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Original article

Comparison of Novel Risk Score CHA2DS2-VASc-HSF to CHADS2and CHA2DS2-VASc Scores to Predict the Risk of Severe Coronary Artery Disease

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Abstract

Background: Risk assessment tools play a pivotal role in predicting the severity of coronary artery disease in patients. The CHA2DS2-VASc and CHADS2 scores have been commonly used for such predictions, but they may benefit from an expanded risk factor profile. This study aimed to improve the validity of the CHA2DS2-VASc score by including new major risk factors of CAD which are hyperlipidemia (H), smoking (S), and family history of CAD (F) and compare it with CHADS2 and CHA2DS2-VASc scores to predict severe CAD in the patients. **Methods:** This prospective observational study was conducted at the Cardiology Department of Benha Insurance Hospital on 250 patients undergoing invasive coronary angiography. Data collection included medical history, physical examinations, laboratory tests, and echocardiography. The Gensini scoring method was employed to evaluate the severity of CAD. The CHA2DS2-VASc-HSF score was calculated. Patients were classified according to the severity of stenosis into 3 groups. Group A: 131 patients with mild to moderate CAD, Group B: 83 patients with severe CAD, and Group C: 36 patients who didn't show stenosis in angiography. **Results:** The CHA2DS2-VASc-HSF score is superior to the CHADS2 and CHA2DS2 scores for prediction of severe CAD. The CHA2DS2-VASc-HSF score showed an AUC of 0.789, with a sensitivity of 89% and specificity of 59% at a cut-off value of >3, outperforming the other scores. **Conclusions:** Incorporating additional risk factors, such as hyperlipidemia, smoking, and family history of CAD, into the CHA2DS2-VASc score (CHA2DS2-VASc-HSF) enhances its predictive accuracy for severe CAD.

Keywords: Severe coronary artery disease; Risk assessment; CHA2DS2-VASc; CHADS2; CHA2DS2-VASc-HSF.

Introduction

Coronary artery disease (CAD) remained the top cause of mortality and morbidity for a person aged 35 and over worldwide. Failure to detect CAD and provide early treatment may cause CAD treatment to become more expensive and higher mortality rate. It is estimated that around one-third of the middle age's population in the USA will suffer from CAD manifestation [1].

Determining the best risk factor assessment for CAD is extremely important for early prevention and treatment. The screening for CAD using angiography is easily available in developed countries with short waiting lists [2].

However, in developing countries, the awareness and accessibility of cardiovascular disease screening are still low. To obtain cost-effective prevention and treatment of CAD at the patient level, stratification of the cardiovascular risk using a simple method is extremely important. Cardiovascular risk screening will have a relevant implication for decision making in early referral and healthcare resource allocation [3].

At present, CHADS2 and CHA2DS2-VASc scores have been established as clinical predictors for cardiac thromboembolism and indication of antithrombotic therapy. Both CHADS2 and CHA2DS2-VASc component has similarities with the risk factors of CAD development [4].

The components within the CHADS2 score also had been proven in large cohort studies to be associated with CAD in ischemic stroke patients, while CHA2DS2-VASc is the refinement of CHADS2 score, which has been proven to outperform its predecessor in the various patient group, including AF patient who received elective electrical cardioversion. This suggests CHA2DS2-VASc score may predict the risk for both cerebrovascular and cardiovascular diseases. However, these scores did not include the major risk factors of CAD such as smoking, hyperlipidemia, and family histories [5].

This study aimed to evaluate the predictive ability of the CHA2DS2-VASc HSF score compared to CHADS2 and CHA2DS2-VASc scores in predicting the severity of CAD.

Patients and Methods

Patients:

This prospective observational study was conducted at the Cardiology Department of Benha Insurance Hospital. The study included 250 patients who had undergone invasive coronary angiography for suspected coronary artery disease, and these patients were selected from those attending the outpatient clinic between August 2022 and February 2023. Ethical approval for this study was obtained from the Ethics Committee of the Faculty of Medicine at Benha University {M.D.1.3.2022}.

Patient selection criteria for this study included the following inclusion criteria: participants had to be over 18 years of age, of both sexes, and must have presented with coronary artery disease (CAD), with a plan for invasive coronary

angiography due to suspected CAD. However, exclusion criteria were infectious processes within 2 weeks prior to catheterization, hepatic dysfunction, thyroid dysfunction, cancer, chronic kidney disease, patient refusal to participate, and patients classified as NYHA class IV.

Methods

Informed Consent and Patient History:

All patients included in this study provided written informed consent. Comprehensive patient history was taken, focusing on the presence of coronary artery disease, New York Heart Association (NYHA) class at hospital presentation, and various risk factors such as hypertension, diabetes mellitus, dyslipidemia, smoking, comorbidities, and current medications, including heart failure treatment.

Physical Examination and Laboratory Tests:

Patients underwent a thorough general and abdominal examination, including the assessment of weight, height, body mass index (BMI), vital signs, and general and local indicators to exclude decompensation. Complete blood counts (CBC) were conducted. Standard laboratory tests measured fasting blood glucose (FBG), total cholesterol, and renal function from blood samples. Additionally, creatinine serum levels and lipid profiles were assessed.

Echocardiography Data:

Echocardiography data were collected using a system V (Vingmed, GE, Horten, Norway) equipped with a 2.5-MHz phased-array transducer. Echocardiograms were obtained from patients in the left lateral decubitus position by two experienced cardiologists following the latest guidelines. Left ventricular ejection fraction (LVEF) was calculated using the Modified Simpson's method [6].

Risk Scoring Assessment:

CHA2DS2-VASc-HSF Score: The CHA2DS2-VASc-HSF score is a composite scoring system that considers congestive cardiac failure (C), hypertension (H), age >75 years (A), diabetes mellitus (D), stroke (S), vascular diseases (V), age 65-74 years (A), sex category (Sc), hyperlipidemia (H), smoking (S), and family history of cardiovascular disease (F). Scores were obtained through a thorough examination of medical records. Each factor was assigned a point based on specific criteria, such as reduced LVEF for congestive cardiac failure or specific blood pressure values for hypertension. The CHA2DS2-VASc-HSF score stratifies patients based on their risk factors [7].

CHA2DS2 Score: The CHA2DS2 score assigns points based on the presence of chronic heart failure, age >75 years, diabetes mellitus, and hypertension, with additional points given for a history of stroke or transient ischemic attack (TIA). In the CHA2DS2-VASc-HSF score, age 65-74 years is assigned 1 point (A), and age >75 years is assigned 2 points (A2). Additional points are awarded for the presence of hyperlipidemia (h), smoking (S), and a family history of cardiac disease (F).

CHADS2 Score: The CHADS2 score is a commonly used method for stratifying stroke risk in atrial fibrillation (AF) patients. It assigns scores as follows: chronic heart failure, hypertension, diabetes, and age >74 years count for one point each, while a previous history of stroke or TIA counts as two points. A score of 0 indicates low risk, 1 point is moderate risk, and more than one point indicates high risk [8].

CHADS2-VASc Score: The CHADS2-VASc score helps stratify the risk of stroke in AF patients. It assigns points for congestive heart failure, hypertension, age ≥75 (doubled), diabetes, stroke (doubled), vascular disease, age 65 to 74, and female sex category. Points are awarded for medical history of stroke, TIA, or thromboembolism and for age over 75. Additional points are given for age 65-75, hypertension, diabetes, heart failure, vascular disease, and female sex. Patients are categorized into low, medium, or high-risk groups based on their CHA2DS2-VASc score [9].

Coronary Angiography

Procedure: Coronary angiography was performed using the Judkins technique 4 and 5-F catheters. Kodak 35-mm cinefilm recorded images at 30 frames per second. A computer-assisted coronary angiography analysis system was employed to detect coronary stenosis, one minute after the injection of ISDN (2.5 mg/5 mL for 20 s) through the Judkins catheter [10].

Gensini Scoring: Coronary atherosclerosis severity was assessed using the Gensini scoring method. The Gensini score was calculated for each patient based on the severity of coronary occlusion. The scoring system assigns points for different degrees of narrowing, with higher scores indicating more severe occlusions. The score is then multiplied based on the location and importance of the artery, with specific factors for left main coronary artery, proximal circumflex artery, proximal left anterior descending artery, mid-left anterior descending artery, distal left anterior descending artery, and the right coronary artery [11].

Statistical analysis:

The collected data underwent a meticulous process of review, coding, and tabulation using the Statistical Package for Social Science (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.). Subsequently, the data were presented and subjected to appropriate analyses tailored to the nature of each parameter. The normality of data distribution was assessed using the Shapiro-Wilk test. Descriptive statistics, including mean, standard deviation (± SD), median, and range for numerical data, as well as frequency and percentage for non-numerical data, were calculated. The significance of results was determined with a p-value considered significant if it was less than 0.05 at a 95% confidence interval.

Results

Baseline characteristics and clinical data of the study participants were shown in **Table 1**.

Patients were then classified according to the severity of stenosis according to Gensini score into 3 groups. **Group A:** 131 patients with mild to moderate CAD, **Group B:** 83 patients with severe CAD, and **Group C:** 36 patients who didn't show stenosis in angiography. **Table 2.**

Age was significantly higher in groups A and B compared to group C, but there was no significant difference between groups A and B. The number of males were significantly higher in group B compared to groups A and C, but there was no significant difference in sex between both groups A and C. BMI was significantly higher in group B compared to groups A and C and was significantly higher in group A compared to group C. **Table 2.**

There was no significant difference in HTN, DM, ischemic stroke, CHF, and family history of CAD between the studied groups. The number of patients with hyperlipidemia, vascular disease, and who are smokers were significantly higher in group B compared to groups A and C, but there was no significant difference between groups A and C. **Table 2.**

Regarding the blood pressure in the studied groups, SBP and DBP were significantly higher in group B compared to groups A and C, but there was no significant difference between groups A and C. Total cholesterol, LDL, HDL, and TG were significantly higher in group B compared to groups A and C, but there was no significant difference between groups A and C. LVEDD and LVESD were significantly higher in group B compared to groups A and C and was significantly higher in group A compared to group C. EF was significantly lower in group B compared to group C, but there was no significant difference between groups A and B and between groups A and C. Table 3.

CHADS2 score was significantly higher in group B compared to groups A and C, but there was no significant difference between groups B and C. CHA2DS2-VASc and CHA2DS2-VASc-HSF scores were significantly higher in group B compared to groups A and C and was significantly higher in group A compared to group C. **Table 4.**

CHADS2 is a significant predictor of severe coronary artery disease (AUC: 0.657, p value <0.001). At a cut-off value of >1 it can predict severe coronary artery disease with a sensitivity of 54% and specificity of 67%.

CHA2DS2-VASc is a significant predictor of severe coronary artery disease (AUC: 0.664, p value <0.001). At a cut-off value of >2 it can predict severe coronary artery disease with a sensitivity of 57% and specificity of 65%. CHA2DS2-VASc-HSF is a significant predictor of severe coronary artery disease (AUC: 0.789, p value <0.001). At a cut-off value of >3 it can predict severe coronary artery disease with a sensitivity of 89% and specificity of 59%. In comparison of the AUC of the three scores, CHA2DS2-VASc-HSF was found to be a significantly better predictor of severe coronary artery disease compared to CHADS2 and CHA2DS2-VASc. **figure 1.**

In a logistic regression model, the CHADS2 score was significantly associated with severe coronary artery. The odds ratio for severe coronary artery with a 1-point increase in CHADS2 score was 1.63 (95% CI 1.24 to 2.15). The CHA2DS2-VASc score was significantly associated with severe coronary artery. The odds ratio for severe coronary artery with a 1-point increase in CHA2DS2-VASc score was 1.58 (95% CI 1.27 to

1.96). The CHA2DS2-VASc-HSF score was significantly associated with severe coronary artery. The odds ratio for severe coronary artery with a 1-point increase in CHA2DS2-VASc-HSF score was 2 (95% CI 1.62 to 2.47). **Table 5 and figure 2.**

Table 1: Baseline characteristics and clinical data of the study participants

		Study participants (n =250)
Age (years)	**Mean ± SD**	64.1 ± 9.8
	Range	33 – 85
Sex	**Male**	177 (71%)
	Female	73 (29%)
BMI (kg/m^2) (kg/m^2)	**Mean ± SD**	34.6 ± 3.4
	Range	27 – 44
HTN	**Yes**	115 (46%)
	No	135 (54%)
Hyperlipidemia	**Yes**	142 (56.8%)
	No	108 (43.2%)
DM	**Yes**	97 (38.8%)
	No	153 (61.2%)
Vascular disease	**Yes**	31 (12.4%)
	No	219 (87.6%)
Ischemic stroke	**Yes**	38 (15.2%)
	No	212 (84.8%)
CHF	**Yes**	36 (14.4%)
	No	214 (85.6%)
Family history of CAD	**Yes**	35 (14%)
	No	215 (86%)
Smoking	**Yes**	128 (51.2%)
	No	122 (48.8%)
SBP (mmHg)	**Mean ± SD**	130 ± 19
	Range	105 – 175
DBP (mmHg)	**Mean ± SD**	87.2 ± 9.2
	Range	70 – 110
HR (beat/minute)	**Mean ± SD**	79.3 ± 7.9
	Range	65 – 95
Total cholesterol (mg/dL)	**Mean ± SD**	228 ± 54
	Range	150 – 350
LDL (mg/dL)	**Mean ± SD**	150 ± 28
	Range	91 – 200
HDL (mg/dL)	**Mean ± SD**	48 ± 9.9
	Range	35 – 65
TG (mg/dL)	**Mean ± SD**	245 ± 99
	Range	120 – 495
LVEDD (mm)	**Mean ± SD**	51 ± 3.9
	Range	42 – 59
LVESD (mm)	**Mean ± SD**	33 ± 3.5
	Range	27 – 39
EF (%)	**Mean ± SD**	59 ± 2.8
	Range	55 – 68

SD: Standard deviation, BMI: Body mass index, HTN: Hypertension, DM: Diabetes mellites, CHF: Congestive heart failure, CAD: Coronary artery disease, SBP: Systolic blood pressure, DBP: Diastolic blood pressure, HR: Heart rate, LDL: Low density lipoprotein, HDL: High density lipoprotein, TG: Triglycerides.

Table 2: Baseline characteristics, Medical and personal history between the studied groups

		Group A (n =131)	Group B (n =83)	Group C (n =36)	P value
Age (years)	**Mean ± SD**	63.8 ± 9.6	66.7 ± 8.3	58.5 ± 8.3	**<0.001***
	Range	33 - 85	47 - 81	38 - 80	P1: 0.053
					P2: **0.004***
					P3: **<0.001***
Sex	**Male**	86 (66%)	65 (78%)	19 (53%)	**0.016***
	Female	45 (34%)	18 (22%)	17 (47%)	P1: **0.048***
					P2: 0.157
					P3: **0.005***
BMI (kg/m^2)	**Mean ± SD**	33.8 ± 3.1	37.1 ± 2.8	31.5 ± 2	**<0.001***
	Range	29 - 39	32 - 44	27 - 35	P1: **<0.001***
					P2: **<0.001***
					P3: **<0.001***
Medical and personal history					
HTN	**Yes**	59 (45%)	44 (53%)	12 (33%)	0.134
	No	72 (55%)	39 (47%)	24 (67%)	
Hyperlipidemia	**Yes**	65 (50%)	61 (73%)	16 (44%)	**<0.001***
	No	66 (50%)	22 (27%)	20 (56%)	P1:**<0.001***
					P2: 0.582
					P3: **0.002***
DM	**Yes**	50 (38%)	36 (43%)	11 (31%)	0.409
	No	81 (62%)	47 (57%)	25 (69%)	
Vascular disease	**Yes**	7 (5%)	23 (28%)	1 (3%)	**<0.001***
	No	124 (95%)	60 (72%)	35 (97%)	P1: **<0.001***
					P2: 0.523
					P3: **0.002***
Ischemic stroke	**Yes**	18 (14%)	17 (20%)	3 (8%)	0.189
	No	113 (86%)	66 (80%)	33 (92%)	
CHF	**Yes**	15 (11%)	18 (22%)	3 (8%)	0.062
	No	116 (89%)	65 (78%)	33 (92%)	
Family history of CAD	**Yes**	16 (12%)	16 (19%)	3 (8%)	0.199
	No	115 (88%)	67 (81%)	33 (92%)	
Smoking	**Yes**	62 (47%)	54 (65%)	12 (33%)	**0.003***
	No	69 (53%)	29 (35%)	24 (67%)	P1: **0.011***
					P2: 0.134
					P3: **0.001***

SD: Standard deviation, BMI: Body mass index, P1: Significance between groups A and B, P2: Significance between groups A and C, P3: Significance between groups B and C, HTN: Hypertension, DM: Diabetes mellites, CHF: Congestive heart failure, CAD: Coronary artery disease., P1: Significance between groups A and B, P2: Significance between groups A and C, P3: Significance between groups B and C, *Statistically significant.

Table 3: Vital signs, Lipid profile and Echocardiography data between the studied groups

		Group A (n =131)	Group B (n =83)	Group C (n =36)	P value
SBP (mmHg)	**Mean ± SD**	128.5 ± 16.9	137.7 ± 22	123.9 ± 15.8	**<0.001***
	Range	105 - 160	105 - 175	100 - 155	P1: **0.009*** P2: 0.475 P3:**0.002***
DBP (mmHg)	**Mean ± SD**	85.8 ± 8.7	90.5 ± 9.3	84.4 ± 8.7	**<0.001***
	Range	75 - 105	80 - 110	70 - 105	P1: **0.001*** P2: 1.000 P3: **0.003***
HR (beat/minute)	**Mean ± SD**	78.5 ± 7.5	84.1 ± 6.2	70.9 ± 4.4	**<0.001***
	Range	65 - 90	75 - 95	65 - 80	P1: **<0.001*** P2: **<0.001*** P3: **<0.001***
Lipid profile					
Total cholesterol (mg/dL)	**Mean ± SD**	211.3 ± 42.4	265.9 ± 57.2	204.4 ± 37	**<0.001*** P1: **<0.001***
	Range	150 - 296	153 - 350	150 - 284	P2: 1.000 P3: **<0.001***
LDL (mg/dL)	**Mean ± SD**	144.3 ± 25.2	165 ± 29.8	140.9 ± 22.5	**<0.001***
	Range	91 - 180	91 - 200	100 - 176	P1: **<0.001*** P2: 1.000 P3: **<0.001***
HDL (mg/dL)	**Mean ± SD**	49.2 ± 10.3	44.7 ± 8.3	50.3 ± 10.1	**<0.001***
	Range	35 - 65	35 - 65	35 - 65	P1: **0.017*** P2: 1.000 P3: **0.029***
TG (mg/dL)	**Mean ± SD**	232.4 ± 87.7	289 ± 114.3	187.6 ± 50.1	**<0.001***
	Range	120 - 441	135 - 495	120 - 337	P1: **<0.001*** P2: 0.086 P3: **<0.001***
Echocardiography data					
LVEDD (mm)	**Mean ± SD**	50.4 ± 3.3	53.5 ± 3	46.3 ± 3.2	**<0.001***
	Range	45 - 56	48 - 59	42 - 51	P1: **<0.001*** P2: **<0.001*** P3: **<0.001***
LVESD (mm)	**Mean ± SD**	33 ± 3.4	35 ± 2.5	30.8 ± 2.7	**0.016***
	Range	28 - 39	31 - 39	27 - 35	P1: **<0.001*** P2: **0.002*** P3: **<0.001***
EF (%)	**Mean ± SD**	59.5 ± 2.9	58.8 ± 2.2	60.8 ± 3.2	**0.011***
	Range	55 - 64	55 - 62	57 - 68	P1: 0.225 P2: 0.222 P3:**0.009***

SD: Standard deviation, SBP: Systolic blood pressure, DBP: Diastolic blood pressure, HR: Heart rate, BMI: Body mass index, P1: Significance between groups A and B, P2: Significance between groups A and C, P3: Significance between groups B and C, *Statistically significant.

Table 4: CHADS2, CHA2DS2-VASc, and CHA2DS2-VASc-HSF scores values in the studied groups

		Group A (n =131)	Group B (n =83)	Group C (n =36)	P value
CHADS2	**Median (IQR)** **Range**	1 (1 - 2) 0 - 6	2 (1 - 2) 1 - 4	1 (0 - 1) 0 - 3	**<0.001*** P1: **0.002*** P2: 0.095 P3: **<0.001***
CHA2DS2-VASc	**Median (IQR)** **Range**	2 (1 - 3) 0 - 8	3 (2 - 4) 1 - 7	2 (1 - 2) 0 - 4	**0.016*** P1: **0.002*** P2: **0.046*** P3: **<0.001***
CHA2DS2-VASc-HSF	**Median (IQR)** **Range**	3 (3 - 5) 0 - 8	5 (4 - 6) 1 - 8	2 (2 - 3) 0 - 6	**<0.001*** P1: **<0.001*** P2: **<0.001*** P3: **<0.001***

SD: Standard deviation, BMI: Body mass index, P1: Significance between groups A and B, P2: Significance between groups A and C, P3: Significance between groups B and C, *Statistically significant.

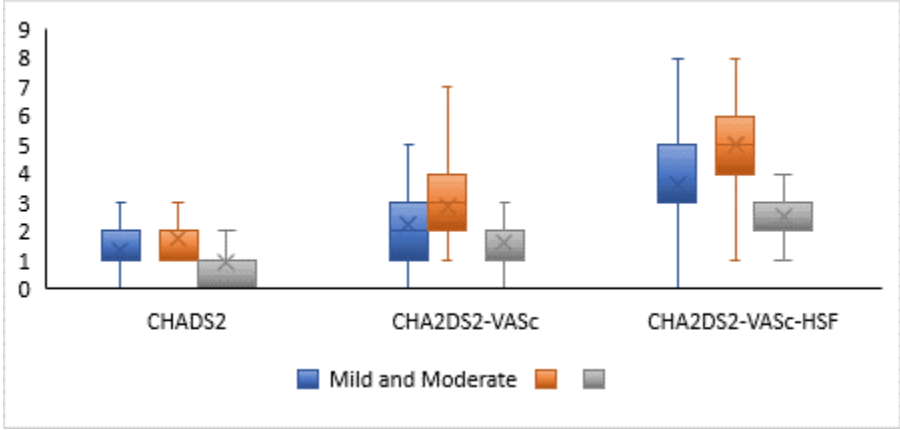

Figure 1: CHADS2, CHA2DS2-VASc, and CHA2DS2-VASc-HSF scores values in the studied groups

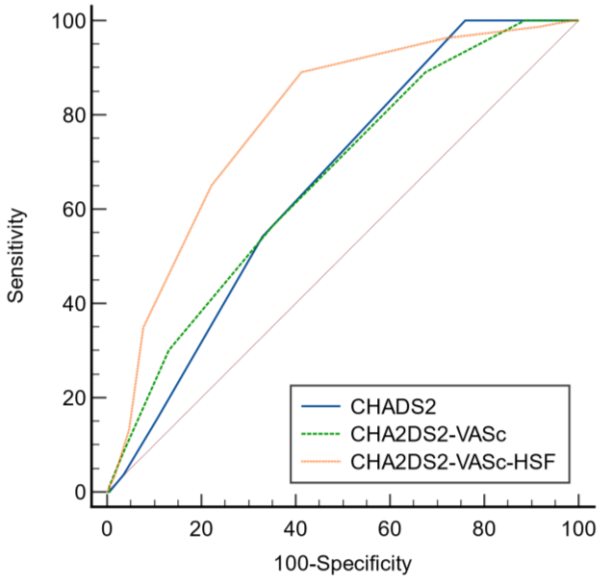

Figure 2: ROC curve analysis of the thromboembolic risk scores in the prediction of severe coronary artery disease in the study participants

Table 5: Logistic regression analysis of CHADS2, CHA2DS2-VASc, and CHA2DS2-VASc-HSF scores for the prediction of severe coronary artery disease

	OR (95% CI)	P value
CHADS2	1.63 (1.24 – 2.15)	**<0.001***
CHA2DS2-VASc	1.58 (1.27 - 1.96)	**<0.001***
CHA2DS2-VASc-HSF	2 (1.62 to 2.47)	**<0.001***

OR: Odds ratio, CI: Confidence interval, *Statistically significant.

Discussion

In the current study, groups A and B had significantly higher average ages compared to group C, but there was no significant age difference between groups A and B. Group B had significantly more males compared to groups A and C, while there was no significant difference in sex between groups A and C. BMI was significantly higher in group B compared to groups A and C, and it was also significantly higher in group A compared to group C.

Also, a study was conducted [5] on 210 patients who underwent coronary angiography, categorizing them into three groups: normal angiogram, mild CAD, and severe CAD. They found that age was a differentiating factor, with those in the severe CAD group being older.

Similarly, scientists [12] studied the association between the CHA2DS2-VASc-HSF score and ACS severity using the Gensini score. They also compared the diagnostic value of various scores for ACS. They noted a slightly higher median age in the ACS group compared to the control group.

Another study [13] investigated the use of CHADS2 and CHA2DS2-VASc scores, along with a newly defined CHA2DS2-VASc-HS score, to predict CAD severity. The youngest patients were in the group with normal coronary angiograms, followed by the group with mild CAD, and the oldest were in the severe CAD group.

In the studied groups, there were no significant differences in the prevalence of HTN, DM, ischemic stroke, CHF, or family history of CAD. However, group B had significantly more patients with hyperlipidemia, vascular disease, and smokers compared to groups A and C, with no significant difference between groups A and C.

In our study, it was observed that hyperlipidemia, diabetes, and hypertension increased across their groups. Statistically significant differences were found between Groups 1 and 3, as well as Groups 2 and 3. Smoking prevalence was significantly higher in Group 3 compared to Group 2. The percentage of patients with diabetes and hypertension also increased from Group 1 to Group 3, with significant differences between Groups 1 and 3 and between Groups 2 and 3. Family history showed a statistically significant difference between Groups 1 and 2 but not between Groups 1 and 3 or Groups 2 and 3.

It was also found that the ACS group had significantly higher rates of hypertension, dyslipidemia, T2DM, vascular disease, and a history of ischemic stroke compared to the control group. A notably higher incidence of previous MI in the ACS group was proved. Family history of CAD showed no significant differences between the two groups [12].

In terms of blood pressure, group B had significantly higher SBP and DBP compared to groups A and C, while there was no significant difference between groups A and C.

In a study done 2022 [12], a significantly higher systolic blood pressure in the ACS group compared to the control group, with a notable difference. Diastolic blood pressure did not significantly differ between the two groups.

Conversely, in another study [5] there were no significant differences in blood pressure (both SBP and DBP) across the three groups.

In group B, total cholesterol, LDL, HDL, and TG levels were significantly higher compared to groups A and C, but no significant differences were observed between groups A and C.

Similar findings were reported, with total cholesterol, LDL, and HDL significantly higher in the severe group compared to the mild and normal groups. However, triglyceride levels did not differ significantly between the studied groups [13].

In the study done on 2022 [12], triglyceride levels were significantly higher in the ACS group compared to the Control group, while HDL-C levels were notably lower in the ACS group. Additionally, LDL-C levels were significantly elevated in the ACS group.

Regarding left ventricular measurements, LVEDD and LVESD were significantly higher in group B compared to groups A and C, and group A had significantly higher values than group C. EF was significantly lower in group B compared to group C, but there were no significant differences between groups A and B or between groups A and C.

A similar trend, with the left ventricular end-diastolic diameter and left ventricular systolic diameter being significantly higher in the ACS group compared to the control group was observed [12].

In group B, the CHADS2 score was significantly higher compared to groups A and C, while there was no significant difference between groups B and C. Both the CHA2DS2-VASc and CHA2DS2-VASc-HSF scores were significantly higher in group B compared to groups A and C, and the scores were also significantly higher in group A compared to group C.

Similarly significantly higher CHADS2, CHA2DS2-VASc, and CHA2DS2-VASc-HSF scores in patients with severe CAD compared to those with normal angiography was reported [5].

It was reported that the ACS group had significantly higher CHADS2,

CHA2DS2-VASc, and CHA2DS2-VASc-HSF scores compared to the control group. These scores exhibited different sensitivities and specificities at specific cutoff points [12].

In accordance with these findings, a group of scientists observed that the CHA2DS2-VASc-HS score was the most effective in predicting CAD severity, with a specific cutoff value yielding a high sensitivity and moderate specificity [13].

The CHA2DS2-VASc-HSF score showed a higher area under the curve (AUC) compared to the CHADS2 and CHA2DS2-VASc scores, suggesting its superior predictive value for severe CAD [5].

In line with the previous studies, it was demonstrated that the AUC for the CHADS2, CHA2DS2-VASc, and CHADS2-VASc-HSF scores varied, with specific sensitivities and specificities at different cutoff points [12].

In logistic regression models, the CHADS2 score was significantly associated with severe CAD, with an odds ratio of 1.63 (95% CI 1.24 to 2.15) for a 1-point increase. The CHA2DS2-VASc score also showed a significant association with severe CAD, with an odds ratio of 1.58 (95% CI 1.27 to 1.96) for a 1-point increase.

This research aimed to assess the predictive value of CHA2DS2-VASc-HSF scores for severe CAD. The study found that the CHA2DS2-VASc-HSF score had the highest odds ratio for predicting severe CAD compared to CHADS2 and CHA2DS2-VASc, with an odds ratio of 2 (95% CI 1.62 to 2.47) for a 1-point increase.

Consistent with these findings, another study identified CHADS2, CHA2DS2-VASc, and CHA2DS2-VASc-HSF scores as significant predictors for severe CAD [5].

Regarding the utilization [12] logistic regression models to analyse risk factors for ACS and observed that the CHADS2, CHA2DS2-VASc, and CHA2DS2-VASc-HSF scores were significantly higher in the ACS group compared to the control group. An increased CHA2DS2-VASc-HSF score was identified as an independent risk factor for ACS, indicating its ability to predict ACS severity.

In a study done previously [14], the CHA2DS2-VASc-HSF score demonstrated a stronger and significant correlation with CAD severity, as measured by the Syntax Score, in patients with non-ST segment elevation myocardial infarction (NSTEMI) compared to CHADS2 and CHA2DS2-VASc scores, underscoring its superior association with CAD severity.

In 2019 [15] a group of researchers introduced the CHA2DS2-VASc-FSH score, which includes family history, hyperlipidemia, and smoking, and found that it independently predicted severe CAD. This score showed good sensitivity and specificity for severe CAD, while the CHA2DS2-VASc score was correlated with severe CAD only in univariate analysis and did not independently predict it in multivariate analysis.

The transition from CHADS2 to CHA2DS2-VASc and further refinement into CHA2DS2-VASc-HSF demonstrated improved predictive power for severe CAD, suggesting that the addition of these factors enhances the prediction of CAD risk [16, 17].

Conclusion

The novel CHA2DS2-VASc-HSF score, incorporating hyperlipidemia, smoking, and family history of CAD, demonstrates superior predictive validity for severe coronary artery disease compared to the CHADS2 and CHA2DS2-VASc scores. This revised risk assessment tool holds promise for refining CAD risk prediction in clinical practice.

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