Research Article | Araştırma Makalesi

RELATION OF CHA₂DS₂-VASc SCORE WITH SEVERITY AND COMPLEXITY OF CORONARY ARTERY DISEASE IN PATIENTS WITH NON-ST SEGMENT ELEVATION MYOCARDIAL INFARCTION

ST SEGMENT YÜKSELMESİZ MİYOKARD ENFARKTÜSÜ OLAN HASTALARDA CHA₂DS₂ - VASc SKORUNUN KORONER ARTER HASTALIĞININ CİDDİYET VE KARMAŞIKLIĞI İLE İLİŞKİSİ

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ABSTRACT

Objective: This study aimed to determine the correlation between CHA2DS2 -VASc score and the Synergy between PCI with Taxus and Cardiac Surgery (SYNTAX) scoring system for predicting severity and complexity of coronary artery disease in patients with non-ST segment elevation myocardial infarction (NSTEMI).

Methods: This is a retrospective cross-sectional study conducted in a tertiary care center. The patients admitted to the emergency department (ED) with NSTEMI and who underwent the PCI were included. The patients' demographic, clinical and angiographic characteristics were gathered from the hospital electronic medical records. Echocardiography and angiography images were evaluated by an experienced interventional cardiologist blinded to the patients' clinical information. The CHA2DS2-VASc and SYNTAX scores were calculated. The primary outcome of this study was the correlation between the CHA2DS2-VASc and SYNTAX scores.

Results: A total of 216 patients were included. The mean CHA2DS2-VASc and SYNTAX scores were 2.9±1.7 and 16.6±7.9, respectively. There were significant differences in the mean CHA2DS2-VASc scores between the low and moderate (2.8±1.7 and 3.4±1.7, respectively, p<0.001), and low and high-risk groups (2.8±1.7 and 3.7±1.8, respectively, p<0.001) according to the SYNTAX score risk classification. The rank correlation analysis showed a significant positive correlation between the CHA2DS2-VASc and SYNTAX scores (Spearman's rho= 0.454, p=0.02).

Conclusion: This study showed a fair, positive correlation between the CHA2DS2-VASc and SYNTAX scores. The use CHA2DS2-VASc score might be practical to predict the severity and complexity of coronary artery disease in patients admitted to the ED with NSTEMI.

Keywords: Non-ST elevation acute coronary syndrome, coronary artery disease, CHA2DS2-VASc score, SYNTAX score

ÖZ

Amaç: Bu çalışmada ST segment yükselmesiz miyokard enfarktüsü (NSTEMI) olan hastalarda CHA2DS2 -VASc skorunun koroner arter hastalığının ciddiyet ve karmaşıklığını predikte eden SYNTAX (Synergy between PCI with Taxus and Cardiac Surgery) skoru ile korelasyonunun belirlenmesi amaçlandı.

Yöntem: Bu retrospektif kesitsel çalışma bir üçüncü basamak sağlık merkezinde yürütüldü. Acil serviste NSTEMI tanısı alan ve perkütan koroner girişim uygulanan hastalar dahil edildi. Hastaların demografik, klinik ve anjiyografik özellikleri hastanenin elektronik veri sisteminden elde edildi. Ekokardiyografi ve anjiyografi görüntüleri hastaların klinik özelliklerine kör, deneyimli bir girişimsel kardiyolog tarafından değerlendirildi. CHA2DS2-VASc ve SYNTAX skorları hesaplandı. Çalışmanın primer sonlanımı CHA2DS2-VASc ve SYNTAX skorları arasındaki korelasyondu.

Bulgular: Çalışmaya toplam 216 hasta dahil edildi. Ortalama CHA2DS2-VASc ve SYNTAX skorları sırasıyla 2,9±1,7 ve 16,6±7,9 olarak belirlendi. SYNTAX skoruna göre risk gruplarına ayrılan hastaların CHA2DS2-VASc skorları arasında düşük ve orta risk arasında (sırasıyla 2,8±1,7 ve 3,4±1,7, p<0,001), düşük ve yüksek risk arasında (sırasıyla, 2,8±1,7 ve 3,7±1,8, p<0.001) anlamlı fark izlendi. CHA2DS2-VASc ve SYNTAX skorları arasında yapılan korelasyon analizinde anlamlı pozitif korelasyon belirlendi (Spearman's rho= 0,454, p=0,02).

Sonuç: Bu çalışmada CHA2DS2-VASc ve SYNTAX skorları arasında kabul edilebilir bir pozitif korelasyon olduğu gösterilmiştir. Acil serviste NSTEMI tanısı alan hastalarda koroner arter hastalığının ciddiyeti ve karmaşıklığını ön görmede CHA2DS2-VASc skorunun kullanılması fayda sağlayabilir.

Anahtar Kelimeler: ST segment yükselmesiz miyokard enfarktüsü, koroner arter hastalığı, CHA2DS2-VASc skoru, SYNTAX skoru

Introduction

Coronary artery disease (CAD) is the most common reason for mortality among cardiovascular diseases.[1] Many factors can affect the complexity of CAD and treatment strategies, including the number and location of affected vessels, degree of stenosis, lesion characteristics or calcification of vessels.[2] These factors also affect the technical feasibility of percutaneous coronary intervention (PCI) and patient prognosis.[2] The Synergy between PCI with Taxus and Cardiac Surgery (SYNTAX) scoring system has been developed to support clinical decision making in determining optimal treatment strategy, predicting prognosis, and taking early measures to prevent complications in high-risk patients who underwent to the PCI.[3] Risk stratification is angiographically made according to the coronary system dominancy, total occlusion, bifurcation or trifurcation lesion, aorto-ostial lesion, thrombus inclusion, tortuosity, length of lesion, calcification, and diffuseness of CAD.[3] Although validated, utility of SYNTAX is limited since it is an angiographic based system that focuses on anatomical complexity rather than predictive clinical variables or individualized risk predictions.[4] Additionally, early use of the SYNTAX score is not possible in some clinical conditions that emergent angiography is not required or in resource-limited settings where the angiography is not accessible.[5-7] Therefore, an easy-to-use risk prediction tool for predicting the severity of CAD could be beneficial where emergent angiography cannot be performed especially in emergency department or critical care setting.[5-7]

CHA2DS2-VASc score is recommended to assess thromboembolic risk in patients with non-valvular atrial fibrillation (A-fib).[8] The need for anticoagulation treatment is determined in high-risk patients according to the CHA2DS2-VASc score.[8] Thromboembolic risk factors include congestive heart failure (CHF), hypertension, advanced age ($\geq$65 years), diabetes mellitus (DM), female sex, stroke/transient ischemic attack (TIA) or thromboembolism and vascular disease (history of myocardial infarct, peripheral arterial disease, aortic plague).[8,9] The risk variables for thromboembolism that included in CHA2DS2-VASc score, is also pose risks for CAD caused by atherosclerosis and inflammation[9]. However, the studies evaluated the value of CHA2DS2-VASc as a prediction tool for the severity and complexity of CAD is limited in the literature.[4,9,10]

This study aimed to determine the correlation between the CHA2DS2-VASc score and, the severity and complexity of CAD. We hypothesized that CHA2DS2-VASc score might be associated with the severity and complexity of CAD correlating with SYNTAX score.

Methods

Study Design, Settings and Population
This was a single center, retrospective, cross-sectional study conducted in a tertiary care hospital in January 2016. Institutional review board approval was obtained for the study (Mustafa Kemal University, Tayfur Sokmen Medical Faculty, Ethics Committee No: 20/10/2015/104). All adult patients diagnosed with non-ST elevation myocardial infarction (NSTEMI) in the ED and admitted to the coronary care unit between January 2015 and January 2016 were evaluated for the eligibility.
Exclusion criteria are listed below:
1. Patients who were <18 years old,
2. Patients with ST segment elevation myocardial infarction (STEMI),
3. Patients who had a history of A-fib,
4. Patients whose past medical history and other clinical characteristics that were required to calculate CHA2DS2-VASc score were not recorded in the hospital electronic medical record (EMR) system,
5. Patients whose echocardiography and angiography images were not included in the hospital EMR system to calculate left ventricular ejection fraction (LVEF) and SYNTAX score.

Study Protocol
The patients' charts who admitted to coronary care unit from the ED with the diagnosis of NSTEMI were reviewed. The diagnosis of NSTEMI was defined as a positive cardiac biomarker (Troponin-I of 0.06 ng/mL) with no detectable ST segment elevation in electrocardiogram (ECG). Data screening was carried out using ICD-10 coding system (I20-I25). Before the enrollment, each patients' chart was reviewed in detail to gather data on the patients' demographic, clinical, and angiographic characteristics to calculate CHA2DS2-VASc and SYNTAX scores. The data of the patients in whom the eligibility criteria met were recorded on a standardized data collection form. Echocardiography and angiography images at the time of the diagnosis were evaluated by an experienced interventional cardiologist who was blinded to clinical information of the patients. SYNTAX score was determined according to angiography images. CHA2DS2-VASc score was calculated according to patients' past medical history recorded in the hospital EMR.

Measurements
The CHA2DS2-VASc score was calculated by scoring 1 point for CHF (LVEF<40%), hypertension, advanced age (>65 years), DM, female sex, stroke/TIA or thromboembolism and vascular disease (history of myocardial infarct, peripheral arterial disease, aortic plague), and 2 points for an age of >75 years and a history of stroke/TIA with a total score of 9 points[8]. The patients were classified in three risk groups (low: 0-2, moderate: 3-4, and high: $\geq$5) according to their CHA2DS2-VASc score[11]. LVEF was calculated from the recorded echocardiographic images using the modified Simpson method. The SYNTAX score was calculated using the 12-

item online calculator from www.syntaxscore.org. The score for each coronary lesion that was ≥1.5 millimeter (mm) and led a ≥50% of vessel stenosis was separately added to the overall SYNTAX scores. According to the overall score, the patients classified in low (<23 points), moderate (23-32) and high (>32) risk groups.

Outcome Measures
The primary outcome of this study was the correlation between CHA2DS2-VASc and SYNTAX scores in patients with NSTEMI.

Data Analysis
IBM SPSS Statistics 18 (SPSS Inc., Chicago, IL, USA) was used to analyze the data. Normality of distribution was assessed using Kolmogorov-Smirnoff test for continuous variables. Continuous variables were expressed as mean and standard deviation (SD) or median and interquartile range (IQR) according to the normality of distribution. Categorical variables were expressed as numbers (n) and percentages (%). Kruskal-Wallis or ANOVA tests were used to compare independent groups for continuous variables, whereas the Chi-square test was used for categorical variables. Post-hoc pairwise comparisons were performed if a significant difference was detected in three group comparisons. Spearman correlation analysis was used to determine the correlation between CHA2DS2-VASc and SYNTAX score. Significance was set at a p value of 0.05. Decimals were rounded for a better read.

Results

A total of 216 NSTEMI patients were included in the study. Of the patients, 158 (78%) were male and the mean age was 62±13 years. The mean CHA2DS2-VASc and SYNTAX scores were 2.9±1.7 and 16.6±7.9, respectively. Other characteristics, including demographic and clinical features were shown in the Table 1.
There were significant differences in patients' smoking status, blood glucose level, glomerular filtration rate (GFR), LVEF and SYNTAX scores between the CHA2DS2-VASc scores of 0-2, 2-5 and ≥ 5 points. Also, differences were detected in variables (age, sex, history of diabetes and hypertension) that included in CHA2DS2-VASc score as expected (Table 2).
When the patients were classified according to severity and complexity of CAD (SYNTAX score), the CHA2DS2-VASc score was significantly different among the three risk groups (p<0.001). In the post-hoc pairwise comparisons, this difference was detected between low-risk and moderate-risk (2.8±1.7 and 3.4±1.7, respectively, p<0.001), and low and high-risk groups (2.8±1.7 and 3.7±1.8, respectively, p<0.001). No significant difference was detected between moderate and high-risk groups (3.3±1.7 and 3.7±1.8, respectively, p=0.318) (Table 3).

Table 1. Demographics and clinical characteristics of the patients

	All patients, n= 216
Demographics	
Sex (male), n (%)	158 (73)
Age (years), M (IQR)	61.7 (12.8)
HTN, n (%)	144 (67)
DM, n (%)	149 (69)
HL, n (%)	69 (32)
Smoking, n (%)	96 (44)
Clinical characteristics	
Blood glucose (mg/dl) M (IQR)	155.0 (102.2)
GFR (ml/min) M (IQR)	72.5 (23.5)
Hgb (g/dl) M (IQR)	14.2 (1.8)
Total cholesterol (mg/dl) M (IQR)	194.3 (42.2)
LDL (mg/dl) M (IQR)	121.4 (34.8)
HDL (mg/dl) M (IQR)	36.9 (8.8)
Triglyceride (mg/dl) M (IQR)	173.5 (109.1)
LVEF %, M (IQR)	42.4 (9.5)
SYNTAX score, m (SD)	16.6 (7.9)
CHA2DS2VASc score, m (SD)	2.9 (1.7)

M: median, IQR: interquartile range, HTN: hypertension, DM: diabetes mellitus, HL: hyperlipidemia, GFR: glomerular filtration rate, Hgb: hemoglobin, LDL: low density lipoprotein, HDL: high density lipoprotein, LVEF: left ventricle ejection fraction, m: mean, SD: standard deviation.

The rank correlation analysis showed a significant positive correlation between the CHA2DS2-VASc and SYNTAX scores (Spearman's rho= 0.454, p=0.02).

Discussion

This study showed a fair positive correlation between the CHA2DS2-VASc and SYNTAX score in patients who underwent coronary angiography with a diagnosis of NSTEMI. This result indicated that the use of CHA2DS2-VASc score might be suggestive in predicting the severity and complexity of CAD.
Risk assessment is essential in patients with CAD for identifying high risk patients to predict cardiac morbidity and mortality, potential complications and determining revascularization strategies.[2] To date, many clinical risk stratification tools have been recommended to use in the decision-making of patients who are admitted with findings suggesting acute coronary syndrome.[12] These scoring systems generally include risks related to clinical history, physical exam, ECG, echocardiography findings and cardiac biomarkers.[12,13] Although they are very sensitive for ruling out low risk patients in the clinical settings; additional evaluation and/or interventions are required to predict cardiac adverse events in those with higher risk groups.[12,14] The SYNTAX is an angiographic-based scoring system that help clinicians to determine treatment strategies and prognosis in high-risk patients[3]. However, angiographic evaluation of the coronary vessels is not always feasible in the clinical settings.[5-7] The

CHA2DS2-VASc score is a validated easy-to-use risk assessment tool for thromboembolism.[11] Although it has been used to assess stroke risk in patients with A-fib, utilization of the CHA2DS2-VASc is suggested for predicting adverse outcomes in several cardiovascular diseases.[15]

Table 2. Comparison of the demographic and clinical characteristics according to the CHA2DS2VASc risk assessment

	Low CHA2DS2VASc score (0-2) n=100	Moderate CHA2DS2VASc score (2-5) n=74	High CHA2DS2VASc score (>5) n=42	P value
Demographics				
Sex (male), n (%)	85 (85)	40 (54)	33 (78.5)	*<0.001*
Age (years), M (IQR)	61.5 (12.8)	63.4 (12.6)	59.3 (12.9)	*<0.001*
HTN, n (%)	56 (56)	53 (72)	35 (83)	*<0.001*
DM, n (%)	60 (60)	52 (70)	37 (88)	*<0.001*
HL, n (%)	33 (33)	22 (29)	14 (33)	0.131
Smoking, n (%)	58 (58)	31 (42)	7 (17)	*<0.001*
Clinical characteristics				
Blood glucose (mg/dl) M (IQR)	151.8 (73.2)	209.3 (97.8)	238.4 (145.6)	*<0.001*
GFR (ml/min) M (IQR)	89.3 (20.8)	78.2 (16.1)	66.3 (18.6)	*<0.001*
Hgb (g/dl) M (IQR)	151.1 (1.6)	14.8 (1.5)	13.3 (1.9)	*<0.001*
Total cholesterol (mg/dl) M (IQR)	191.3 (46.8)	172.4 (34.5)	181.7 (52.8)	0.132
LDL (mg/dl) M (IQR)	121.1 (21.2)	103.5 (28.6)	121.7 (34.2)	0.74
HDL (mg/dl) M (IQR)	31.8 (8.9)	36.2 (8.4)	38.3 (9.9)	0.25
Triglyceride (mg/dl) M (IQR)	178.2 (114.3)	163.1 (92.5)	153.7 (94.9)	0.64
LVEF %, M (IQR)	41.6 (8.4)	33.8 (8.9)	33.7 (9.3)	*<0.001*

M: median, IQR: interquartile range, HTN: hypertension, DM: diabetes mellitus, HL: hyperlipidemia, GFR: glomerular filtration rate, Hgb: hemoglobin, LDL: low density lipoprotein, HDL: high density lipoprotein, LVEF: left ventricle ejection fraction

Table 3. Comparison of the risk groups according to the SYNTAX and CHA2DS2VASc scores

	All groups	Low SYNTAX score (<23)	Moderate SYNTAX score (23-32)	High SYNTAX score (>32)	p value
CHA2DS2VASc score, m (SD)	2.9 (1.7)	2.8 (1.7)	3.3 (1.7)	3.7 (1.8)	*<0.001*
		Low CHA2DS2VASc score (0-2)	Moderate CHA2DS2VASc score (2-5)	High CHA2DS2VASc score (> 5)	
SYNTAX score, m (SD)	16.6 (7.4)	16.6 (7.4)	16.9 (7.7)	17.8 (7.6)	*<0.001*

m: mean, SD: standard deviation

In the recent years, the CHA2DS2-VASc score has been studied as an alternative prediction tool for cardiac adverse events in patients with acute coronary syndrome (ACS). Kurtul et al. conducted a retrospective validation study for CHA2DS2-VASc score for predicting higher atherosclerotic burden in patients with ACS.[9] The CHA2DS2-VASc score was found to be significantly higher in patients with high SYNTAX score than the patients with moderate and low SYNTAX score (4.24 ± 1.49, 2.89 ± 1.49, and 2.40 ± 1.36, respectively, p <0.001).[9] It was suggested that higher CHA2DS2-VASc score could be an independent predictor for higher coronary atherosclerotic burden in patients with ACS. Another study by Akboga et al. evaluated the prognostic value of CHA2DS2-VASc for predicting high risk patients according to the SYNTAX score in patients with NSTEMI.[4] A significant positive correlation has been reported between CHA2DS2-VASc and SYNTAX scores (r=0.320).

Also, the CHA2DS2-VASc score of > 4 had been found to be associated with in-hospital mortality (OR: 1.445, 95% CI, 1.268-1.648, p<0.001).[4] It was suggested that both CHA2DS2-VASc and SYNTAX scores could be beneficial in predicting prognosis in patients with NSTEMI. Moreover, the CHA2DS2-VASc score has been reported to have a better predictive performance than SYNTAX score for in-hospital mortality (hazard ratio of 1.9 and 1.05, respectively).[4] Similarly, our study also showed that the CHA2DS2-VASc score was significantly higher in patients with high SYNTAX score than in those with moderate and low SYNTAX scores.

There are some other risk stratification tools has been studied as an alternative to the SYNTAX score. Tasolar et al. compared the Global Registry for Acute Coronary Events (GRACE), Thrombolysis in Myocardial Infarction (TIMI) and CHA2DS2-VASc scores in predicting severity and complexity of CAD, and in hospital MACE in patients

with NSTEMI.[10] The CHA2DS2-VASc score has been found to be comparable with the GRACE and TIMI for predicting severity and complexity of CAD, and in-hospital MACE. Also, consistent with our study results, a fair positive correlation was reported between the CHA2DS2-VASc and SYNTAX scores (r=0.574, p<0.001).[10] Ma et al. evaluated the prognostic value of CHADS2 and CHA2DS2-VASc scores for post-discharge outcomes in patients with ACS who underwent PCI.[16] The performance of CHA2DS2-VASc score was found to be associated with MACE with a c statistic of 0.614, whereas CHADS2 did not reach statistically significance.[16] Although the primary outcome of our study was only correlation of CHA2DS2-VASc with SYNTAX score, interpreting our results with previous studies, it could be deducible that the use of CHA2DS2-VASc in variety clinical settings including EDs, critical care or hospital wards, could be practical in predicting risks for in-hospital or post-discharge mortality, and other non-lethal cardiovascular complications. Therefore, in patients with no prior angiographic evaluation, or when an emergent angiographic intervention is not feasible, the CHA2DS2-VASc score could help clinicians to determine cardiovascular risk and optimize treatment opportunities.

Limitations

This study has a number of limitations. First, this is a single-center, retrospective study conducted with a relatively limited number of patients. This limits the generalizability of study results. Second, the primary outcome of this study was the correlation of the CHA2DS2-VASc score with the SYNTAX score. Therefore, the predictive performance of the CHA2DS2-VASc score for the clinical outcomes was not evaluated in this study. The association between the patient risk and adverse outcomes cannot be interpreted from this study. Third, the study included NSTEMI patients who were admitted from the ED. Including patients from critical care units or hospital wards might affect the study results.

Conclusion

The CHA2DS2-VASc score could be a practical risk assessment tool that is correlated with the severity and complexity of CAD in patients admitted to the ED with NSTEMI. The use of this score might help clinicians in decision-making where the angiographic evaluation of coronary vessels is not readily available.

Compliance with Ethical Standards

This study was approved by the Ethics Committee of Mustafa Kemal University, Tayfur Sokmen Medical Faculty (No:20/10/2015/104).

Conflict of Interest

None.

Author Contribution

Authors contributed equally to this work.

Financial Disclosure

None.

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