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Association of CHA_2DS_2-VASc-HSF Score with Coronary Artery Disease Severity in Patients with Non-ST Segment Elevation Myocardial Infarction

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Abstract

Background and Objectives: Due to the wide spectrum of risk for death and recurrent events among patients with Non-ST Elevation Myocardial Infarction (NSTEMI), management guidelines emphasize the importance of early risk stratification. In addition to prognostic assessment, predicting the anatomical extension of coronary artery disease (CAD) is potentially useful for clinical decisions. The aim of the study was to determine whether the CHA2DS2-VASc-HSF score correlates with the angiographic extent and severity of CAD in patients with NSTEMI.

Methods: It was a cross-sectional observational study. A total of 80 patients with NSTEMI were enrolled. Based on the CHA2DS2-VASc-HSF score, the patients were divided into low (≤4) and high (>4) risk groups. All patients underwent coronary angiography during the index hospitalization and the severity of CAD was assessed by the SYNTAX score. The association between the CHA2DS2-VASc-HSF score and the SYNTAX score was evaluated.

Results: The mean age of patients was 50.58±9.53 and 54.48±10.66 years for group I and group II respectively with the majority (81.2%) being male. The mean CHA2DS2-VASc-HSF score of the patients was 2.68±0.92 in group I and 5.48±0.60 in group II (P value=<0.001). The median SYNTAX score was 7.50 (range 0.0 to 24.0) in Group I and 23.3 (range 0.0 to 39.0) in Group II (P value=<0.001). The CHA2DS2-VASc-HSF score was positively and significantly correlated with the SYNTAX score (Spearman's ρ =0.703, p<0.001). A CHA2DS2-VASc-HSF score of 4.5 has 86.7% sensitivity and 72.0% specificity to detect severe coronary artery involvement (SYNTAX score >22).

Conclusion: The study demonstrated that the CHA2DS2-VASc-HSF score was associated with the severity of coronary artery disease in patients with NSTEMI. Notably, those with elevated CHA2DS2-VASc-HSF scores tended to have higher SYNTAX scores.

Keywords: CHA_2DS_2-VASc-HSF score; Coronary Artery Disease severity; Angiographic severity; SYNTAX score; NSTEMI; Bangladesh

Introduction

Coronary artery disease (CAD), a form of atherosclerotic cardiovascular disease (CVD), is responsible for a significant global health burden, causing approximately 9.14 million deaths, which accounts for 16.2% of all global fatalities [1]. South Asians are particularly susceptible to CAD,

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exhibiting distinct characteristics, including early onset, increased severity, 2-4 times higher prevalence, incidence, hospitalization rates, and mortality, as well as a 5-10 year earlier occurrence of the first myocardial infarction (MI), along with a 5-10 times higher rate of MI and mortality before the age of 40 [2]. Bangladeshis are also at a heightened risk of CAD, experiencing early onset, rapid progression, and more severe angiographic presentations [3]. Ischemic heart disease (IHD) is the leading cause of death in Bangladesh, with acute myocardial infarction (AMI) being the leading cause (3.7% of deaths) across 504 public hospitals in the country in 2012 [4]. NSTEMI and UA are often grouped together under the term non-ST segment elevation acute coronary syndrome (NSTE-ACS) [5]. Globally, the prevalence of NSTEMI is rising compared to ST-elevation MI [6]. Patients with NSTEMI typically have more cardiac and non-cardiac comorbidities than those with STEMI [7]. Patients presenting with NSTE-ACS are at risk for adverse events such as death or recurrent infarction. While in STEMI management is clear and well defined, in patients with suspected NSTE-ACS early risk stratification is crucial to define the type of early management [8,9]. Therefore, identifying patients at high risk of developing major adverse cardiovascular events (MACEs) that may contribute to optimal management is crucial. Risk evaluation is important for the management of patients with ACS. Clinicians need simple, reliable, reproducible, and quantitative tools to identify patients risks and recommend prevention strategies. The Thrombolysis in Myocardial Infarction (TIMI) and Global Registry of Acute Coronary Events (GRACE) scoring systems used for the risk stratification of ACS patients are primarily based on multivariable models that include components of the medical history, admission electrocardiogram, and cardiac biomarker variables [10]. In a study, the association of risk score systems like GRACE and TIMI was evaluated with regard to angiographic scores [11]. Recently, the CHA_2DS_2-VASc-HS score has emerged as a novel predictor of CAD severity in stable CAD patients who have undergone diagnostic coronary angiography. In another study, the diagnostic accuracy of the CHA_2DS_2-VASc-HS score was compared with the TIMI and GRACE risk scores, revealing no significant differences [12]. In a study, the CHA_2DS_2-VASc-HS score was found to be useful in predicting the risk of clinical adverse events in patients with NSTEMI [13]. In yet another study, the CHA_2DS_2-VASc-HSF score demonstrated a correlation with CAD severity and showed potential for predicting short-term prognosis [14]. In a study, the CHA_2DS_2-VASc-HSF score positively correlated with the severity of CAD in patients presenting with ST-segment elevation myocardial infarction [15]. The purpose of this study is to find out the utility of the CHA_2DS_2-VASc-HSF scoring system in predicting the angiographic extent and severity of CAD in patients with NSTEMI in our population. This score is practical, simple, and an easily remembered formula that includes multiple risk factors.

Methods and Materials

Study design: Cross-sectional observational study.

Place of study: This study was carried out in the Department of Cardiology, National Institute of Cardiovascular Diseases (NICVD), Dhaka, Bangladesh.

Study period: Study period was from September, 2022 to August, 2023.

Study population: On the basis of inclusion and exclusion criteria, NSTEMI patients admitted into NICVD who underwent coronary angiography during index hospitalization within the specified period of time were the study population.

The sample size was 40 in each group:

The study subjects were divided into two groups.

Group I: 40 patients, with lower CHA_2DS_2-VASc-HSF score (≤4)

Group II: 40 patients, with higher CHA_2DS_2-VASc-HSF score (>4)

Inclusion criteria:

- Patients ≥ 18 years of either sex with NSTEMI undergoing coronary angiography at NICVD during index hospitalization.

Exclusion criteria:

Patients with the following conditions were excluded:

- New left bundle branch block
- History of prior CABG
- Valvular heart diseases
- Congenital heart diseases
- Chronic Kidney disease with estimated glomerular filtration rate (eGFR) < 30 mL/m²/min
- Severe liver disease
- Advanced malignancy
- Active infection

Study procedure:

- All patients who were admitted in the Department of Cardiology, NICVD presenting with NSTEMI and fulfilling the inclusion criteria were the study subjects.
- Informed written consent was taken from each patient before enrollment.
- Meticulous history was taken and detailed clinical examinations were performed and recorded in a predesigned structured questionnaire.
- Demographic data such as, age and sex were recorded.

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- Risk factors profile including smoking, hypertension, diabetes, hyperlipidemia, history of stroke or TIA, PVD, and family history of CAD were noted.
- Laboratory investigations were done on index hospitalization: hs-Troponin I, serum creatinine, random blood sugar and serum electrolytes, CBC, Blood grouping, and screening blood tests. Automated Hormone Analyzer, Model- ACCESS 2 (Beckman Coulter, USA) assay was used for high sensitivity cTnI measurement (99th percentile cut-off value for males ≤ 0.020 ng/ml and females ≤ 0.012 ng/ml).
- ECG: 12 lead resting ECG was done at a paper speed of 25 mm/s and 10 mm standardization at admission (model- iMAC 300, Wuhan Zoncare Bio-medical Electronics Co., Ltd, China).
- Transthoracic echocardiography was done by an expert cardiologist before coronary angiography using the echocardiography machine (model- PHILIPS affiniti 30, country of origin-USA).
- CHA_2DS_2-VASc-HSF scores were calculated where the presence of congestive heart failure 1 point, hypertension 1 point, age >75 years 2 points, diabetes mellitus 1 point, previous stroke or TIA 2 points, vascular disease 1 point, age 65–74 years 1 point, male gender 1 point, hyperlipidemia 1 point and smoker 1 point, Family history of CAD 1 point. The total score was 12 points.
- Cut-off value of the CHA_2DS_2-VASc-HSF score were >4. The patients were categorized according to CHA_2DS_2-VASc-HSF score:
  - CHA_2DS_2-VASc-HSF score > 4 (High risk)
  - CHA_2DS_2-VASc-HSF score ≤ 4 (Low risk) [14]
- Following standard protocol coronary angiography was carried out through a trans-femoral or trans-radial approach within the index hospitalization using the C-arm machine and Trinias system for Interventional Angiography, SHIMADZU (Origin-Japan).
- All standard views were taken. In selected cases, additional views were taken.
- Angiographic severity assessment was done by visual estimation. Two expert cardiologists who were blind to the ECG changes evaluated the CAG images.
- Angiographic data were analyzed for the presence, extent, and severity of CAD. CAD severity was assessed by the SYNTAX score. All coronary lesions with diameter stenosis > 50% in vessels > 1.5 mm were scored, using the SYNTAX algorithm. The SYNTAX score calculator software version 2.11 (SYNTAX Score Working Group, www.syntaxscore.com) was used to calculate the SYNTAX score.
- The SYNTAX score was defined as low if < 23, intermediate if 23 and 32, and high if >32. By this definition, patients with SYNTAX score ≥ 23 were considered to have moderate to severe CAD. Thus, the patients were divided into 2 groups:
  - low SYNTAX score (0–22)
  - Intermediate to high SYNTAX score (> 22) [16]
- The comparison of the SYNTAX Score with the CHA_2DS_2-VASc-HSF Score was performed.
- Data were presented in appropriate tables, graphs, charts, diagrams, etc., and were shown in the results section of the study.

Statistical Methods

- The nature of the data was explored by exploratory data analysis.
- Quantitative (continuous) data such as age were expressed as mean/ median and standard deviation and comparison was done by the "Student's t test" and 'Mann-Whitney-U' test.
- Qualitative (categorical) data such as DM, HTN, and smoking were expressed as frequency and percentage, and comparison was carried out by chi-square ($\chi 2$) Test.
- The comparison of the CHA_2DS_2-VASc-HSF Score with the SYNTAX Score was performed.
- Logistic regression analysis was done to adjust for the potential confounders in predicting angiographic severity among NSTEMI patients.
- A p value <0.05 was considered as statistically significant.
- Analysis was conducted by SPSS 26.0 for Windows software.

Results

Total 80 patients with NSTEMI were enrolled in this study after considering inclusion and exclusion criteria. A coronary angiogram was done within index hospitalization**.** Coronary angiograms were analyzed for the extent and severity of CAD using the SYNTAX score. Depending on the CHA_2DS_2-VASc-HSF score patients were divided into two groups.

- Group I = CHA_2DS_2-VASc-HSF Score ≤4
- Group II = CHA_2DS_2-VASc-HSF Score >4
- SYNTAX score was calculated. The cut-off value of SYNTAX score was 22.
  - low SYNTAX score (0–22)
  - Intermediate to high SYNTAX score (> 22)

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Table 1: Comparison of the study group according to age (N=80).

Age group (years)	Group I (n=40)	Group II (n=40)	p-value
21-30	0(0.0%)	1(2.5%)	
31-40	8(20.0%)	3(7.5%)	
41-50	14(35.0%)	13(32.5%)	
51-60	14(35.0%)	9(22.5%)	
61-70	3(7.5%)	12(30.0%)	
>70	1(2.5%)	2(5.0%)	
Total	40(100.0%)	40(100.0%)	
Mean±SD Range	50.58±9.53 (35.00 - 72.00)	54.48±10.66 (28.00 - 75.00)	0.088

P value obtained by Unpaired t-test, p<0.05 considered as a level of significance, SD-Standard Deviation

Group I = CHA_2DS_2-VASc-HSF Score ≤4, Group II = CHA_2DS_2-VASc-HSF Score >4

Table 1 shows the age distribution between the two groups. The most common age group among participants in both Group I and Group II was 41-50 years, with 35.0% in Group I and 32.5% in Group II. The mean age in Group I was 50.58 years (±9.53), and in Group II, it was 54.48 years (±10.66). There was no statistically significant difference between the two groups (p=0.088). In both groups, the majority of participants were male, constituting 80.0% of Group I and 82.5% of Group II. The remaining participants in 20% female in Group I and 17.5% in Group II. There was no statistically significant difference in sex distribution between two groups.

Table 2: Comparison of the study group according to the cardiovascular risk factors (N=80).

Cardiac risk factor	Group I (n=40)	Group II (n=40)	p value
Smoking	12(30.0%)	27(67.5%)	**<0.001**
Hypertension	22(55.0%)	29(72.5%)	0.104
Diabetes mellitus	16(40.0%)	28(70.0%)	**0.007**
Hyperlipidemia	5(12.5%)	26(65.0%)	**<0.001**
Family history of CAD	6(15.0%)	18(45.0%)	**0.003**
Congestive Heart Failure	4(10.0%)	15(37.5%)	**0.004**
History of stroke or TIA	0(0.0%)	4(10.0%)	**0.040**
History of vascular disease	2(5.0%)	17(42.5%)	**<0.001**

P value obtained by chi-square test, p<0.05 considered as a level of significance, CAD-coronary artery disease, TIA-Transient Ischaemic attack Group I = CHA_2DS_2-VASc-HSF Score ≤4, Group II = CHA_2DS_2-VASc-HSF Score >4

Table 2 describes risk factors among the studied patients, the highest percentage had a history of hypertension (72.5%), followed by diabetes mellitus (70.0%), smoking (67.5%), hyperlipidemia (65.0%), family history of CAD (45.0%), history of vascular disease (42.5%), congestive heart failure (37.5%), history of stroke or TIA (10.0%) in group II. The Table 2 also describes that there was a significant difference between the two groups in terms of diabetes mellitus (p=0.007), smoking (p=<0.001), hyperlipidemia (p=<0.001), family history of CAD (p=0.003), congestive heart failure (p=0.004), history of stroke (p=0.040s) and history of vascular disease (<0.001). It shows hypertension was higher in group II than in group I but statistically no significant difference (p>0.05).

Table 3: Distribution of study subjects by biochemical parameters (N=80).

Parameters	Group I (n=40)	Group II (n=40)	p value
Serum creatinine	0.97±0.20 (0.40 - 1.30)	1.04±0.17 (0.80 – 1.40)	0.096
RBS	7.71±2.19 (5.10 - 13.80)	9.93±3.07 (4.90 - 14.80)	**<0.001**
Serum Cholesterol	174.43±7.76 (150.00 - 190.00)	180.2±20.75 (105.00 - 220.00)	0.104
Serum LDL	89.85±18.00 (40.00 - 108.00)	107.13±14.79 (36.00 - 128.00)	**<0.001**
Serum HDL	39.40±2.11 (35.00 - 43.00)	38.91±3.50 (35.00 - 40.00)	0.451
Serum TG	150.23±9.05 (138.00 - 170.00)	154.25±15.47 (135.00 - 190.00)	0.160

P value obtained by chi-square test, p<0.05 considered as a level of significance, RBS-Random blood sugar, LDL-low density lipoprotein, HDL-High density lipoprotein, TG-triglycerides. Group I = CHA_2DS_2-VASc-HSF Score ≤4, Group II = CHA_2DS_2-VASc-HSF Score >4

Table 3 shows a comparative overview of biochemical parameters in two study groups. Group II exhibited significantly higher levels of RBS (9.93±3.07 vs. 7.71±2.19, p<0.001), serum LDL (107.13±14.79 vs. 89.85±18.00, p<0.001) compared to Group I. However, there were no statistically significant differences between the two groups in terms of serum creatinine (p=0.096), serum cholesterol (p=0.104), serum HDL (p=0.451), and serum triglycerides (p=0.160).

Table 4 shows a comparison of coronary dominance between the two study groups. In Group I, 97.5% of participants showed Right coronary dominance, while only 2.5% exhibited Left dominance. Group II had a similar distribution, with 95.0% displaying Right coronary dominance and 5.0% showing Left dominance. Notably,

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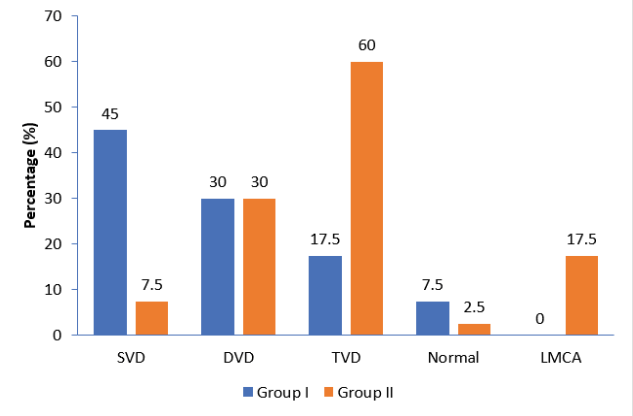
no participants in either group had Co-dominant coronary dominance. There was no statistically significant difference in coronary dominance between the two groups (p=0.556).

Table 4: Demonstration of coronary dominance between study groups (N=80).

Coronary dominance	Group I (n=40)	Group II (n=40)	p value
Right	39(97.5%)	38(95.0%)	0.556
Left	1(2.5%)	2(5.0%)	
Co-dominant	0(0.0%)	0(0.0%)	
Total	40(100.0%)	40(100.0%)	

P value obtained by chi-square test, p<0.05 considered as a level of significance. Group I = CHA_2DS_2-VASc-HSF Score ≤4, Group II = CHA_2DS_2-VASc-HSF Score >4

Figure 1: Comparison of the study group according to the coronary artery lesion severity (N=80).



(SVD-single vessel disease, DVD-double vessel disease, TVD-triple vessel disease, LMCA-left main coronary artery)

Figure 1 presents a comparison of lesion severity between the two study groups. In Group I, 45.0% of the participants had SVD, while only 7.5% of Group II participants had SVD (p<0.001). Regarding DVDs, both groups had a similar prevalence of 30.0%. For TVD, Group I had a prevalence of 17.5%, while Group II had a prevalence of 60.0% which was statistically significant (p=0.001). The prevalence of normal lesions was 7.5% in Group I and 2.5% in Group II, with no significant difference between the two groups (p=0.305). In terms of LMCA disease, none of the participants in Group I had LMCA disease, while 17.5% of Group II participants had LMCA disease which was statistically significant (p=0.006).

Table 5 shows that there is a significant difference in the mean CHA_2DS_2-VASc-HSF score between the different severity of lesions (p<0.001). Patients with TVD had the highest mean CHA_2DS_2-VASc-HSF score of 4.97±1.20, followed by patients with DVD with a mean score of 4.21±1.38 and SVD with a mean score of 2.90±1.45. Only 4 patients had normal results with a mean CHA_2DS_2-VASc-HSF score of 3.0±1.41.

Table 5: Relationship of the number of affected vessels and CHA_2DS_2-VASc-HSF Score (N=80).

Severity of lesion	n	CHA_2DS_2-VASc-HSF Score		p value
		Mean±SD (N=80)	Range (Min-Max)	
SVD	21	2.90±1.45	1.0 - 6.0	<0.001
DVD	24	4.21±1.38	2.0 - 6.0	
TVD	31	4.97±1.20	2.0 - 7.0	
Normal	4	3.0±1.41	2.0 - 5.0	

P value obtained by ANOVA test, p<0.05 considered as a level of significance. (SVD-single vessel disease, DVD-double vessel disease, TVD-triple vessel disease, SD-standard deviation, Min-minimum, Max-maximum)

Table 6 presents a comparison of the CHA_2DS_2-VASc-HSF score and SYNTAX score between two study groups (Group I and Group II). Regarding the CHA_2DS_2-VASc-HSF score, Group I had a mean score of 2.68±0.92, while Group II had a mean score of 5.48±0.60 (p<0.001). In Group I, 90.0% of the participants had a low SYNTAX score (≤22), while only 35.0% of Group II participants had a low SYNTAX score and the group difference was statistically significant (p<0.001). The median SYNTAX score was 7.50 (Range 0.0 to 24.0) in Group I and 23.3 (range 0.0 to 39.0) in Group II (P value=<0.001) (Figure 3).

Table 6: Comparison of CHA_2DS_2-VASc-HSF score and SYNTAX score between the study groups (N=80).

	Group I (n=40)	Group II (n=40)	p value
CHA2DS2-VASc-HSF score			
Mean±SD	2.68±0.92	5.48±0.60	<0.001[a]
Range	1-4	5-7	
SYNTAX score			
Low Score (≤22)	36(90.0%)	14(35.0%)	<0.001[b]
Intermediate to high Score (>22)	4(10.0%)	26(65.0%)	
Mean±SD	8.96±6.47	25.24±9.22	
Median	7.50	23.3	<0.001[c]
Range	0.0-24.0	0.0-39.0	

P value obtained by [a]Unpaired t-test, [b]chi-square test, [c]Mann-Whitney-U test and, SD-standard deviation, p<0.05 considered as a level of significance. Group I = CHA_2DS_2-VASc-HSF Score ≤4, Group II = CHA_2DS_2-VASc-HSF Score >4

Figure 2 shows a strong positive correlation (ρ = 0.703) between the CHA_2DS_2-VASc-HSF score and the SYNTAX Score, which was statistically significant (p < 0.001). The higher the CHA_2DS_2-VASc-HSF score, the higher the SYNTAX score.

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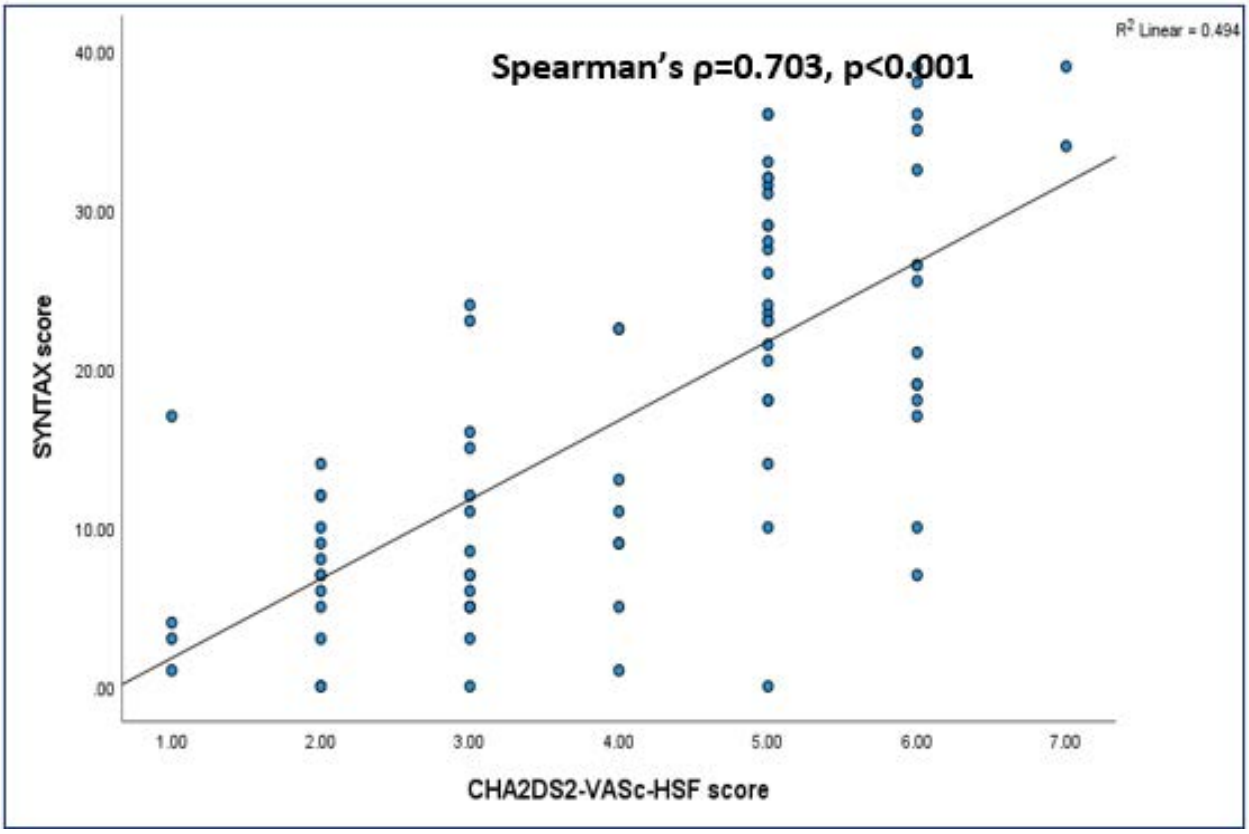

Figure 2: The Scatter plot shows a correlation between the CHA_2DS_2-VASc-HSF score and SYNTAX Score.

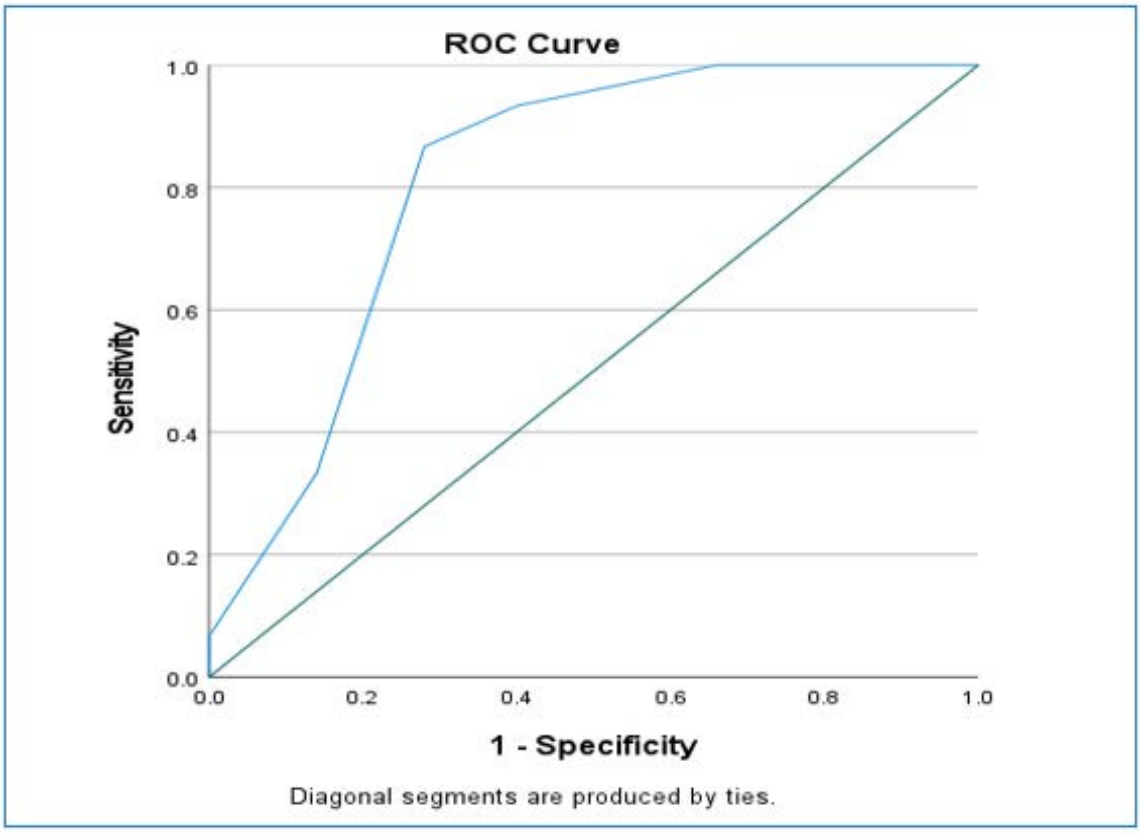

Figure 3: ROC analysis to predict the best cut-off value of CHA_2DS_2-VASc-HSF score.

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AUC-area under curve, SE-standard error, p<0.05 considered as a level of significance. ROC curve showed that a cut-off value of CHA_2DS_2-VASc-HSF score 4.5 had a sensitivity of 86.7%, and specificity of 72.0% to predict severity CAD. AUC was statistically significant (81.1%).

Discussion

The objective of the study was to investigate the association of CHA_2DS_2-VASc-HSF score with CAD severity. Following specific inclusion and exclusion criteria, this study involved 80 patients diagnosed with Non-ST-Segment Elevation Myocardial Infarction (NSTEMI), who were then categorized into two groups based on their CHA_2DS_2-VASc-HSF scores. Patients with a CHA_2DS_2-VASc-HSF score of ≤4 were designated as Group I, while those with a CHA_2DS_2-VASc-HSF score exceeding 4 were assigned to Group II. The defined cut-off point for the SYNTAX score was set at >22. In Group I, patients had an average age of 51 years, and in Group II, it was 55 years. No significant age difference was found between the two groups (P value = 0.088). Compared patients were younger, indicating a probable earlier onset of CAD in Bangladeshi individuals [13]. This study exhibited a significant male predominance, with a male-to-female ratio of 4:1. This finding aligns with similar studies, such as Cetin et al. [17] in which reported a 71% male frequency among study subjects. Male predominance in CAD has been consistently observed in various studies [12,16,18]. The higher prevalence of males in CAD studies may be influenced by factors such as limited healthcare access for females, particularly in low socioeconomic populations like our country [19]. Among the studied patients, hypertension was the most prevalent, followed by diabetes mellitus, smoking, hyperlipidemia, family history of CAD, history of vascular disease, and history of stroke in group II patients. Significantly higher rates of smoking, diabetes mellitus, hyperlipidemia, family history of CAD, history of stroke, and history of vascular disease were observed in group II compared to group I. A significant difference in smoking habits was observed between the two groups. This finding is in line with several studies that have reported similar disparities between smoker groups [14,17,20]. Sanlialp et al [14] demonstrated that a family history of CAD was significantly higher in the high CHA_2DS_2-VASc-HSF score group than low CHA_2DS_2-VASc-HSF score group (30% vs. 13%, P value 0.006) which was consistent with this study. Sunman et al [21] indicated that a family history of CAD is linked to the severity and extent of coronary atherosclerosis . In the present study, the history of stroke or TIA was higher in group II than in group I with a statistically significant difference (p=0.048) and was compatible with other studies [12,14,15,20]. Additionally, in a separate study, investigators pointed out that the risk of CAD was particularly elevated in stroke patients [22]. In this study, hyperlipidemia and vascular disease were higher in group II than in group I with a significant difference (P value <0.001 for both) which was compatible with another study Sanlialp et al [14], although some other studies showed no significant difference Rahim et al and Uysal et al [15,18]. Korkmaz et al [23] found, there was a strong correlation between the degree of peripheral artery disease and the severity of coronary atherosclerosis. The mean LDL cholesterol and RBS levels were high in group II. These findings are consistent with other similar studies [12,14]. This significant difference in RBS and LDL is likely due to more diabetic and hyperlipidemic patients in the high-score group. However, serum creatinine levels showed no significant difference between the two groups, consistent with other studies [12,14,15,17]. In this study, the burden of atherosclerosis was evaluated by SYNTAX score. SYNTAX score was significantly higher in group II (Median 23.3) than in group I (Median 7.50) with a P value of <0.001. An almost similar result was demonstrated by another study where the SYNTAX score was 24±3 in the high SYNTAX score group and 12±2 in the low SYNTAX score group [18]. In another study, the SYNTAX score was 20.24±12.38 in the low-score group and 28.46±9.67 in the high-score group [14]. Rahim et al [15] found a SYNTAX score of 28.6±4.5 in the high CHA_2DS_2-VASc-HSF score group and 11.4±5.8 in the low CHA_2DS_2-VASc-HSF group. It was found that the mean CHA_2DS_2-VASc-HSF score in group II was significantly higher than in group I (2.68±0.92 vs. 5.48±0.60, p=<0.001). The study also observed an increasing trend in the CHA_2DS_2-VASc-HSF score with higher SYNTAX scores. These findings align with previous research, including studies by Sanlialp et al. [14] and Tasolar et al. [12], which both reported a significant association between high SYNTAX scores and high CHA_2DS_2-VASc-HSF scores (6.00 vs. 3.50, p value <0.001 and 4.87±1.94 vs. 2.89±1.31, respectively). Similar trends were also noted in other studies [15,18]. Receiver operating characteristic (ROC) curve analysis determined that a CHA_2DS_2-VASc-HSF score of 4.5 is the optimal cut-off value for predicting CAD severity, with an area under the curve (AUC) of 0.811 and a 95% confidence interval (CI) ranging from 0.718 to 0.905 (P value 0.000). This cut-off value aligns with findings from other studies, including Cetin et al [17], Taşolar et al [12], and Sanlialp et al [14]. In predicting the severity of CAD, CHA_2DS_2-VASc-HSF score with a cut-off value of 4.5 demonstrated a sensitivity of 86.7%, a specificity of 72.0%. These findings are consistent with studies by Cetin et al [17] and Sanlialp et al [14], which reported similar performance metrics. Bala et al [13] and Taşolar et al [12] found comparable results but focused on predicting major adverse cardiac events (MACE). This study established a significant positive correlation (Spearman's $\rho = +0.703$, $p < 0.001$) between the CHA_2DS_2-VASc-HSF score and the SYNTAX score, indicating that higher CHA_2DS_2-VASc-HSF scores were associated with increased CAD severity, as measured by the SYNTAX score. These findings align with similar strong correlations reported in other studies, including

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Sanlialp et al. [14] (r = 0.825, p < 0.001), Al-shorbagy et al. (r = 0.4811, p < 0.01), Rahim et al [15] (r = 0.74, p < 0.001), and Taşolar et al [12] (r = 0.474, p < 0.001). However, Uysal et al. [18] reported a weaker positive correlation (r = 0.271, p < 0.001) in their study. The main findings of this study were CHA_2DS_2-VASc-HSF score was independently associated with the severity of CAD in patients with NSTEMI. A high CHA_2DS_2-VASc-HSF score was significantly associated with an increased number of vessel involvement and a high SYNTAX score (p value <0.001). CHA_2DS_2-VASc-HSF score >4 predicts severe CAD assessed by SYNTAX score with 86.7% sensitivity and 72.0% specificity (AUC: 0.811, 95% CI: 0.718-0.905, p value 0.000). In clinical practice, straightforward risk scores are more appreciated during risk assessment. The ideal risk score should be easy to calculate and effective for rapid screening of high-risk patients to prevent adverse outcomes. This is why the CHA_2DS_2-VASc-HSF risk scoring systems may play an important role as predictive models. They are user-friendly for healthcare professionals and do not add extra costs to routine practice, making them practical risk assessment tools.

Conclusion

This study demonstrated a significant association between the CHA_2DS_2-VASc-HSF score and the severity of CAD in NSTEMI patients. Patients with higher CHA_2DS_2-VASc-HSF scores tended to have higher SYNTAX scores, indicating a more severe coronary artery disease.

Limitations

- The sampling method used was not random but purposive, which introduces the potential for selection bias.
- It's important to note that this study was limited to a single center and may not accurately reflect the broader population's characteristics and experiences.
- Assessment of coronary angiography relied on visual observation, increasing the possibility of interobserver variation in the results.
- The sample size was quite small, making it challenging to draw general conclusions from the findings.

Recommendations

- The CHA_2DS_2-VASC-HSF score can be used as a valuable risk assessment tool for evaluating the prognosis and severity of CAD in NSTEMI patients.
- To further investigate the relationship between the CHA_2DS_2-VASC-HSF score and CAD severity, large-scale, randomized, and multi-center studies are warranted.

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