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ORIGINAL ARTICLE

CHA_2DS_2-VASc-HSF Score Calculation and its Comparison with the Severity of Coronary Artery Disease (CAD) in Patients Undergoing Coronary Angiography

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Abstract

Background: CHA_2DS_2-VASc score has been widely used in atrial fibrillation patients to predict the risk of thromboembolism. The new CHA_2DS_2-VASc-HSF score has additional risk factors of atherosclerosis and thus evaluates the risk of CAD and predict its severity. Our study aims to assess CHA_2DS_2-VASc-HSF score and compare it with the severity of CAD by Gensini score among Nepalsese population.

Methods: This is a prospective, hospital based, cross-sectional observational study conducted in SGNHC and Bir Hospital, Kathmandu, Nepal. Our study included 100 patients who underwent coronary angiography for the diagnosis of CAD after meeting inclusion criteria from July 2023 to June 2024. CHA_2DS_2-VASc and CHA_2DS_2-VASc-HSF score were calculated in all patients and compared to vessel score and Gensini score.

Results: Out of 100 patients, 55 patients were males and 45 patients were females. The most common risk factor was hypertension. Majority of patients having CHA_2DS_2-VASc score ³2 and CHA_2DS_2-VASc-HSF score ³2.5 had severe CAD (p-value <0.001). 91.4% and 97.1% patients having severe CAD had a CHA_2DS_2-VASc score ³2 and CHA_2DS_2-VASc-HSF score ³2.5 respectively. Similarly, many patients with CHA_2DS_2-VASc-HSF score <2.5 did not have any CAD (94.7%) or had mild CAD (73.9%) (p-value <0.001).

Conclusion: CHA_2DS_2-VASc-HSF score is a convenient and useful diagnostic tool for early prediction of CAD and its severity, more so in resource limited setting.

Keywords: CHA2DS2VASc, CHA2DS2VAScHSF, Coronary Artery Disease (CAD), coronary angiography

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Introduction:

Coronary Artery Disease (CAD) is one of the major causes of morbidity and mortality worldwide, especially among those aged 35 years or older[1,2]. Hypertension, diabetes mellitus, obesity, hyperlipidemia and older age are among the major risk factors for development of CAD[3]. Therefore, risk factor assessment, their prevention and treatment of CAD is of utmost importance. Due to the widespread availability of angiography in developed countries, screening for CAD is easily available. In contrast, patients from developing countries like Nepal do not have an easy access to angiography for detection of CAD. Thus, stratification of cardiovascular risk for prevention and treatment of CAD using simple method is needed which can easily be applied by primary care physicians in resource limited settings.

Currently, CHA_2DS_2-VASc score is considered as a clinical predictor for cardiac thromboembolism and indication for antithrombotic and anticoagulant therapy in patients with atrial fibrillation[4]. CHA_2DS_2-VASc score includes congestive heart failure (C), hypertension (H), age >75 years (A), diabetes mellitus (D), stroke or TIA (S), vascular diseases (V), age 65-74 years (A), female as sex category (Sc). The risk factors for development of CAD and the components

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of CHA_2DS_2-VASc score share similarities[5]. However, other major risk factors of CAD like hyperlipidemia, smoking and family history of CAD are not included in this score. Therefore, a new score CHA_2DS_2-VASc-HSF has been introduced which includes hyperlipidemia (H), smoking (S) and family history of CAD (F) in addition to aforementioned risk factors to assess the risk of CAD.

During patient evaluation for presence of CAD, traditional risk factors are taken into account subjectively. However, this score can provide an objective measure which may help identify patients with higher likelihood of having a CAD. CHA_2DS_2-VASc-HSF score can be a handy tool in resource limited healthcare facilities, but has not been widely studied for this purpose. Therefore, our study aims to calculate CHA_2DS_2-VASc-HSF score with the help of clinical and demographic parameters and to compare it with CAD severity in all patients undergoing coronary angiography.

Materials and Methods:

Our study was a hospital based, cross-sectional observational study conducted at Bir Hospital and Shahid Gangalal National Heart Centre (SGNHC), Kathmandu, Nepal from July, 2023 to June, 2024.

Sample size calculation:

Sample size is calculated by the formula: n, $n = \frac{Z^2pq}{d^2}$ where

n= required sample size

z= 1.96 at 95% confidence interval

p= prevalence of coronary artery disease (CAD); q= 100 – p

d= 8 % of maximum tolerable error

The prevalence of CAD based on a study "A study of cardiovascular disease pattern of admitted cases in newly emerged national heart centre" by Limbu et. al. was 21%. Similarly, another study titled "Coronary Artery Disease in Bangladesh" published in Indian Heart Journal also demonstrated the prevalence of CAD to be between 1.85 to 19.6%. The data were identical in both the articles. According to Nepalese data, taking prevalence of CAD to be 21%, a sample size of 100 has been estimated.

A total of 100 consecutive patients admitted in wards or those attending outpatient department of the hospitals were enrolled after obtaining informed consent. Patients above 18 years undergoing coronary angiography were included, whereas those with a history of Percutaneous Coronary Intervention (PCI), Coronary Artery Bypass Graft (CABG), congenital heart diseases, valvular heart diseases, arrhythmia (Atrial Fibrillation) or renal disease were excluded. Demographic and clinical data including age, gender, history, physical examination, risk factors (like hypertension and diabetes mellitus), fasting lipid profile or history of lipid lowering drugs, electrocardiography (ECG) and echocardiography were recorded.

CHA_2DS_2-VASc and CHA_2DS_2-VASc-HSF score were then calculated. CHA_2DS_2-VASc score includes congestive heart failure (C), hypertension (H), age >75 years (A), diabetes mellitus (D), stroke or TIA (S), vascular diseases (V), age 65-74 years (A), female as sex category (Sc). C, H, D, V, Sc and A 65-74 years are assigned 1 point each; whereas, A >75 years and S were assigned 2 points each when present. Hyperlipidemia (H), smoking (S) and family history (F) are three additional categories along with male gender (instead of female) in CHA_2DS_2-VASc-HSF score which were assigned 1 point each. Congestive heart failure (C) is defined as signs/ symptoms of heart failure confirmed with objective evidence of cardiac dysfunction, hypertension (H) as systolic and diastolic blood pressure ≥140/90 mm Hg or taking anti-hypertensive medications, diabetes mellitus (D) as fasting blood glucose level >126 mg/dL or taking anti-diabetic medications, vascular disease (V) as peripheral artery disease (PAD) including prior revascularization or angiographic evidence of aortic plaque, hyperlipidemia (H) as increased level of low density lipoprotein cholesterol (LDL-C) according to National Cholesterol Education Program-3 recommendations or using lipid lowering medications, smoking (S) as >10 cigarettes a day for at least one year without an attempt to quit, and family history of CAD (F) as MI before 55 years of age for men or 65 years of age for women in first-degree relatives.

Coronary angiogram (CAG) was done via radial or femoral artery route. Vessel score and Gensini score were calculated after CAG. A patient was considered to have CAD when the coronary artery stenosis exceeded 50% on angiography.

Vessel score[6] denotes the number of vessels with a significant stenoses. For left main coronary artery (LMCA) 50% or greater and for other vessels 70% or

greater reduction in luminal diameter is considered significant. Score ranges from 0 to 3, depending on the number of vessel involved i.e. no vessel involved, single vessel disease (SVD), double vessel disease (DVD) and triple vessel disease (TVD).

The Gensini score[7] was also calculated and severity score was assigned for each coronary stenosis as 1 for 1-25% narrowing, 2 for 26-50% narrowing, 4 for 51-75% narrowing, 8 for 76-90% narrowing, 16 for 91-99% narrowing and 32 for totally occluded coronary artery. The score was then multiplied by multiplication factor; which is 5 for left main coronary artery, 2.5 for proximal left anterior descending artery and proximal left circumflex artery, 1.5 for mid left anterior descending artery, 1 for distal left anterior descending artery, mid or distal left circumflex artery and right coronary artery. The multiplication factor for any other branch was 0.5. Patients with Gensini score of 1-19 were considered to have mild CAD and those with 20 or more were considered to have severe CAD.

All data were entered in an electronic spreadsheet (Microsoft Excel) and the statistical analysis was done using SPSS version 20 software. Chi square test/ Fisher's exact test was used for statistical analysis. The level of significance was considered at $p < 0.05$.

Ethical approval for the study was obtained from Institutional Review Board (IRB) of National Academy of Medical Sciences (NAMS), Bir Hospital before conducting the study (Ref. number: 916/ 2079/ 80).

Results

Among 100 patients in our study, 55 patients were males and 45 patients were females (table 1). Majority of the patients were in the age group of 61-70 years with average age being 58.9 years (table 1).

Table-I

Gender and Age distribution of patients

Gender	Frequency (n)	Percentage (%)
Males	55	55.0
Females	45	45.0
Total	100	100.0
Age (years)	Frequency (n)	Percentage (%)
18-40	3	3.0
41-50	23	23.0
51-60	28	28.0
61-70	29	29.0
>70	17	17.0
Total	100	100.0

The most common risk factor was hypertension followed by diabetes mellitus in 59% and 39% cases respectively (table II).

Table-II

Risk factors among patients

Risk Factors	Number
Hypertension	59
Diabetes	39
Smoking	37
Dyslipidemia	21
Family history of CAD	5
Stroke/ TIA	3
Vascular disease/ PAD	1

62 patients had a CHA_2DS_2-VASc score of ³2 and 47 patients had a CHA_2DS_2-VASc-HSF ³2.5 (Table 3). The average CHA_2DS_2-VASc score was 1.99, whereas the average CHA_2DS_2-VASc-HSF score was 2.72.

Table-III

Distribution of CHA_2DS_2-VASc and CHA_2DS_2-VASc-HSF scores

Scoring method	Score	Frequency
CHA_2DS_2-VASc	<2	38
	≥2	62
CHA_2DS_2-VASc-HSF	<2.5	53
	≥2.5	47

Patients were classified according to vessel score into those having Single Vessel Disease (SVD), Double Vessel Disease (DVD) and Triple Vessel Disease (TVD). This score revealed SVD, DVD and TVD among 16, 9 and 14 patients respectively. The remaining patients had either normal coronary arteries or minor coronary artery disease (CAD). It was noted that as the number of vessels involved increased, the scores (CHA_2DS_2-VASc and CHA_2DS_2-VASc-HSF) also increased significantly (Table 4). All patients having DVD and TVD had CHA_2DS_2-VASc-HSF score ³2.5 (p-value <0.001).

Table-IV

Comparison of CHA_2DS_2-VASc and CHA_2DS_2-VASc-HSF scores with Vessel score

CHA_2DS_2-VASc Score	Vessel Score						P-value
	SVD	%	DVD	%	TVD	%	
<2	5	31.3	0	0	1	7.1	<0.001
≥2	11	68.8	9	100	13	92.9	
CHA_2DS_2-VASc-HSF Score	SVD	%	DVD	%	TVD	%	P-value
<2.5	5	31.3	0	0	0	0	<0.001
≥2.5	11	68.8	9	100	14	100	
Total	16	100	9	100	14	100	

Similarly, Gensini score classified patients into three categories: No CAD, Mild CAD and Severe CAD. According to Gensini score, 19 patients did not have any CAD, 46 patients had mild CAD and 35 patients had severe CAD (Table 5).

Table-V

Distribution of Gensini score

Gensini Score	Frequency	Percentage (%)
0 (No CAD)	19	19.0
1-19 (Mild CAD)	46	46.0
≥20 (Severe CAD)	35	35.0

Majority of patients having CHA_2DS_2-VASc score ³2 and CHA_2DS_2-VASc-HSF score ³2.5 had severe CAD (p-value <0.001) (Table 6). 91.4% and 97.1% patients having severe CAD had a CHA_2DS_2-VASc score ≥2 and CHA_2DS_2-VASc-HSF score ≥2.5 respectively. Likewise, many patients whose CHA_2DS_2-VASc-HSF score was <2.5 did not have any CAD (94.7%) or had mild CAD (73.9%), and it was statistically significant.

Thus, CHA_2DS_2-VASc-HSF score is a good predictor of severe CAD and a cut-off value of ³2.5 can predict severe CAD among patients prior to coronary angiography.

Table-VI

Comparison of CHA_2DS_2-VASc and CHA_2DS_2-VASc-HSF scores with Gensini score

CHA_2DS_2-VASc Score	Severity of CAD (Gensini Score)						P-value
	No CAD	%	Mild CAD	%	Severe CAD	%	
<2	13	68.4	22	47.8	3	8.6	<0.001
≥2	6	31.6	24	52.2	32	91.4	
CHA_2DS_2-VASc-HSF Score	No CAD	%	Mild CAD	%	Severe CAD	%	P-value
<2.5	18	94.7	34	73.9	1	2.9	<0.001
≥2.5	1	5.3	12	26.1	34	97.1	
Total	19	100	46	100	35	100	

Discussion

Atherosclerotic cardiovascular disease (CVD) may have an insidious course and the patients may remain asymptomatic for a longer period of time. Presence of risk factors like older age, male gender, hypertension, diabetes mellitus and dyslipidemia play a crucial role for the development of CAD[3]. Most patients of CAD may have one or more of these risk factors.

There have been several risk prediction scores for the assessment of atherosclerotic CVD which include Framingham Risk Score (FRS), Systematic Coronary Risk Evaluation (SCORE), QRESEARCH cardiovascular risk (QRISK), assessing cardiovascular risk to Scottish Intercollegiate Guidelines Network to assign preventative treatment (ASSIGN) score among others[8,9]. FRS is one of the most commonly used risk scores. Age, dyslipidemia, diabetes mellitus, hypertension and smoking are the risk factors included in its risk prediction chart according to gender. However, FRS excludes the risk estimate of those aged >74 years of age and seems to overestimate the risk of cardiovascular morbidity and mortality in low-risk population and to underestimate the risk in high-risk population[10,11]. CHA_2DS_2-VASc-HSF includes risk factors that are attributed to atherosclerosis with a score for each variable. Thus, it gives a sum of total score, which is a quantitative measure of risk for atherothrombosis. Calculation of CHA_2DS_2-VASc-HSF score is easy and can be communicated well between doctors regarding the patient's risk of having an atherosclerotic CAD. This may help early identification of patients who might have a significant CAD, and the patient may be benefitted by early referral from resource limited setting or early coronary intervention. Moreover, calculation of a simple score does not add any financial burden to the patients. Therefore, scores like CHA_2DS_2-VASc and CHA_2DS_2-VASc-HSF may be useful to determine severity of CAD which can easily be applied by treating doctors at resource limited setting also.

The mean age of the patients in our study was 58.9 years which was similar to a study conducted by Uysal OK et al[12]. However, unlike their study, female patients were higher in number in our study (45%). Hypertension, Diabetes Mellitus, Dyslipidemia and Smoking were among the most common risk factors in our patients. These findings were in accordance to a similar study done by Modi R et al[13] among 2976 patients.

As the number of diseased vessels increased, CHA_2DS_2-VASc-HSF score also increased significantly in our study, with multivessel CAD having higher score (p-value <0.001). Modi R et al[13] also concluded similar finding. Also, patients having CHA_2DS_2-VASc score ≥2 and CHA_2DS_2-VASc-HSF score ≥2.5 showed severe CAD when Gensini score was calculated (p-value <0.001). Higher CHA_2DS_2-VASc-HSF score was associated with severe CAD in our study, and it was also observed in a recent study from Egypt[14]. Addition of few risk factors to the existing CHA_2DS_2-VASc score led to improved prediction for severe CAD. Most studies have used a cut-off value of CHA_2DS_2-VASc-HSF score to be ³2.5 for the prediction of severe CAD. Few studies have also stated a cut-off value of 3.0. Nonetheless, a high CHA_2DS_2-VASc-HSF score may help to predict the presence of significant CAD. Conversely, patients with lower CHA_2DS_2-VASc-HSF score are more likely to not have a significant CAD and may avoid further testing, reducing overall financial burden to the patients.

Limitations

Since consecutive sampling of patients was done, selection bias may occur. Also, female patients included in our study after a positive exercise stress test might have shown false positive exercise stress test results.

Conclusion

CHA_2DS_2-VASc-HSF score is a convenient and useful diagnostic tool that helps in early prediction of CAD and its severity, more so in resource limited setting. High risk patients and those with predicted severe CAD from this score may benefit from early referral and intervention, if required.

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