **Aksoy *et al.*** [3] who found that there was a high Statistical significant difference between both groups regarding to CHA2DS2-VASc score (1.5± 1.4 versus 2.7 ± 1.3; P < 0.001).

Also**, Arslan *et al.*** [9] reported that the there was a high Statistical significant difference between both groups regarding CHA2DS2-VASc score (1.6±1 versus 2.7±2 ; P < 0.001). while **Li *et al.*** [8] found that mean CHA2DS2-VASc scores significantly differed between the AF group and the non-AF group (4.09±1.38 and 3.27±1.51, respectively; P<.001). That is, CHA2DS2-VASc scores tended to be higher in AMI patients with AF compared with AMI patients without AF.

Although CHA2DS2-VASC score is recommended for determining thromboembolism risk in patients with nonvalvular atrial fibrillation, it was showed the relationship between this score and various cardiovascular diseases [10]. **Bozbay *et al.*** [11] demonstrated that CHA2DS2-VASC score was a strong predictor factor of one month in hospital and long-term mortality and morbidity.

The current study showed that there was no statistically significant difference between both groups regarding to complications. Also, regarding to kilip classification, there was no significant difference between both groups.

Arslan *et al.* [9] reported that the there was no statistical significant difference between both groups regarding to Killip classification**.**

Mehta *et al.* [12] found that new-onset AF was predicted by older age, female gender, history of hypertension, presence of STEMI, higher Killip class, higher heart rate, lower blood pressure, cardiac arrest on presentation and high initial serum creatinine levels.

The current study showed that there was significant difference between both groups regarding to EF % that was lower in STEMI with AF than STEMI without AF. Which nearly similar to **Aksoy *et al.*** [3] who found that there was significant difference between both groups regarding to EF that was lower in STEMI with AF than STEMI without AF (45 ±9.6 versus 40 ± 9.8, P < 0.001). But **Cirakoglu *et al.*** [13] who found that there was significant difference between both groups regarding to EF that was lower in STEMI with AF than STEMI without AF (50 (43–61) versus 37 (30–45) <0.001).

The current study showed that there was no statistically significant difference between both groups regarding to syntax score.

Which in agreement with the study of **Ling *et al.*** [14]**,** who found that there was no statistically significant difference between both groups regarding to syntax score (19.5 (14.0–23.5) versus 20.0 (15.4–25.5), P = 0.134.

In contrast to our results **Yildirim *et al.*** [15]**,** reported a significant difference between both groups regarding to syntax score (14.9 ± 5.2 versus 18.7 ± 4.9, P< 0.001)

The current study showed that there was no significant difference between both groups regarding to troponin and CKMB.

Which in contrast with the study of **Aksoy *et al.*** [3] who found that there was a high significant difference between both groups regarding to **Troponin T** between both groups (P < 0.001), but like our results there was no significant difference regarding to CKMB between both groups.

The current study showed that CHA2DS2-VASC score was very good predictor for high syntax score in both groups. Which in agreement with the study of **Elmenshawy *et al.*** [16] who reported that regarding diagnostic accuracy of CHA2DS2-VASc Score in prediction of severity of CAD based on high SS, the best cutoff point was score >4 with 87% sensitivity and 57.1% specificity.

Kalkan *et al.* [17] reported that the Receiver Operating Characteristic (ROC) curve analysis was conducted to determine the optimal CHA2DS2-VASc score cut-off value to indicate high rSS. The highest combined sensitivity and specificity values crossed the curve at 1.5 (sensitivity 49.2% and specificity 67.6%). The area under the curve (AUC) was 0.611 (95% CI:0.562-0.659, p<0.001). Also, there was a positive correlation between the CHA2DS2-VASc score and the residual Syntax score (rSS) (r:0.234, p<0.001). Additionally, patients with a baseline low Syntax score had a lower CHA2DS2- VASc score (1 (0-2), 1 (0-3); p<0.001) compared to patients with a baseline intermediate or high Syntax score.

The current study showed that by applying univariate and multivariate logistic regression analysis, Kilip class >1 and CHA2DS2-VASc score were independent predictors of short-term adverse outcomes

in patients with STEMI without atrial fibrillation and it was very good predictor for complications among STEMI without AF group.

Elmenshawy *et al.*[16], reported that regarding diagnostic accuracy of CHA2DS2-VASc Score in prediction of severity of high thrombus grade, the best cutoff point was score >4 with 72% sensitivity and 66% specificity. **Aksoy *et al.*[3]** found that ROC curve analysis showed that the CHA2DS2-VASc score (C-statistic: 0.698; 95% CI: 0.631-0.765; P < 0.001) was significant predictors of AF following STEMI, with sensitivities of 56% and 75% and specificities of 71% and 54%, respectively.

CONCLUSION

It could be concluded that the CHA2DS2-VASc score could serve as simple yet effective tool for prediction short outcomes. The present study demonstrated that the CHADSVASC SCORE >2 can predict short outcomes in ST elevation myocardial infarction (STEMI) patients underwent primary percutaneous intervention (PPCI). This study support applicability of the CHA2DSV2ASC SCORE for prediction short outcomes in ST elevation myocardial infarction underwent primary percutaneous intervention.

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