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Study of Novel CHA_2DS_2-VASc-HSF Score as a Predictor of Short-Term Clinical Outcomes in STEMI Patients Undergoing Primary Percutaneous Coronary Intervention

Hany H. Ebaid[1], Heba Abdelkader Mansour[1], Mohamed Abdelshafy Tabl[1], Mohamed Kelany[2*]
[1]Department of Cardiology, Faculty of Medicine, Benha University, Egypt
[2]Department of Cardiology, Nasser Institute for Research and Treatment, Egypt
***Corresponding author:** Mohamed Kelany, **Mobile:** (+20) 01067290288, **E-mail:** mohamed.kelany.m@gmail.com

ABSTRACT
Background: In order to anticipate the common side effects and to direct the treatment choices, risk stratification scores are an essential tool in the management of ST segment elevation myocardial infarction (STEMI) patients. The GRACE risk score (Global Registry of Acute Coronary Events) and the TIMI risk score (Thrombolysis in Myocardial Infarction) are the two most commonly utilized scores for risk stratification in STEMI. The CHA_2DS_2-VASc-HSF score, which was recently created, was derived from the CHA_2DS_2-VASc score. **Objective:** This study aimed to assess the relationship between patients with STEMI undergoing primary percutaneous coronary intervention (PCI) and their admission CHA_2DS_2-VASc-HSF score and short-term clinical outcomes. **Subjects and methods:** This prospective observational study was done on 100 consecutive STEMI patients treated with primary PCI at Benha University Hospital and Nasser Institute for Research and Treatment Hospital between December 2022 and April 2023. All patients underwent a thorough medical history, physical examination, ECG, and echocardiography. For each patient, we calculated their TIMI, GRACE, and CHA_2DS_2-VASc-HSF risk scores. **Results:** The three risk scores CHA_2DS_2-VASc-HSF, TIMI, and GRACE were statistically significant predictor of in-hospital 3-point MACE. According to our study, high CHA_2DS_2-VASc-HSF scores > 4 were statistically significantly associated with cardiovascular mortality, the composite endpoint of 3-point MACE, patients requiring cardiopulmonary resuscitation and patients experiencing cardiogenic shock. Additionally, there was a statistically significant correlation between patients with three vessel disease and high CHA_2DS_2-VASc-HSF scores > 4. High CHA_2DS_2-VASc-HSF score > 4 was statistically significantly associated with patients' 30-days death from all causes, lethal re-infarction, and 3-point MACE. **Conclusion:** Every STEMI patient should be assessed by the CHA_2DS_2-VASc-HSF score to help identify potential high-risk patients (those with a CHA_2DS_2-VASc-HSF score > 4 points), who should receive more aggressive therapy and vigilant monitoring.
Keywords: STEMI, Primary percutaneous coronary intervention, CHA_2DS_2-VASc-HSF.

INTRODUCTION
A widespread cardiovascular issue is STEMI. Both in wealthy and developing nations, it has significant death and morbidity rates. In order to direct medical and interventional treatments, risk categorization of STEMI patients and fatality rate prediction are crucial [(1)]. Numerous risk scores have been created during the past 20 years to categorize patients hospitalised with STEMI The (GRACE) and (TIMI) risk scores are two examples of the scores that are used to forecast long-term and in-hospital mortality in STEMI patients [(2-3)].

In practice guidelines for administering oral anticoagulants in non-NVAF diseased patients, the CHA_2DS_2-VASc score is a suggested risk score [(4)]. It has similar risk factors to that of CAD. There is evidence from numerous research that the CHA_2DS_2-VASc scores and both CAD and acute coronary syndrome are correlated [(5)]. From the CHA_2DS_2-VASc score, the CHA_2DS_2-VASc-HSF score has been created by including three additional risk factors: hyperlipidemia, smoking, and a family history of early CAD. Additionally, they changed the gender in the CHA_2DS_2-VASc score from female to male [(6-10)].
This study aimed to assess the relationship between patients with STEMI undergoing primary PCI and their admission CHA_2DS_2-VASc-HSF score and short-term clinical outcomes.

PATIENTS AND METHODS
This study was an observational prospective cross-sectional design. It was conducted in the CCUs of Nasser Institute for Research and Treatment Hospital and Benha University Hospital. They enrolled 100 consecutive STEMI patients who had primary PCI treatment. The study was conducted between December 2022 and April 2023.

Inclusion Criteria: According to the ESC Guidelines, patients with STEMI must have "ST-segment elevation > one millimetre in at least two contiguous (ECG) leads or new left bundle branch block with increasing cardiac enzymes twice the upper limit of normal" [(1)], presented within twenty-four hours from symptoms onset, and receive primary PCI.

Exclusion Criteria: Patients unable or unwilling to give written informed permission, patients presented more than 24 hours after the beginning of their symptoms, patients received thrombolytic therapy prior to PCI, patients over 85 years old, and patients diagnosed with an active tumor at the time of their presentation.

At the time of admission, all patients provided a thorough medical history. In addition to demographic information (age, gender), medical history of cardiac

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risk factors like HTN, DM, smoking, and history of previous cardiac or vascular diseases like CHF, myocardial infarction, stroke, TIA, or peripheral arterial disease were also included.

Patients got a complete clinical examination when they arrived at the emergency room to check their HR, bl pr and any signs of HF according to the Killip classification. At the time of initial medical contact, 12-lead ECGs were performed for every patient to identify the type of STEMI and diagnose it. Within twenty-four hours of admission, every individual underwent a thorough 2D echocardiogram in order to calculate their EF using the modified Simpson method [EF = (EDV - ESV) / EDV x 100] in apical 4 and 2-chamber views [11].

Prior to coronary angiography, 300 mg of aspirin in addition to 180 mg of ticagrelor, or 600 mg of clopidogrel were administered to all patients presenting with STEMI. Depending on the operator's discretion, either a radial or femoral approach was used for primary PCI. Only (IRA) underwent primary PCI using balloon angioplasty and/or stent placement in accordance with the lesion morphology. A reduction in stenosis of the IRA to fifty percent with TIMI flow between 2 and 3 was considered a favourable outcome. Following PPCI, all patients were admitted to the CCU. The operator was given complete discretion over the use of glycoprotein IIb/IIIa inhibitors. Other adjuvant medical treatments were given according to European Society of Cardiology guidelines such as statins, ACEIs, and BBs [1]. Calculation of risk scores TIMI, GRACE & CHA_2DS_2-VASc-HSF was done for all patients (Tables 1 & 2).

Table (1): TIMI risk score for STEMI [6]

Points	Characteristic
	History
Two points	Age: sixty-five – seventy-four years
Three points	Age: more-than seventy-five years
One point	DM, HTN or Angina
	Examination
Three points	SBP < 100 mmHg
Two points	HR > 100 BPM
Two points	Killip class II-IV
One point	Wt < 67 kilogrmams
	Presentation
One point	Anterior STEMI or LBBB
One point	More-than 4 hrs time for treatment
0 - 14	**Total Score**

Table (2): CHA_2DS_2-VASc-HSF risk score [6]

Characteristic		Points
C	CHF	**One Point**
H	HTN	**One Point**
A_2	Age >75 years	**Two Points**
D	DM	**One Point**
S_2	Stroke	**Two Points**
V	Vascular diseases	**One Point**
A	Age 65-74 years	**One Point**
Sc	Sex Category (Male sex)	**One Point**
H	Hyperlipidaemia	**One Point**
S	Smoking	**One Point**
F	Family hx of CHD	**One Point**
Total Score		**0 - 12**

To monitor the patient's condition and gather data, follow-up was performed clinically in the CCU and then in the cardiology ward until the time of discharge.

The three-point major adverse cardiovascular events (MACE), which is cardiovascular death, re-infarction, or non-fatal stroke, served as the study's main objective. For 3-point (MACE) and echocardiography, a 30-day follow-up was conducted.

Ethical approval:

Ethics Committee of Faculty of Medicine, Benha University's granted the study approval. All participants signed informed consents after a thorough explanation of the goals of the study. The Helsinki Declaration was followed throughout the study's conduct.

Statistical Analysis

SPSS version 20 (IBM Corp, 2011) was used to code and process the data. According to the kind of variable, the data was summarised using the mean ± standard deviation, and frequencies for quantitative variables and relative frequencies for categorical variables.

Unpaired t-tests were used for comparisons between quantitative variables with normally distributed distributions, and non-parametric Mann-Whitney tests were used for comparisons between quantitative variables with non-normally distributed distributions. We utilized the Chi-square (X^2) test to compare categorical data, and the Exact test when the anticipated frequency was less than 5. Statistics were considered significant for P-values ≤ 0.05.

RESULTS

There were 100 STEMI patients (69% men) in this study. The average body weight was 94.70 kg, plus or minus 12.22 kg. Between 33 and 85 years old, they ranged in age. Regarding their medical histories, 55% of patients were smokers, 13% of patients had a history of hyperlipidemia, 44% were hypertension, 11% had a history of congestive heart failure, 25% had a family history of cardiac disease, 14% of patients had an old myocardial infarction, 18% of patients reported history of PCI, and 7% had a histopathology.

Of the patients, 47% were diabetics, 9% had a history of stroke or TIA. According to the clinical examination, the mean systolic blood pressure measurement at admission was 129.45 ± 28.67 mmHg while diastolic was 81.20 ± 15.13 mmHg. Their mean heart rate was 87.21 ± 12.18 BPM. 75% of patients were of Killip class I, 17% were Killip class II, 7% were Killip class III and 1% of patients were Killip class IV. 27% were diagnosed with anterior STEMI.

The mean of Patients' pain-to-balloon time was 5.84 ± 3.06 hours and the mean of Patients' door-to-balloon time was 1.15 ± 0.39 hours. Echocardiography at admission showed the mean ejection fraction to be 49.22 ± 12.21 % (Table 3).

Table (3): Studied cases distribution depending on demographics and clinical data at admission (n = 100)

Demographics Data	No.	%
Gender		
Male	69	69.0
Female	31	31.0
Age (ys) (Mean ± SD)	59.08 ± 11.34	
Wt (kg) (Mean ± SD)	94.70 ± 12.22	
DM	47	47.0
Stroke or TIA	9	9.0
Vascular Disease	17	17.0
Smoking	55	55.0
Hyperlipidaemia	13	13.0
HTN	44	44.0
CHF	11	11.0
Family history of CAD	25	25.0
MI	14	14.0
PCI	18	18.0
CABG	7	7.0
Systolic (Mean ± SD)	129.45 ± 28.67	
Diastolic (Mean ± SD)	81.20 ± 15.13	
HR (Mean ± SD)	87.21 ± 12.18	
Killip Class		
Class I	75	75.0
Class II	17	17.0
Class III	7	7.0
Class IV	1	1.0
Anterior STEMI		
No	73	73.0
Yes	27	27.0
Door-to-Ballon (Mean ± SD)	1.15 ± 0.39	
Pain-to-Ballon (Mean ± SD)	5.84 ± 3.06	
EF at admission (Mean ± SD)	49.22 ± 12.21	

Inter quartile range (IQR)

After dividing the study sample into two groups according to the development of the composite endpoint 3-point MACE during hospital stay, the first group was patients who didn't develop MACE (91 patients) and the second group of patients who developed MACE (9 patients). There was a statistical significance correlation between the risk of the development of in-hospital 3-point MACE and the three risk scores used in this study CHA_2DS_2-VASc-HSF, TIMI and GRACE as P values were <0.001, <0.001, 0.023 respectively (Table 4).

Table (4): Comparing risk scores for development of in-hospital 3-point MACE

Risk scores	3 Point Mace		U	p
	No (n = 91)	Yes (n = 9)		
CHA_2DS_2-VASc-HSF Mean ± SD.	3.19 ± 1.49	6.11 ± 1.96	105.50*	<0.001*
TIMI Mean ± SD.	3.15 ± 1.78	6.56 ± 2.30	107.0*	<0.001*
GRACE Mean ± SD.	107.0 ± 14.86	119.44 ± 11.15	221.0*	0.023*

*: Statistical significance at $p \leq 0.05$

The optimal CHA_2DS_2-VASc-HSF cut-off point for predicting in-hospital MACE was determined using the (ROC) curve. The optimum cut-off value was > 4 points, with a sensitivity of 88.89%, specificity of 78.02%, and AUC of 0.871. The cut-off value for the TIMI score was > 4, with an AUC of 0.869, a sensitivity of 77.78%, and a specificity of 74.73%. The GRACE score had a cut-off value of >114, with a 77.78% sensitivity, 62.64% specificity of and an AUC of 0.730. After analyzing all of these data, we can say that CHA_2DS_2-VASc-HSF had the highest specificity for predicting in-hospital 3-point MACEs, followed by TIMI and GRACE scores. However, CHA_2DS_2-VASc-HSF has a better sensitivity than GRACE & TIMI scores, which were both equal (Figure 1 & Table 5).

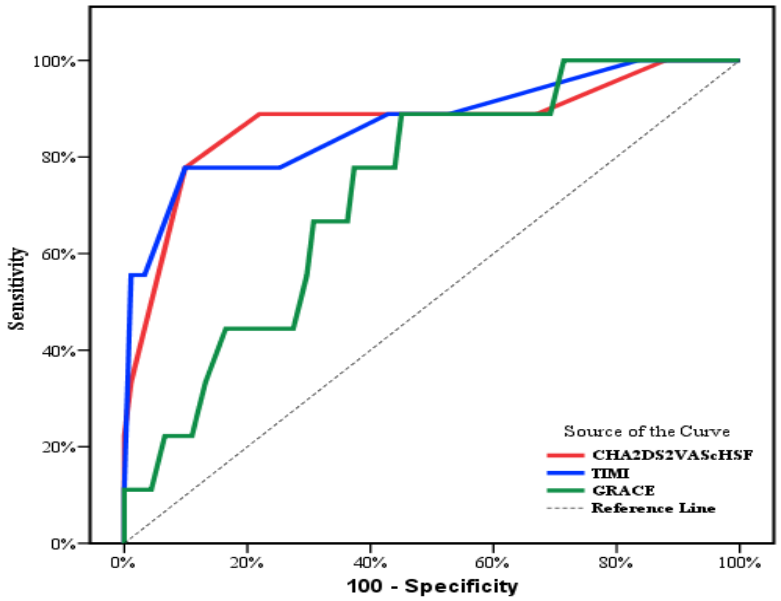

Figure (1): ROC curve for risk scores for prediction in-hospital 3-Point MACE

Table (5): Prognostic performance for risk scores to predict in-hospital 3-Point MACE

Risk scores	AUC	P-value	95% CI	Cut-off	SN	SP	PPV	NPV
CHA_2DS_2-VASc-HSF	0.871	<0.001*	0.715 – 1.0	>4	88.89	78.02	28.6	98.6
TIMI	0.869	<0.001*	0.721 – 1.0	>4	77.78	74.73	23.3	97.1
GRACE	0.730	0.023*	0.581 – 0.879	>114	77.78	62.64	17.1	96.6

*: Statistical significance at $p \leq 0.05$

The studied patients were divided based on their CHA_2DS_2-VASc-HSF score using the calculated cut-off value into a low CHA_2DS_2-VASc-HSF score group ≤ 4 (n = 72) and a high CHA_2DS_2-VASc-HSF score group > 4 (n = 28). High CHA_2DS_2-VASc-HSF scores patients had higher values of three-vessel disease incidence (p=0.039), cardiovascular mortality (p < 0.001), composite endpoint 3-point MACE (p < 0.001), patients that needed cardiopulmonary resuscitation (p < 0.001) and patients who developed cardiogenic shock (p=0.021). There was no statistical significance difference between the 2 groups regarding any other outcome during the hospital stay (Table 6).

Table (6): Comparison between low and high CHA_2DS_2-VASc-HSF groups according to in-hospital outcomes (n= 100)

Hospital outcomes	CHA_2DS_2-VASc-HSF				Test of sig.	p
	≤4 (n = 72)		>4 (n = 28)			
	No.	%	No.	%		
3 Vessel disease	12	16.7	10	35.7	χ^2=4.262*	0.039*
TIMI flow grade < 3	8	11.1	0	0.0	χ^2=3.382	0.101
Tirofiban use	9	12.5	5	17.9	χ^2=0.481	FEp=0.527
Stent implantation	59	81.9	21	75.0	χ^2=0.608	0.436
No-Reflow	2	2.8	0	0.0	χ^2=0.794	FEp=1.000
CV mortality	0	0.0	7	25.0	χ^2=19.355*	FEp<0.001*
Re-infraction	0	0.0	2	7.1	χ^2=5.248	FEp=0.076
Stroke	0	0.0	1	3.6	χ^2=2.597	FEp=0.280
Target vessel revascularization	1	1.4	2	7.1	χ^2=2.294	FEp=0.189
3-Point MACE	1	1.4	8	28.6	χ^2=18.188*	FEp<0.001*
Cardiopulmonary resuscitation	0	0.0	8	28.6	χ^2=22.360*	FEp<0.001*
Cardiogenic shock	1	1.4	4	14.3	χ^2=7.059*	FEp=0.021*
Atrial fibrillation	2	2.8	1	3.6	χ^2=0.044	FEp=1.000
Transient pacemaker	3	4.2	1	3.6	χ^2=0.019	FEp=1.000
Ejection fraction Mean ± SD.	49.67 ± 12.37		48.07 ± 11.92		t=0.585	0.560

*: Statistical significance at p ≤ 0.05

Regarding the Thirty-day follow-up, ninety-three patients who were admitted survived, were released from the hospital, and received follow-up 30 days later. According to the establishment of the composite endpoint 3-point MACE, these 93 patients were divided into 2 further groups: the 1st group included patients who did not develop MACE (87 patients), while the 2nd group included patients who did (6 patients). The three risk scores CHA_2DS_2-VASc-HSF, TIMI and GRACE were significantly correlated with 30-day 3-point MACE (Table **7**).

Table (7): Comparison between the risk scores for development of 30-days post STEMI 3-point MACE

Risk scores	30-days 3-point MACE		U	p
	No (n = 87)	Yes (n = 6)		
CHA_2DS_2-VASc-HSF Mean ± SD.	3.07 ± 1.45	5.17 ± 0.75	64.50*	0.002*
TIMI Mean ± SD.	3.06 ± 1.74	4.83 ± 1.72	120.0*	0.024*
GRACE Mean ± SD.	106.41 ± 14.75	119.0 ± 10.60	127.50*	0.037*

*: Statistical significance at p ≤ 0.05

The optimal cut-off point for the CHA_2DS_2-VASc-HSF score was determined using ROC curve, and it was > 4 with a sensitivity of 83.33%, specificity of 81.61%, and AUC of 0.876. The cut-off value for the TIMI score was > 4, with an AUC of 0.77, a sensitivity of 66.67%t, and 77.01% specificity, 83.33% sensitivity, 66.67% specificity, and AUC of 0.756, the GRACE cut off value was >115. By examining all of these numbers, we can draw the conclusion that GRACE scores are less accurate than CHA_2DS_2-VASc-HSF in predicting MACEs at 30 days after STEMI, followed by TIMI. Both the GRACE score and the CHA_2DS_2-VASc-HSF score had greater sensitivity than the TIMI score, which was lower (Figure & Table 8).

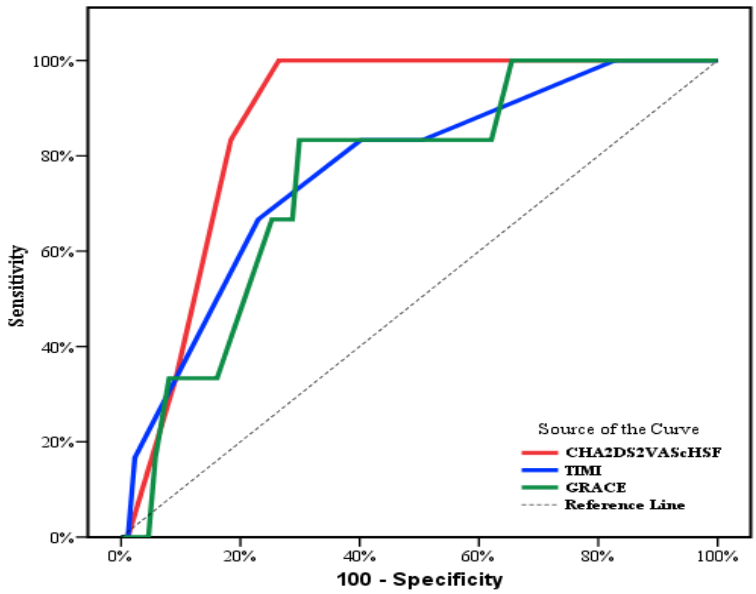

Figure (2): ROC curve for risk scores to predict 30-days post STEMI 3-point MACE

Table (8): Prognostic performance for risk scores to predict 30-days post STEMI 3-point MACE

Risk scores	AUC	P-value	95% C.I	Cut off	SN	SP	PPV	NPV
CHA_2DS_2-VASc-HSF	0.876	0.002*	0.799 – 0.954	>4	83.33	81.61	23.8	98.6
TIMI	0.770	0.027*	0.583 – 0.957	>4	66.67	77.01	16.7	97.1
GRACE	0.756	0.037*	0.587 – 0.925	>115	83.33	66.67	14.7	98.3

*: Statistical significance at $p \leq 0.05$

The surviving patients at 30-days follow-up (n= 93) were divided based on their CHA_2DS_2-VASc-HSF score into a low CHA_2DS_2-VASc-HSF score group ≤ 4 (n = 72) and a high CHA_2DS_2-VASc-HSF score group > 4 (n = 21). The high CHA_2DS_2-VASc-HSF score group showed higher all-cause mortality (p=0.002), fatal re-infarction (p=0.01) and the composite endpoint 3-point MACE at 30 days. (p=0.002) (Table 9).

Table (9): Relation between CHA_2DS_2-VASc-HSF score and 30-days post STEMI outcomes (n= 93)

30 days outcomes	CHA_2DS_2-VASc-HSF				Test of sig.	p
	≤4 (n = 72)		>4 (n = 21)			
	No.	%	No.	%		
All-cause mortality	0	0.0	4	19.0	χ^2=14.331*	^{FE}p=0.002*
Fatal re-infraction	0	0.0	3	14.3	χ^2=10.629*	^{FE}p=0.010*
Stroke	0	0.0	1	4.8	χ^2=3.466	^{FE}p=0.226
Target vessel revascularization	1	1.4	1	4.8	χ^2=0.879	^{FE}p=0.403
3-point MACE	1	1.4	5	23.8	χ^2=13.541*	^{FE}p=0.002*
Hospitalization with CHF	2	2.8	2	9.5	χ^2=1.798	^{FE}p=0.219
Ejection fraction Mean ± SD.	51.01 ± 15.49		50.75 ± 11.26		t=0.064	0.949

*: Statistically significant at $p \leq 0.05$

DISCUSSION

Globally, acute myocardial infarction (MI) is the main cause of death. The majority of cardiovascular disease patients live in underdeveloped nations. A less expensive yet accurate marker is also required for patients with acute myocardial infarction to utilise in risk stratification and prognosis prediction [12-14]. The CHA_2DS_2-VASc score also incorporates similar risk variables for the onset of coronary artery disease (CAD) and is used to predict the likelihood of thromboembolic events in individuals with atrial fibrillation. The CHA_2DS_2-VASc-HSF score was recently developed by adding three risk factors: hyperlipidemia, smoking, and a family history of early CAD. Also replacing the female sex that was used as a sex category in the CHA_2DS_2-VASc score with the male sex [3].

In this study, we looked into the relationship between the CHA_2DS_2-VASc-HSF score at the time of admission and short-term clinical outcomes in patients with STEMI who underwent primary PCI.

One-hundred STEMI patients (69% males, 31% females) were included in this study. Their average age was 59.08 ± 11.34 years. The information shown here is comparable to that provided by **Uysal *et al.*** [15], who looked into the relationship between the CHA_2DS_2-VASc-HSF score and the severity of CAD in STEMI patients who underwent primary PCI. Their study comprised 454 STEMI patients. With a mean age of 57.3 ± 12.9 years, 79% of them were male. Studies on CAD typically reveal a male predominance, as in **Rahim *et al.*** [16], who looked at the relationship between the severity of CAD in STEMI patients and the CHA_2DS_2-VASc-HSF score. In this study, 79% of the participants were men. The mean age of their study population was 51.8 ± 9.8 years old, which is lower than our study population probably due to different life expectancy, and geographical and racial differences.

Smoking was by far the most common risk factor for CAD in our study fifty-five percent of patients were smokers. This is in line with the findings of the **Uysal *et al.* study** [15], which found that smoking was the most common risk factor across all study groups, with rates of forty-one percent, fifty-two percent, and forty-nine percent in the low, intermediate, and high SYNTAX groups, respectively. This is also consistent with the findings of **Rahim *et al.*** [16], who found that smoking accounted for seventy-one percent of the risk factors among STEMI patients. In accordance with their presentation, twenty-seven percent of the participants in our study had an anterior STEMI diagnosis. As 31.4% & 30.2% of their patients presented with anterior wall myocardial infarction in the successful thrombolysis and failed thrombolysis groups, respectively. **Kilic *et al.*** [17] evaluated the potential of CHA_2DS_2-VASc-HS scores to predict failure reperfusion in STEMI patients. The demographic characteristics of the several patients could account for this minor difference.

In our study, echocardiography at admission showed that the mean ejection fraction was 49.22 ± 12.21. This is in concordance with **Uysal *et al.*** [15] who stated that the ejection fraction of STEMI patients was 48±8, 44±7 and 39±8 in low, intermediate and high SYNTAX groups respectively.

Patients were split into two groups (MACE & NO-MACE) based on how MACE developed throughout their hospital stay. For each patient, we calculated their respective CHA_2DS_2-VASc-HSF, TIMI, and GRACE risk scores. Our study revealed that the three risk scores, CHA_2DS_2-VASc-HSF, TIMI and GRACE were statistically significant predictors of in-hospital 3-point MACE as P values were < 0.001, < 0.001 & 0.023 respectively. We calculated the best cut-off value of CHA_2DS_2-VASc-HSF to be > 4 points for prediction of in-hospital MACE, with a sensitivity of 88.89%, specificity of 78.02% and AUC was 0.871. This is similar to the work by **Uysal *et al.*** [15] who established that STEMI patients who underwent PPCI and had a high CHA2DS2-VASc-HSF score 4 had very high SYNTAX scores. This concurs with the findings of a study by **Modi *et al.*** [6] that looked at the relationship between the CHA_2DS_2-VASc-HSF score and the severity of CAD in elective patients who had coronary angiography. They noted that patients with CHA_2DS_2-VASc-HSF scores > 3 had significantly higher Gensini scores than those with scores 3. The study by **Al-Farabi *et al.*** [18] indicated that the CHA_2DS_2-VASc-HSF score can predict the severity of CAD and referral for CABG in patients who underwent elective coronary angiography. Other studies, however, support our findings while proposing other cut-off values. However, they determined that the CHA_2DS_2-VASc-HSF score cut-off point for predicting the severity of CAD was 2.5 (sensitivity of 81% and specificity of 68.1%), and another cut-off point to provide the maximum predictive value for CABG indication was 3.5 (sensitivity of 80% and specificity of 74.6%).

In our study, a high CHA_2DS_2-VASc-HSF score of > 4 was statistically significantly associated with cardiovascular mortality (p0.001), the composite endpoint of 3-point MACE ($p<0.001$), patients requiring cardiopulmonary resuscitation (p0.001), and patients experiencing cardiogenic shock ($p=0.021$). The **Sanlialp** [19] study, which examined the CHA_2DS_2-VASc-HSF score and its capacity to forecast the short-term prognosis in acute coronary syndrome patients, reported that individuals with high CHA_2DS_2-VASc-HSF were associated with a significant rise in mortality in the hospital environment. With 88% specificity and 66% sensitivity, they arrived at a cut-off value of 5.5 for CHA_2DS_2-VASc-HSF to predict in-hospital death in ACS patients.

In our research, there was a statistical significance correlation between patients with three vessel disease and high CHA_2DS_2-VASc-HSF scores > 4 ($p=0.039$). This is consistent with **Singh *et al.*** [20] study, which established a link between the CHA_2DS_2-VASc-HSF score, SYNTAX score, and the

number of sick arteries discovered in PPCI for STEMI patients. Additionally, **Rahim *et al.*** [16] found a significant correlation between the SYNTAX score and the CHA_2DS_2-VASc-HSF score in STEMI patients. This finding implied that in STEMI patients who underwent primary PCI, the CHA_2DS_2-VASc-HSF could predict the severity of CAD. Additionally, there was a substantial correlation between the SYNTAX score and the CHA_2DS_2-VASc-HSF score, which is consistent with the research by **Uysal *et al.*** [15] that revealed the CHA_2DS_2-VASc-HSF score can predict the severity of atherosclerosis in patients with STEMI who had PPCI. This is in line with **Modi *et al.*** [6] study, which examined the CHA_2DS_2-VASc-HSF score in patients undergoing diagnostic CAG and its potential use as a risk assessment tool to predict the severity of CAD. They discovered that patients receiving elective CAG had a positive association between their CHA_2DS_2-VASc-HSF score and the number of diseased vessels, which was able to predict the severity of CAD. This is also supported by **Liu *et al.*** [3], who found that both ACS patients and non-ACS patients can have multi-vessel disease based on their CHA_2DS_2-VASc-HSF scores. According to **Al-Farabi *et al.*** [19] study, which involved suspected CAD patients who later underwent elective CAG for screening purposes, the CHA_2DS_2-VASc-HSF score was a reliable indicator of the severity of CAD because it had a significant and positive correlation with the severity of coronary artery disease as determined by the Gensini score. Additionally, **Al-shorbagy *et al.*** [21] discovered that in NSTEMI patients, the CHA2DS2-VASC-HSF score predicts the degree of atherosclerosis. The CHA_2DS_2-VASc-HSF score and CAD severity in ACS patients were found to be strongly correlated in **Sanlialp** [19] experiment, which examined CHA_2DS_2-VASc-HSF score in ACS patients.

In the current study, there was no other statistical significance difference between the high CHA_2DS_2-VASc-HSF score > 4 and other outcomes we followed during the hospital stay (TIMI flow grade < 3, tirofiban use, stent implantation, no-reflow, re-infraction, stroke, target vessel revascularization, atrial fibrillation, transient pacemaker and ejection fraction). This contrast with the findings of **Zhang *et al.*** [22] who sought to determine if a high CHA_2DS_2-VASc-HSF score is related to NRP in primary PCI or STEMI. They concluded that the CHA_2DS_2-VASc-HSF score is a reliable predictor of the NRP. According to **Zhang *et al.* study** [22], a CHA_2DS_2-VASc-HSF score of 4 can predict NRP in STEMI patients treated with PPCI, with a sensitivity of 75.5% and a specificity of 63.2%. This cut-off value was identical to the one we established in our study. Due to the small sample size of STEMI patients in our investigation, there were even fewer NRP patients, leading to these inconsistent outcomes in NRP prediction despite the identical cut-off value.

In terms of the 30-days follow-up, 93 patients were still alive after being discharged from the hospital and were still being monitored for thirty days after their hospitalisation. We separated the 93 patients into two additional groups based on how the 3-point MACE developed within thirty days after the STEMI.

The three risk scores CHA_2DS_2-VASc-HSF, TIMI, and GRACE, as well as the 30-days after STEMI 3-point MACE, were found to be statistically correlated in the current investigation, with P values of < 0.002, 0.024, and 0.037 respectively. This was consistent with the findings of **Kalyoncuoğlu *et al.*** [23] who discovered that the CHA_2DS_2-VASc-HSF score can predict CAD severity, one-year mortality, and one-year MACE in NSTE-ACS independently. When predicting the long-term cardiovascular outcomes of NSTE-ACS patients, the CHA_2DS_2-VASc-HSF score was non-inferior to the GRACE score.

We calculated the cut-off value of the CHA_2DS_2-VASc-HSF score for prediction of 30-days post STEMI 3-point MACE, which was also > 4 with sensitivity of 83.33%, specificity of 81.61% and AUC of 0.876.

In our investigation, there was a statistically significant relationship between patients' 30-days all-cause mortality (p=0.002), 30-day fatal re-infarction (p=0.01), and 30-days 3-point MACE (p=0.002) and high CHA_2DS_2-VASc-HSF scores > 4. According to **Sanlialp** [19] research, the cut-off score for CHA_2DS_2-VASc-HSF to predict MACE after 30 days of ACS was 4.5 with eighty-three percent specificity and eighty percent sensitivity. NSTE-ACS patients with high CHA_2DS_2-VASc-HSF scores > 4 points are at a high risk for unfavourable long-term cardiovascular outcomes, according to **Kalyoncuoğlu *et al.*** [23]**.** A high CHA_2DS_2-VASc-HSF score > 4 did not significantly differ from any other outcome assessed after 30 days following STEMI (stroke, target vessel revascularization, hospitalisation with CHF, ejection fraction). The findings of the **Sanlialp study** [19], which found a link between a high CHA_2DS_2-VASc-HSF score and a poor LV ejection percent, were in contrast to this. The **Sanlialp study** [19] was conducted on a study population with various characteristics who experienced other types of ACS other than STEMI, and of that study population, not all patients were treated with PPCI, which may account for the variance in the results.

CONCLUSION

In patients who presented with STEMI and underwent primary percutaneous intervention, the CHA_2DS_2-VASc-HSF risk score can forecast the development of MACE during hospitalisation and after 30 days. The threshold value to predict 30-days MACE in hospitals using the CHA_2DS_2-VASc-HSF risk score is > 4. In STEMI patients treated with PPCI, this score can also indicate the occurrence of more advanced coronary artery disease, the presence of three vessel disease, and the likelihood that patients will experience cardiogenic shock.

RECOMMENDATIONS

For the purpose of identifying potential high-risk patients in each STEMI patient, we advise the use of the CHA_2DS_2-VASc-HSF score because it is a straightforward, affordable risk stratification score that doesn't call for any special software or prior clinical experience. Patients who receive more aggressive care and frequent follow-up should have CHA_2DS_2-VASc-HSF scores of > 4. To confirm the validity of the application of the CHA_2DS_2-VASc-HSF score for the prediction of the severity of CAD and STEMI patients' prognosis, additional studies should be conducted with bigger sample sizes and longer follow-up periods. By including additional biochemical, echocardiographic, and other predictors of atherosclerosis in future research, the CHA_2DS_2-VASc-HSF score can be improved.

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