IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 18, Issue 4 Ser. 17 (April. 2019), PP 59-63
www.iosrjournals.org

Is CHA_2DS_2-VASc Score Useful in Predicting Atherosclerosis Burden?

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Abstract

Background: *Cardiovascular diseases are the major cause of death world wide. To reduce the mortality a method to detect and assess the severity of diseaseearly is essential. CHA_2DS_2-VASc score used to guide antithrombotic therapy in patients with atrial fibrillation,has as its components risk factors similar to those of coronary artery disease. Aim of this study to investigate usefulness of CHA_2DS_2-VASc score in predicting atherosclerosis burden.*

Methods: *This prospective, observational study included376 consecutive patients with coronary artery disease, who underwent coronary angiogram. This study used SYNTAX (Synergy between percutaneous coronary intervention with Taxus and cardiac surgery)score and carotid intima-media thickness (CIMT) as markers of atherosclerosis. Analysis of variance and Pearson correlation was done between CHA_2DS_2-VASc score, SYNTAX score and carotid intima-media thickness.*

Results: *Among 376 patients 71% were males, mean age was 55.8± 10.3years. While, 63% were hypertensive, 28% were diabetic, 38% were smokers and 11% had past history of cerebrovascular accident. SYNTAX score and CIMT were significantly high in patients with high CHA_2DS_2-VASc score ($p < 0.001$). Pearson correlation showed thatCHA_2DS_2-VASc scorepositively correlated with SYNTAX score ($r=0.707$, $p< 0.0001$, $n=376$) and CIMT ($r=0.639$, $p<0.0001$, $n=376$).*

Conclusion: *CHA_2DS_2-VASc score is useful in predicting atherosclerosis burden in patients with coronary artery disease. Our study is the only study in the literature compared CHA_2DS_2-VASc score and CIMT.*

Date of Submission: 11-04-2019 Date of acceptance: 26-04-2019

I. Introduction

Cardiovascular disease(CVD), especially coronary artery disease (CAD), has assumed epidemic proportions worldwide. CVDs are the number one cause of death globally.**[1]**An estimated 17.7 million people died from CVDs in 2015, representing 31% of all global deaths. Of these deaths, an estimated 7.4 million were due to CAD.[1] In contrast to developed countries, where mortality from CAD is rapidly declining, it is increasing in developing countries including India.[2]Various attempts have been made to reduce the death rate from CAD. Among them one is finding a method to detectand assess the severity of CAD early in its course.

Understanding of risk factors is critical for prevention of cardiovascular morbidity and mortality.The association between conventional risk factors and presence of CAD and adverse clinical events is universal and well established.[3,4] Practical and reliable risk scoring system is required to estimate presence and severity of CAD and its management.

$CHADS_2$ and CHA_2DS_2-VASc scores are clinical predictors used to evaluate the risk of cardiac thromboembolism and to guide antithrombotic therapy.[5,6] These scores are widely used in clinical practice and include similar risk factors for the development of CAD. Various studies established role of above scores in predicting morbidity and mortality in CAD patients.Among these, Cetin et al.[7] reported that CHA_2DS_2-VASc score can predict CAD severity using Gensini score in patients who underwent coronary angiography (CAG).Like Gensini score, SYNTAX(Synergy between percutaneous coronary intervention with Taxus and cardiac surgery)score is a usefultool to estimate coronary atherosclerosis burden and anatomical extent of CAD. Another non-invasive method of assessing atherosclerosis burden is carotid intima-media thickness (CIMT), N. Ikeda[8] et al. showed positive correlation between CIMT and SYNTAX score in CAD patients.

Hence, this studyaimed to examine usefulness of CHA_2DS_2-VASc score in predicting atherosclerosis burden in CAD patients. This study used SYNTAX score and CIMT as marker of atherosclerosis burden.

II. Materials and Methods

This is a prospective, observational study conducted in Sri Venkateswara Institute of Medical sciences, Tirupati, India. Thestudy was approved by institutional ethics committee on 18th May, 2016. Each participant provided written, informed consent.

A total of 376 consecutive patients with CAD, including ST elevation myocardial infarction , non-ST elevation myocardial infarction , unstable angina and chronic stable angina were included in the study. Patients with renal dysfunction, bleeding diathesis, post coronary artery bypass graft surgery, post percutaneous coronary intervention, atrial fibrillation and pregnant women were excluded from the study.

Detailed medical history, physical examination, electrocardiography and echocardiogram were performed for each patient. The following components of CHA_2DS_2-VASc score were obtained for each patient: Heart failure (defined as signs/symptoms of heart failure confirmed with objective evidence of cardiac dysfunction or left ventricular ejection fraction<40%), hypertension (defined as measurements of systolic and diastolic blood pressure ≥ 140/90 mm Hg or taking antihypertensive medications), age, diabetes mellitus (defined as a fasting blood glucose level >126 mg/dL or blood glucose ≥ 200 mg/dL or using antidiabetic drugs), previous ischaemic stroke or transient ischaemic attack (TIA), vascular disease (defined as MI and peripheral artery disease including prior revascularisation, amputation or angiographic evidence or aortic plaque) and gender. Each component was scored as per **table I,** total score was the sum-up of components.

All the patients underwent CAG by using a trans radialor trans femoral approach. CAG and SYNTAX scores were evaluated by two experienced interventional cardiologists who were blinded to the clinical characteristics and laboratory results of the patients. According to the baseline diagnostic angiogram, each coronary lesion creating a stenosis obstructing ≥50% of the diameter in vessels ≥1.5 mm were scored separately, and these scores were added together to calculate overall SYNTAX score,using the onlineSYNTAXscore algorithm.[10]Low, intermediate and high SYNTAX score were defined as 0 to 22, 23 to 32 and 33 or more, respectively.

Bilateral common carotid arteries of the subjects was scanned longitudinally with an L 11-3 MHz linear transducer attached to PHILIPS IE 33 machine, Netherlands. The bulb dilation served as a landmark to indicate the border between the distal common carotid artery and the carotid bulb. Images were obtained from the distal portion of the common carotid artery, 1–2 cm proximal to the carotid bulb. The two bright echogenic lines in the arterial wall were identified as the intima and media lines. The intima-media thickness was measured as the distance from the leading edge of the first to the leading edge of the second echogenic line.Only arterial wall intima-media thickness of the distal 1-cm portion of the common carotid artery, just before bifurcation, was measured at end-diastole.[11] Images showing the maximum intima-media thickness were stored in a digitized fashion and CIMT measurements were made off line.

The study was conducted according to the recommendations of the Declaration of Helsinki on Biomedical Research Involving Human Subjects.

Statistical analysis:

Quantitative variables were expressed as mean ± standard deviation and qualitative variables as numbers and percentages.Differences between independent groups were assessed by student t-test for normally distributed quantitative variables, ANOVA test for multiple groups. Mann-Whitney's U-test for variables without a normal distribution, and the Chi-square test for qualitative variables.Pearson correlation analysis was used to assess correlation between variables. Data analysis was performed with IBM Statistical Package for Social Sciences (SPSS) for Windows version 20. SPSS Inc., Chicago, USA. Microsoft Word and Excel were used to generate tables and graphs. All results were considered statistically significant at the level of $p \leq 0.05$.

III. Results

A total of 376 patients were included in the study, among them 71% were males, 63% were hypertensive, 28% were diabetic, 38% were smokers and 11% had past history of cerebrovascular accident (CVA). Baseline characteristics of study population are shown in **table II.**

CAG results showed that 286 (76%) patients had significant CAD, 28 (7.5%) had insignificant disease and 62 (16.5%) had normal coronaries. The mean CHA_2DS_2-VASc score in single vessel disease, double vessel disease and triple vessel disease was 3.33 ± 1.31, 3.64 ± 1.08 and 4.71 ±1.65 respectively. ($p< 0.001$)

The baseline characteristics and laboratory measurements of patients classified according to SYNTAX score are compared in **table III**. The mean age, body mass index(BMI), hospital stay, CHA_2DS_2-VASc score, CIMT and blood urea were significantly higher in intermediate and high SYNTAX group on compared to low SYNTAX group.

One way analysis of variance was done between the study variables. SYNTAX score and CIMT were significantly higher in patients with high CHA_2DS_2-VASc score. ($p< 0.001$) (**Table IV**).

Pearson correlation showed, CHA_2DS_2-VASc score positively correlated with SYNTAX score (r=0.707, p< 0.0001, n=376) and CIMT (r=0.639, p<0.0001, n=376). (**Figure 1**)

IV. Discussion

The major finding of the present study is that high CHA_2DS_2-VASc scorewas found in patients with high SYNTAX score and high CIMT, indicating usefulness of this score in predicting atherosclerosis burden. We also found that CHA_2DS_2-VASc scoreincreased as the number of diseased vessels increased.

Components of CHA_2DS_2-VASc score are known to promote atherosclerosis and are associated with severity of CAD.[12]This association can be explained as follows. Low ejection fraction isn't the cause of complex lesions, however it is the outcome of CAD severity. As the complexity and number of lesions, such as chronic total occlusion, bifurcation and ostial lesionsincrease, it leads to increase in SYNTAX score. Therefore, angiographic lesion characteristics and complexity may impactventricular systolic functions, so low ejection fraction indirectly indicate angiographic severity of CAD .Also, neurohumoral and inflammatory response in heart failure patients are associated with atherosclerosis pathogenesis. High levels of inflammatory markers, especially high sensitive C-reactive protein, have been associated with left ventricular systolic dysfunction.[13]

The other components of CHA_2DS_2-VASc score likehypertension, diabetes mellitus and age are traditional risk factors for CAD. Moreover, diabetic patients are known to have increased severity of atherosclerosis as well as higher rates ofmultivessel disease and more complex lesions such as long lesions, bifurcation lesions and diffuse small vessel disease.[12]

Another component, CVA can be explained as suggested by, in Yoo J[14]etal.that a substantial portion of stroke patients have preclinical CAD and there is a clear association between coronary and cerebral artery atherosclerosis in terms of location and burden. The risk of CAD is particularly high in stroke patients with multiple risk factors and atherosclerosis of the carotid and/or vertebrobasilararteries.[12]In another study, Korkmaz[15] et al. found increased coronary artery lesion complexity among patients with acute coronary syndrome and peripheral artery disease. There was a strong correlation between degree of peripheral artery disease and atherosclerosis severity in coronary arteries.

In Ikeda N[8] et al. study a statistically significant correlation was found between the CIMT and SYNTAX score and also between the plaque score and SYNTAX score. Our study is the only study in the literature, which compared CHA_2DS_2-VASc score and CIMT in CAD patients. This study found positive correlation between CHA_2DS_2-VASc score and CIMT.

Hence, it can be concluded that, CHA_2DS_2-VASc score may be useful in predicting atherosclerosis burden. This clinical score also might enable physicians to select patients for primary prevention of atherosclerosis and to identify patients who will benefit from further diagnostic tests for CAD.

Limitations of this study are that we have no follow-up data such as mortality and complications that could provide more information on prognostic value of CHA_2DS_2-VASc score. This study needs tobe validated in larger study population.

V. Conclusion

In conclusion, CHA_2DS_2-VASc score maybe useful as an excellent bedside simple clinical scoring system to predict atherosclerosis burden and guide to implement preventive therapy for cardiovascular disease. This study shows that by calculating CHA_2DS_2-VASc score and measuring CIMT with B-mode ultrasound, one can predict CAD burden non-invasively.

References

[1]. WHO fact sheet on cardiovascular disease. http://www.who.int/mediacentre/factsheets/fs317/en/ [Accessed 7 November 2017].
[2]. Fuster V, Kelly BB. Board for Global Health. Promoting Cardiovascular Health in Developing World: A Critical Challenge to Achieve Global Health. Washington, DC: Institutes of Medicine; 2010.
[3]. C.J. Murray, A.D. Lopez. Evidence-based health policy – lessons from the Global Burden of Disease Study Science, 274 (1996), pp. 740-743.
[4]. S. Yusuf, S. Hawken, S. Ounpuu, et al. Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): case-control study. Lancet, 364 (2004), pp. 937-952.
[5]. January CT, Wann LS, Alpert JS et al. 2014 AHA/ACC/HRS Guideline for the Management of Patients With Atrial Fibrillation: A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines and the Heart Rhythm Society. J Am CollCardiol, 2014; 64: e1–e76. doi: 10.1016/j.jacc.2014.03.022.
[6]. Camm AJ, Kirchhof P, Lip GY et al. European Heart Rhythm Association; European Association for Cardio-Thoracic Surgery, Guidelines for the management of atrial fibrillation: the Task Force for the Management of Atrial Fibrillation of the European Society of Cardiology (ESC). Eur Heart J, 2010; 31: 2369–2429. doi: 10.1093/eurheartj/ehq278. No abstract available. Erratum in: Eur Heart J, 2011; 32: 1172.
[7]. Cetin M, Cakici M, Zencir C et al. Prediction of coronary artery disease severity using CHADS2 and CHA2DS2-VASc and a newly defined CHADS2-VASc-HS Score. Am J Cardiol, 2014; 113: 950–956.doi: 10.1016/j.amjcard.2013.11.056.
[8]. Nobutaka Ikeda, NorihiroKogame, RaisukeIijima, Masato Nakamura, Kaoru Sugi; Carotid artery intima-media thickness and plaque score can predict the SYNTAX score, European Heart Journal, Volume 33, Issue 1, 1 January 2012, Pages 113–119, https://doi.org/10.1093/eurheartj/ehr399.

[9]. Lip GY, Nieuwlaat R, Pisters R, Lane DA, Crijns HJ. Refining clinical risk stratification for predicting stroke and thromboembolism in atrial fibrillation using a novel risk factor-based approach: the Euro Heart Survey on Atrial Fibrillation. Chest 2010; 137:263–72.
[10]. Sianos G, Morel MA, Kappetein AP, Morice MC, Colombo A, Dawkins K. The SYNTAX score: an angiographic tool grading the complexity of coronary artery disease. EuroIntervention. 2005;1(2):219-27.
[11]. Pignoli, P., Tremoli, E., Poli, A., Oreste, P., and Paoletti, R. Intimal plus medial thickness of the arterial wall: a direct measurement with ultrasound imaging. Circulation. 1986; 74: 1399–1406.
[12]. Uysal O, Turkoglu C, Duran M, Kaya M, Sahin D, Gur M et al. Predictive value of newly defined CHA2DS2-VASc-HSF score for severity of coronary artery disease in ST segment elevation myocardial infarction. KardiologiaPolska. 2016;74(9):954-960.
[13]. Choi EY, Rosen BD, Fernandes VR et al. High-sensitivityC-reactive protein as an independent predictor of progressivemyocardial functional deterioration: the multiethnic study ofatherosclerosis. Am Heart J, 2012; 164: 251–258.
[14]. Yoo J, Yang JH, Choi BW et al. The frequency and risk of preclinicalcoronary artery disease detected using multichannelcardiac computed tomography in patients with ischemic stroke.kmCerebrovasc Dis, 2012; 33: 286–294.
[15]. Korkmaz L, Adar A, Erkan H et al. Ankle-brachial index andcoronary artery lesion complexity in patients with acutecoronary syndromes. Angiology, 2012; 63: 495–499.

Table I: CHA_2DS_2-VASc scoring system[9]

CHA_2DS_2-VASc	Score
Congestive Heart Failure	1
Hypertension	1
Age ≥ 75 years	2
Diabetes Mellitus	1
Stroke / TIA / TE	2
Vascular disease (prior MI, PAD, Aortic plaque)	1
Age 65-74 years	1
Sex category (Female)	1
Maximum score	9

TIA- Transient ischaemic attack; TE-Thromboembolic event; MI- Myocardial infarction; PAD- Peripheral arterial disease.

Table II: Baseline characteristics of study population.

Baseline characteristic	**Mean ± SD**
Age	55.85 ± 10.35 years
BMI	23.31 ± 3.85 kg/ m^2
Hospital stay	3.87 ± 1.95 days
CHA_2DS_2-VASc score	3.11 ± 1.45
Troponin I	5.64 ± 9.15 mcg/L
SYNTAX score	15.63 ± 12.81
CIMT	0.75 ± 0.18 mm
Total Cholesterol	170.81 ± 45.78 mg/dl
HDL-Cholesterol	39.63 ± 9.71 mg/dl
Triglycerides	140.09 ± 100.04 mg/dl
Hemoglobin	12.88 ± 1.92 gm/dl
Platelet count	2.25 ± 0.81 lakhs/mm^3
Blood Urea	30.20 ± 12.19 mg/dl
Serum creatinine	0.95 ± 0.27 mg/dl

BMI – Body mass index; CIMT- Carotid intima-media thickness; HDL- High density lipoprotein.SD-Standard deviation.

Table III: Baseline characteristics and laboratory measurements in patients classified according to SYNTAX score.

	Low (0-22) n=248	**Intermediate (23-32) n=87**	**High (≥ 33) n=41**	**P value**
Age (years)	53.44±10.14	60.67±9.48	60.15±8.47	< 0.00001
BMI (Kg/m^2)	23.06±3.69	22.93±3.50	25.52±4.83	0.000413
Hospital stay (days)	3.56±1.74	4.41±2.48	4.59±1.45	0.000074
CHA_2DS_2-VASc score	2.45±1.02	4.07±1.18	5.02±1.42	< 0.00001
SYNTAX score	8.21±8.62	27.27±4.14	35.78±3.31	< 0.00001
CIMT (mm)	0.70±0.14	0.84±0.19	0.91±0.20	< 0.00001
Total cholesterol (mg/dl)	172.06±49.32	171.62±40.97	161.44±30.25	0.381965
HDL-C (mg/dl)	39.69±10.22	39.17±8.79	40.20±8.51	0.843218
Triglycerides (mg/dl)	135.23±102.38	140.01±74.08	169.68±127.55	0.124033
TROP-I (mcg/L)	4.91±8.72	7.45±10.45	6.29±8.41	0.075194
Hemoglobin (grams/dl)	12.99±1.97	13.00±1.77	11.99±1.76	0.006692
Platelet count ($lakhs/mm^3$)	2.33±0.82	2.06±0.76	2.23±0.76	0.022885
Serum creatinine (mg/dl)	0.93±0.27	1.00±0.27	0.97±0.28	0.110199
Blood urea (mg/dl)	28.60±11.06	32.52±14.49	34.93±11.77	0.001053

BMI- Body mass index; CIMT- Carotid intima-media thickness; HDL-C – HDL cholesterol; TROP-I – Troponin I.

Table IV: ANOVA analysis betweenCHA_2DS_2-VASc score, SYNTAX score and carotid intima-media thickness.

CHA_2DS_2-VASc score	**Number**	**Mean SYNTAX score**	**Mean CIMT (mm)**	**p value**
0	6	0	0.52 ± 0.08	p < 0.001
1	37	2.27 ± 5.97	0.62 ± 0.11	
2	96	6.79 ± 9.49	0.63 ±0.11	
3	105	16.51 ± 10.57	0.74 ± 0.12	
4	68	21.16 ± 9.78	0.82 ± 0.13	
5	41	29.14 ± 5.81	0.96 ± 0.16	
6	15	34 ± 5.59	0.92 ± 0.28	
7	7	32.42 ± 3.35	1.01 ± 0.29	
8	1	34	1.22	

CIMT- Carotid intima-media thickness, mm – Millimetres.

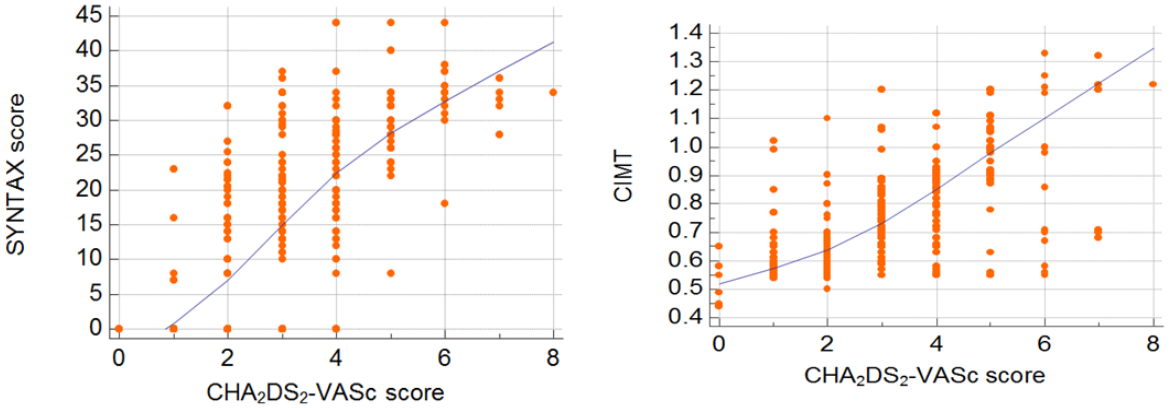

Figure 1: Scatter diagram showing correlation between CHA_2DS_2-VASc score, SYNTAX score and carotid intima-media thickness.