Cardiovasc Surg Int 2025;12(1):51-58
http://dx.doi.org/DOI: 10.5606/e-cvsi.2025.1801
www.e-cvsi.org

Cardiovascular Surgery and Interventions

Original Article Open Access

Prognostic predictive value of CHA2DS2-VA score in patients with permanent atrial fibrillation

Serdar Söner[1], Oktay Şenöz[2]

[1]Department of Cardiology, Health Science University, Gazi Yaşargil Training and Research Hospital, Diyarbakır, Türkiye
[2]Department of Cardiology, Bakırçay University, Çiğli Training and Research Hospital, İzmir, Türkiye

Received: December 24, 2024 ***Accepted:*** January 08, 2025 ***Published online:*** February 25, 2025

ABSTRACT

Objectives: This study aims to investigate the prognostic value of the CHA_2DS_2-VA score in patients with permanent atrial fibrillation (AF).

Patients and methods: Between January 20223 and June 2023, a total of 917 patients with permanent AF (446 males, 471 females; mean age: 70.2±9.7 years; range, 27 to 89 years) were retrospectively analyzed. The patients were divided into two groups based on their CHA_2DS_2-VA scores: high-risk (score ≥2, n=743) and low-risk (score <2, n=174). Data on one-year all-cause mortality were collected through follow-ups and interviews.

Results: In the univariate analysis, CHA_2DS_2-VA score, age, sex, systolic blood pressure (SBP), left ventricular ejection fraction (LVEF), chronic obstructive pulmonary disease (COPD), chronic kidney disease, hemoglobin, neutrophil, and lymphocyte counts were found to be significant predictors of mortality. Multivariate analysis revealed that only age, sex, SBP, COPD, LVEF, and hemoglobin were independent predictors. There was a significant relationship between CHA_2DS_2-VA score and one-year all-cause mortality (p=0.002).

Conclusion: Our study results showed that the CHA_2DS_2-VA score was associated with one-year all-cause mortality in AF patients, but it was not an independent predictor when evaluated with all parameters affecting mortality. In the management of AF patients, the CHA_2DS_2-VA score may be useful not only in determining oral anticoagulation strategy, but also in the approach of clinicians to AF patients, considering that it may be a predictor of mortality.

Keywords: All-cause mortality CHA_2DS_2-VA score, permanent atrial fibrillation.

Atrial fibrillation (AF) is the most prevalent persistent arrhythmia, which significantly and adversely affects the quality of life and increases mortality and morbidity rates.[1] Preventing thromboembolism is the main goal to reduce the overall mortality rate associated with AF. Indeed, compared to a placebo or control, oral anticoagulation with Vitamin K antagonists (VKAs) dramatically lowers stroke and systemic embolism by 64%, while also significantly lowering all-cause mortality by 26.[2] Numerous extensive randomized studies have shown that non-Vitamin K oral anticoagulants (NOACs) are safe and effective.[3-6] Over the last decade, NOAC use has become widespread due to the impact of these studies and as NOAC use does not require international normalized ratio (INR) monitoring.

One commonly used metric to estimate the risk of thromboembolic events in individuals with AF was the CHA_2DS_2-VASc score (congestive heart failure, hypertension, age ≥75 [doubled], diabetes, stroke [doubled], vascular disease, age 65 to 74 and sex category [female]). Physicians widely used the CHA_2DS_2-VASc score, since it is straightforward: it does not require an online calculation, each point is assigned to a binary risk factor, and it does not require laboratory or radiographic testing. Numerous conventional coronary artery disease (CAD) risk

Corresponding author: Serdar Söner, MD. Sağlık Bilimleri Üniversitesi, Gazi Yaşargil Eğitim ve Araştırma Hastanesi, Kardiyoloji Kliniği, 21070 Kayapınar, Diyarbakır, Türkiye
E-mail: drserdar_89@hotmail.com

Citation:
Söner S, Şenöz O. Prognostic predictive value of CHA2DS2-VA score in patients with permanent atrial fibrillation. Cardiovasc Surg Int 2025;12(1):51-58. doi: 10.5606/e-cvsi.2025.1801.

factors are also included in the CHA_2DS_2-VASc score. Therefore, independent of the occurrence of AF, the CHA_2DS_2-VASc score is a good predictor of both in-hospital and long-term unfavorable cardiovascular events. All-cause mortality, non-fatal myocardial infarction, acute stent thrombosis, no-reflow phenomenon, non-fatal stroke, pulmonary embolism, and other adverse cardiovascular events have been linked to high CHA_2DS_2-VASc scores.[7-13]

In the final European Society of Cardiology (ESC) consensus, the sex component was removed from the CHA_2DS_2-VASc score, and this score was renamed CHA_2DS_2-VA. In the present study, we aimed to investigate the prognostic value of the CHA_2DS_2-VA score newly defined by the ESC in patients with permanent AF.

PATIENTS AND METHODS

This single-center, retrospective study was conducted at University of Health Sciences, Gazi Yaşargil Training and Research Hospital, Department of Cardiology between January 2023 and June 2023. All patients over the age of 18 who were admitted to our clinic and diagnosed with permanent AF were included in the study. Initially, a total of 1,032 patients were reviewed. Patients who were restored to sinus rhythm for any reason (n=14), patients whose data were inaccessible (n=67), patients with active infection (n=23), and patients with malignancy or receiving chemotherapy (n=11) were excluded from the study. Finally, a total of 917 patients (446 males, 471 females; mean age: 70.2±9.7 years; range, 27 to 89 years) who met the inclusion criteria were recruited. The study flowchart is shown in Figure 1. A written informed consent was obtained from each patient. The study protocol was approved by the University of Health Sciences, Gazi Yaşargil Training and Research Hospital (No: 275-12/12/2024). The study was conducted in accordance with the principles of the Declaration of Helsinki.

Demographic and echocardiographic characteristics of the patients, oral anticoagulation drug regimens, and one-year follow-up results were evaluated. Stroke risk was calculated using the CHA_2DS_2-VA score, while bleeding risk was calculated using the HAS-BLED score (Hypertension, Abnormal Renal/Liver Function, Stroke, Bleeding History or Predisposition, Labile INR, Elderly, Drugs/Alcohol Concomitantly), when applicable. The patients were, then, divided into two groups according to the CHA_2DS_2-VA scores newly defined by the ESC.[14] Patients with a CHA_2DS_2-VA score ≥2 were included in the high-risk group (n=743), and those with a CHA_2DS_2-VA score <2 were included in the low-risk group (n=174). Follow-up data were collected by telephone interviews or clinic visits. The primary outcome measure was one-year all-cause mortality.

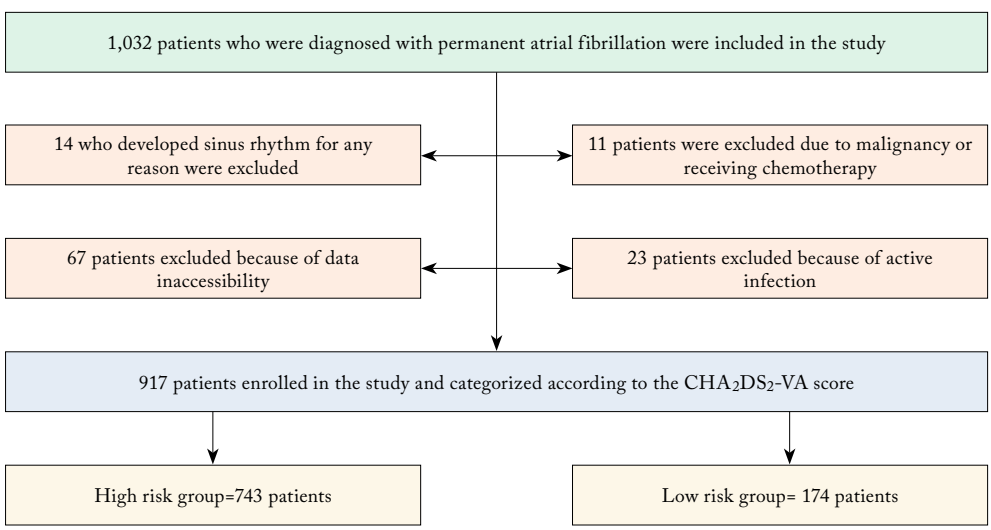

Figure 1. Study flowchart.

Definitions

Systolic blood pressure (SBP) ≥140 mmHg, diastolic blood pressure (DBP) ≥90 mmHg, or the use of antihypertensive medication were considered as hypertension (HT). A fasting blood glucose level of ≥126 mg/dL, the use of anti-diabetic drugs, or a glycated hemoglobin (HbA1c) result in higher than 7% were considered diabetes mellitus (DM). Current smoking was the definition of smoking. The INR levels were measured at each center's local laboratory. The Cockroft-Gault formula was used to determine glomerular filtration rates.[15] Glomerular filtration rate (GFR) <60 mL/min/1.73 m² or signs of kidney damage, or both, for a minimum of three months was considered chronic kidney disease (CKD).

The CHA_2DS_2-VA score was calculated according to the criteria published by the ESC in the latest guideline. The CHA_2DS_2-VA ranges from 0 to 8 (ESC). While calculating the CHADS-VA score, 1 point is given for ages 65-74, 1 point for heart failure, 1 point for HT, 1 point for DM, 1 point for a history of vascular disease, 2 points for age 75 and over, and 2 points for the history of stroke, transient ischemic attack, or systemic thromboembolism.[13]

Statistical analysis

Statistical analysis was performed using the IBM SPSS for Windows version 27.0 software (IBM Corp., Armonk, NY, USA). The normal distribution of variables was analyzed using the Kolmogorov-Smirnov and Shapiro-Wilk tests. Continuous variables were expressed in mean ± standard deviation (SD) or median (interquartile range), while categorical variables were expressed in number and frequency. Depending on the distributions, the Mann-Whitney U test or Student t-test were used to compare continuous variables. For continuous variables, univariate analysis was used, while the chi-square or Fisher exact test was utilized for categorical variables. The association between survival and CHA_2DS_2-VA score over a 12-month follow-up period was examined using the Kaplan-Meier test. The variables influencing mortality for one-year were assessed using univariate Cox regression analysis. Parameters with a p value of <0.05 in the univariate Cox regression analyses were included in the multivariate Cox regression analyses. A p value of <0.05 was considered statistically significant.

RESULTS

In this study, patients with a CHA_2DS_2-VA score of ≥2 were included in the high-risk group (n=743), and patients with a CHA_2DS_2-VA score of <2 were included in the low-risk group (n=174). No significant difference was observed between the groups in terms of body mass index (BMI), heart rate, smoking, hemoglobin, platelet, and albumin ($p<0.05$ for all).

Mean age (71.9±9 *vs.* 62.8±8.8 years, p<0.001), CHA_2DS_2-VA score (3.12±1.16 *vs.* 0.75±0.43, p<0.001), SBP (129±17.6 *vs.* 125.9±16.9 mmHg, p=0.035), DBP (78.3±11.6 *vs.* 75.2±11.1 mmHg, p=0.002), and HAS-BLED score (2 [1] *vs.* 1 [1], p<0.001) were higher in the high-risk group. Additionally, as expected, the number of patients with HT (539 [72.5] *vs.* 76 [43.7], p<0.001), DM (174 [23.4] *vs.* 13 [7.5], p<0.001), ischemic cerebrovascular disease (CVD) (57 [7.7] *vs.* 4 [2.3], p=0.010), hemorrhagic CVD (4 [0.5] *vs.* 2 [1.1], p=0.368), chronic obstructive pulmonary disease (COPD) (147 [19.8] *vs.* 24 [13.8], p=0.040), CKD (556 [74.8] *vs.* 110 [63.2], p=0.002), heart failure with reduced ejection fraction (HFrEF) (209 [28.1] *vs.* 17 [9.8], p<0.001) and one-year mortality rates (69 [9.3] *vs.* 4 [2.3], p=0.002) were higher in the high-risk group. Also, the mean left ventricular ejection fraction (LVEF) (49.9±10.8 *vs.* 54.5±8.6%, p<0.001) and GFR (39.1 [33] *vs.* 52.4 [43] mL/min/1.73 m², p<0.001) were statistically significantly lower in the high-risk group (Table 1).

Univariate Cox regression analyses were performed to investigate predictors of one-year all-cause mortality. In these analyses, CHA_2DS_2-VA score (hazard ratio [HR]=1.368, 95% confidence interval [CI]: 1.180-1.585, p<0.001), age (HR=1.057, 95% CI: 1.029-1.086, p<0.001), female sex (HR=3.630, 95% CI: 2.109-6.246, p<0.001), SBP (HR=0.982, 95% CI: 0.968-0.996, p=0.009), LVEF (HR=0.961, 95% CI: 0.941-0.981, p<0.001), COPD (HR=1.972, 95% CI: 1.196-3.251, p=0.008), CKD (HR=1.792, 95% CI: 1.004-3.215, p=0.014), hemoglobin (HR=0.867, 95% CI: 0.772-0.973, p=0.015), neutrophil (HR=1.060, 95% CI: 1.036-1.085, p<0.001), and lymphocyte (HR=0.930, 95% CI: 0.930-0.957, p<0.001) were statistically significant predictors of one-year all-cause mortality (Table 2).

Table 1

Baseline characteristics of total population

	High risk group					Low risk group					Total					
Parameters	n	%	Mean±SD	Median	IQR	n	%	Mean±SD	Median	IQR	n	%	Mean±SD	Median	IQR	*p*
Age (year)			71.9±9					62.8±8.8					70.2±9.7			**<0.001**
Sex																**<0.001**
Female	351	47.2				120	69				471	51.4				
CHA_2DS_2-VA score			3.12±1.16					0.75±0.43					2.7±1.4			**<0.001**
Body mass index (kg/m^2)			28.3±3.8					28±3.9					28.2±3.8			0.410
Heart rate (min)			88.6±17.5					88±18.5					88.5±17.7			0.696
Systolic blood pressure (mmHg)			129±17.6					125.9±16.9					128.4±17.5			**0.035**
Diastolic blood pressure (mmHg)			78.3±11.6					75.2±11.1					77.7±11.6			**0.002**
LVEF (%)			49.9±10.8					54.5±8.6					50.4±10.6			**<0.001**
GFR (mL/min)-IQR				39.1	33				52.4	43				41.4	35	**<0.001**
HAS-BLED score-IQR				2	1				1	1				2	1	**<0.001**
Hemoglobin (g/dL)			13±2					13.2±1.9					13.1±2			0.318
Platelet (10^3/μL)			230.7±72					232.1±64.5					231±70.6			0.812
Neutophile (10^3/μL)			64.2±9.8					60.1±9.7					63.4±9.9			**<0.001**
Lymphocyte (10^3/μL)			24.7±8.7					28±9.4					25.3±9			**<0.001**
Glucose (mg/dL)			120.6±41.7					105.8±23					117.7±39			**<0.001**
Urea (mg/dL)			34.3±15.4					28.1±13.5					33.1±15.3			**<0.001**
Creatinin (mg/dL)-IQR				0.9	0.41				0.8	0.23				0.9	0.34	**<0.001**
Albumin (g/dL)			4.06±0.52					4.05±0.49					4.1±0.53			0.873
Total cholesterol (mg/dL)			174.9±42					181.1±44					176.3±42			**0.043**
HFrEF	209	28.1				17	9.8				226	24.6				**<0.001**
CKD	556	74.8				110	63.2				666	72.6				**0.002**
Smoker	118	15.9				24	13.8				142	15.5				0.493
Hypertension	539	72.5				76	43.7				615	67.1				**<0.001**
Diabetes mellitus	174	23.4				13	7.5				187	20.4				**<0.001**
Ischemic CVD/TIA	57	7.7				4	2.3				61	6.7				**0.010**
Hemorrhagic CVD	4	0.5				2	1.1				6	0.7				0.368
COPD	147	19.8				24	13.8				171	18.6				**0.040**
One-year mortality	69	9.3				4	2.3				73	8				**0.002**

SD: Standard deviation; IQR: Interquartile range; LVEF: Left ventricular ejection fraction; GFR: Glomerular filtration rate; CKD: Chronic kidney disease; CVD: Cerebrovascular disease; TIA: Transient ischemic attack; COPD: Chronic obstructive pulmonary disease. Low risk group; patients with a CHA2DS2-VA score <2; High risk group; patients with a CHA2DS2-VA score ≥2; P value of <0.05 shows statistical significance.

Table 2
Cox Regression analysis of 1-year all-cause mortality

	Univariable			Multivariable		
Parameters	HR	95% CI	*p*	HR	95% CI	*p*
CHA_2DS_2-VA score	1.368	1.180-1.585	**<0.001**	1.040	0.863-1.254	0.679
Age	1.057	1.029-1.086	**<0.001**	1.035	1.005-1.065	**0.022**
Sex / Female	3.630	2.109-6.246	**<0.001**	2.978	1.662-5.337	**<0.001**
Body mass index	0.949	0.892-1.009	0.092			
Heart rate	0.992	0.979-1.006	0.255			
Systolic blood pressure	0.982	0.968-0.996	**0.009**	0.984	0.970-0.997	**0.019**
LVEF	0.961	0.941-0.981	**<0.001**	0.977	0.954-1.000	**0.047**
COPD	1.972	1.196-3.251	**0.008**	1.759	1.040-2.974	**0.035**
CKD	1.792	1.004-3.215	**0.014**	1.133	0.607-2.112	0.695
Smoking	2.208	0.585-7.279	0.154			
Hypertension	1.072	0.654-1.756	0.783			
Diabetes mellitus	1.294	0.760-2.204	0.342			
Ischemic CVD/TIA	1.280	0.555-2.951	0.562			
Hemoglobin	0.867	0.772-0.973	**0.015**	0.870	0.774-0.978	**0.019**
Glucose	0.999	0.992-1.005	0.638			
Platelet	1.000	0.996-1.003	0.786			
Neutrophile	1.060	1.036-1.085	**<0.001**	1.033	0.995-1.072	0.091
Lymphocyte	0.930	0.930-0.957	**<0.001**	0.989	0.943-1.036	0.632
Albumin	0.853	0.550-1.323	0.477			

HR: Hazard ratio; CI: Confidence interval; LVEF: Left ventricular ejection fraction; COPD: Chronic obstructive pulmonary disease; CKD: Chronic kidney disease; CVD: Cerebrovascular disease; TIA: Transient ischemic attack.

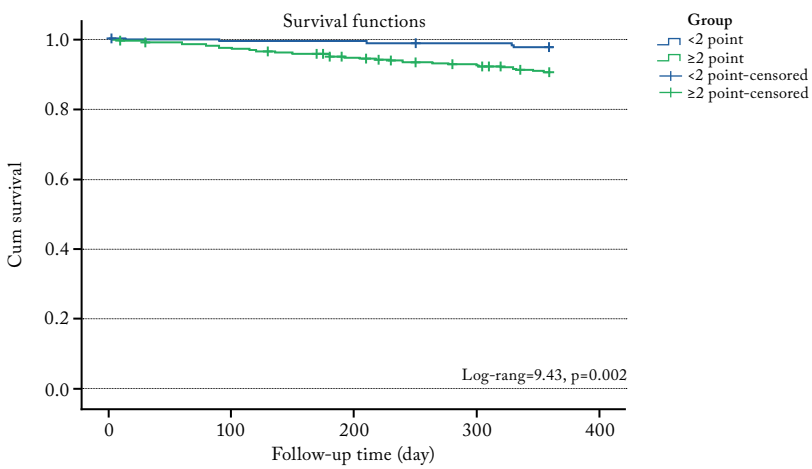

Figure 2. Kaplan-Meier analysis of relationship between CHA2DS2-VA score and 1-year all-cause mortality.

In the multivariate Cox regression analyses, only age (HR=1.035, 95% CI: 1.005-1.065, p=0.022), female sex (HR=2.978, 95% CI: 1.662-5.337, p<0.001), SBP (HR=0.984, 95% CI: 0.970-0.997, p=0.019), COPD (HR=1.759, 95% CI: 1.040-2.974, p=0.035), LVEF (HR=0.977, 95% CI: 0.954-1.000, p=0.047), and hemoglobin (HR=0.870, 95% CI: 0.774-0.978, p=0.019) were found to be independent predictors (Table 2).

The Kaplan-Meier analysis was performed to identify the relationship between CHA_2DS_2-VA score and one-year all-cause mortality. As a result of the analysis, the relationship between CHA_2DS_2-VA score and one-year all-cause mortality was statistically significant (log-rank=9.43, p=0.002) (Figure 2).

DISCUSSION

In the current study, we investigated the effect of CHA_2DS_2-VA score on one-year all-cause mortality in patients with permanent AF. Our study results showed a statistically significant relationship between the CHA_2DS_2-VA score and one-year mortality. However, the CHA_2DS_2-VA score was not an independent predictor of one-year all-cause mortality in patients with permanent AF. In addition, age, LVEF, COPD, female sex, hemoglobin level, and SBP were independent predictors of one-year all-cause mortality in permanent AF patients.

In previous studies investigating AF prognosis, results regarding the effect of sex are confusing. In the study by Dagres et al.,[16] male patients were more likely to have CAD and idiopathic AF, whereas female patients were older and more likely to have DM, thyroid disease, valvular heart disease, and HT. Overall, women were more likely than males to have comorbidities, be at the highest risk for stroke, and had symptoms. Other long-term morbidities and mortality rates were similar. The results from the Global Anticoagulant Registry in the FIELD-Atrial Fibrillation (GARFIELD-AF) study, which included over 28,000 patients, showed that the unadjusted rate of all-cause mortality was only slightly higher in women than in men and, after adjustment for baseline risk factors, the rate of all-cause mortality was similar between women and men.[17] According to Emdin et al.'s[18] meta-analysis of more than 4,000,000 patients, women with AF had a greater relative risk of heart failure, cardiovascular death, stroke, all-cause mortality, and cardiac events than males.[18] In our study, similar results were found in the meta-analysis study conducted by Emdin et al.[18] in female AF patients. However, the effect of sex on mortality in AF patients is debatable. Many studies have shown that female patients have more comorbidities, more suffer from obesity, and are older patients. The outcomes of the female sex are expected to be worse, although its effect on mortality is still unclear.

According to Goldhaber et al.,[19] compared to patients under 65 years of age, the HRs for major adverse clinical outcomes within 24 months of follow-up for overall mortality, cardiovascular and non-cardiovascular mortality, non-hemorrhagic stroke or systemic embolism, major bleeding, myocardial infarction/acute coronary syndrome, and new or worsening heart failure increased with older age category. Many comorbidities and frailties are expected in older patients. It is not surprising that many diseases are predictors of mortality in this patient group. In our study, similar to previous studies,[19,20] age was an independent predictor of one-year mortality.

Previous studies have demonstrated that anemia is associated with poor prognosis and death in patients with AF.[21,22] Anemia was revealed to be an independent predictor of major adverse cardiac and cerebrovascular events as well as all-cause mortality by the Atrial Fibrillation Undergoing Coronary Stenting (AFCAS) registry.[22] Additionally, compared to AF patients who were not anemic, anemia was linked to a considerably higher risk of severe bleeding events, stroke, thromboembolic events, and all-cause death, according to the Danish registry.[21] In our study, in line with these studies, low hemoglobin level was an independent predictor of one-year all-cause mortality.

Heart failure has also been shown to increase one-year mortality in patients with AF in previous studies. A significant relationship was demonstrated between heart failure and mortality in the study conducted by Fauchier et al.[1] The Randomized Evaluation of Long-term Anticoagulant Therapy: dabigatran vs. warfarin (RELY-AF) study[23] and XANTUS (Xarelto® for Prevention of Stroke in Patients with Atrial Fibrillation)[24] real-life data also showed that heart failure was associated with

one-year all-cause mortality in patients with AF. The difference between our study and these studies is the mortality rate in patients. In our study, the one-year all-cause mortality rate was 8% and the mortality rate was higher compared to other studies. We believe that the reason for this is that we only included permanent AF patients in our study. Permanent AF is seen in more frail and older patients than other types of AF, and worse clinical outcomes are expected in permanent AF.

In Denmark, an observational study examined whether death rates differed for patients with AF and COPD based on the order of diagnosis.[25] After five years, more than half of these patients died, showing poor prognosis. Patients diagnosed with AF before COPD had a 26% lower death risk than those with COPD diagnosed first. Earlier COPD diagnosis increased mortality risk. In the meta-analysis study by Ye et al.,[26] AF patients with COPD were found to be associated with increased overall mortality, increased cardiovascular mortality, and more frequent bleeding complications compared to AF patients without COPD. Our study found similar results to previous studies. Taken together, it should be kept in mind that COPD is a risk factor in predicting mortality, given the fact that it is frequently seen in AF patients.

Nonetheless, there are some limitations to this study. First, this study is a single-center and retrospective study. Therefore, the results cannot be generalized. Second, since our study is retrospective, some bias could not have been completely eliminated. Third, in the multivariate analyses, some other parameters could have been included; however, we have missing data. Finally, we have no data on hemorrhagic or ischemic CVD that developed during follow-up in the patients, and since we are unaware of the causes of death, only predictors of all-cause death were analyzed.

In conclusion, our study results showed that the CHA_2DS_2-VA score was associated with one-year all-cause mortality in AF patients, but it was not an independent predictor when evaluated with all parameters affecting mortality. In the management of AF patients, the CHA_2DS_2-VA score may be useful not only in determining oral anticoagulation strategy, but also in the approach of clinicians to AF patients, considering that it may be a predictor of mortality.

Data Sharing Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Author Contributions: All authors contributed equally to this article.

Conflict of Interest: The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

Funding: The authors received no financial support for the research and/or authorship of this article.

REFERENCES

1. Fauchier L, Villejoubert O, Clementy N, Bernard A, Pierre B, Angoulvant D, et al. Causes of death and influencing factors in patients with atrial fibrillation. Am J Med 2016;129:1278-87. doi: 10.1016/j.amjmed.2016.06.045.
2. Hart RG, Pearce LA, Aguilar MI. Meta-analysis: Antithrombotic therapy to prevent stroke in patients who have nonvalvular atrial fibrillation. Ann Intern Med 2007;146:857-67. doi: 10.7326/0003-4819-146-12-200706190-00007.
3. Patel MR, Mahaffey KW, Garg J, Pan G, Singer DE, Hacke W, et al. Rivaroxaban versus warfarin in nonvalvular atrial fibrillation. N Engl J Med 2011;365:883-91. doi: 10.1056/NEJMoa1009638.
4. Connolly SJ, Ezekowitz MD, Yusuf S, Eikelboom J, Oldgren J, Parekh A, et al. Dabigatran versus warfarin in patients with atrial fibrillation. N Engl J Med 2009;361:1139-51. doi: 10.1056/NEJMoa0905561.
5. Giugliano RP, Ruff CT, Braunwald E, Murphy SA, Wiviott SD, Halperin JL, et al. Edoxaban versus warfarin in patients with atrial fibrillation. N Engl J Med 2013;369:2093-104. doi: 10.1056/NEJMoa1310907.
6. Gencpınar T, Bilen C, Kemahli B, Sayarer C, Akokay P, Bayrak S, et al. The effect of edoxaban on apoptosis in an abdominal aortic aneurysm model in rats. Turk Gogus Kalp Dama 2024;32:378-86. doi: 10.5606/tgkdc.dergisi.2024.25890.
7. Peng H, Sun Z, Chen H, Zhang Y, Ding X, Zhao XQ, et al. Usefulness of the CHA2DS2-VASc score to predict adverse outcomes in acute coronary syndrome patients without atrial fibrillation undergoing percutaneous coronary intervention. Am J Cardiol 2019;124:476-84. doi: 10.1016/j.amjcard.2019.05.036.
8. Guerra F, Scappini L, Maolo A, Campo G, Pavasini R, Shkoza M, et al. CHA2DS2-VASc risk factors as predictors of stroke after acute coronary syndrome: A systematic review and meta-analysis. Eur Heart J Acute Cardiovasc Care 2018;7:264-74. doi: 10.1177/2048872616673536.
9. Chen YL, Zeng M, Liu Y, Xu Y, Bai Y, Cao L, et al. CHA2DS2-VASc score for identifying patients at high risk of postoperative atrial fibrillation after cardiac surgery: A meta-analysis. Ann Thorac Surg 2020;109:1210-6. doi: 10.1016/j.athoracsur.2019.07.084.

10. Borovac JA, Kwok CS, Mohamed MO, Fischman DL, Savage M, Alraies C, et al. The predictive value of CHA2DS2-VASc score on in-hospital death and adverse periprocedural events among patients with the acute coronary syndrome and atrial fibrillation who undergo percutaneous coronary intervention: A 10-year National Inpatient Sample (NIS) analysis. Cardiovasc Revasc Med 2021;29:61-8. doi: 10.1016/j.carrev.2020.08.003.
11. Akboğa MK, Yılmaz S, Yalçın R. Prognostic value of CHA2DS2-VASc score in predicting high SYNTAX score and in-hospital mortality for non-ST elevation myocardial infarction in patients without atrial fibrillation. Anatol J Cardiol 2021;25:789-95. doi: 10.5152/AnatolJCardiol.2021.03982.
12. Ipek G, Onuk T, Karatas MB, Gungor B, Osken A, Keskin M, et al. CHA2DS2-VASc score is a predictor of no-reflow in patients with ST-segment elevation myocardial infarction who underwent primary percutaneous intervention. Angiology 2016;67:840-5. doi: 10.1177/0003319715622844.
13. Ünal S, Açar B, Yayla Ç, Balci MM, Ertem A, Kara M, et al. Importance and usage of the CHA2DS2-VASc score in predicting acute stent thrombosis. Coron Artery Dis 2016;27:478-82. doi: 10.1097/MCA.0000000000000388.
14. Van Gelder IC, Rienstra M, Bunting KV, Casado-Arroyo R, Caso V, Crijns HJGM, et al. 2024 ESC Guidelines for the management of atrial fibrillation developed in collaboration with the European Association for Cardio-Thoracic Surgery (EACTS). Eur Heart J 2024;45:3314-414. doi: 10.1093/eurheartj/ehae176.
15. Cockcroft DW, Gault MH. Prediction of creatinine clearance from serum creatinine. Nephron 1976;16:31-41. doi: 10.1159/000180580.
16. Dagres N, Nieuwlaat R, Vardas PE, Andresen D, Lévy S, Cobbe S, et al. Gender-related differences in presentation, treatment, and outcome of patients with atrial fibrillation in Europe: A report from the Euro Heart Survey on Atrial Fibrillation. J Am Coll Cardiol 2007;49:572-7. doi: 10.1016/j.jacc.2006.10.047.
17. Camm AJ, Accetta G, Al Mahmeed W, Ambrosio G, Goldhaber SZ, Haas S, et al. Impact of gender on event rates at 1 year in patients with newly diagnosed non-valvular atrial fibrillation: Contemporary perspective from the GARFIELD-AF registry. BMJ Open 2017;7:e014579. doi: 10.1136/bmjopen-2016-014579.
18. Emdin CA, Wong CX, Hsiao AJ, Altman DG, Peters SA, Woodward M, et al. Atrial fibrillation as risk factor for cardiovascular disease and death in women compared with men: Systematic review and meta-analysis of cohort studies. BMJ 2016;532:h7013. doi: 10.1136/bmj.h7013.
19. Goldhaber SZ, Bassand JP, Camm AJ, Virdone S, Pieper K, Cools F, et al. Clinical outcomes in older patients with atrial fibrillation: Insights from the GARFIELD-AF registry. Am J Med 2024;137:128-36.e13. doi: 10.1016/j.amjmed.2023.10.027.
20. Kılıç R, Kaya AF. Clinical significance of CONUT score in atrial fibrillation patients aged 65 and over. Cardiovasc Surg Int 2024;11:10-7. doi: 10.5606/e-cvsi.2024.1572
21. Bonde AN, Blanche P, Staerk L, Gerds TA, Gundlund A, Gislason G, et al. Oral anticoagulation among atrial fibrillation patients with anaemia: An observational cohort study. Eur Heart J 2019;40:3782-90. doi: 10.1093/eurheartj/ehz155.
22. Puurunen M, Kiviniemi T, Nammas W, Schlitt A, Rubboli A, Nyman K, et al. Impact of anaemia on clinical outcome in patients with atrial fibrillation undergoing percutaneous coronary intervention: Insights from the AFCAS registry. BMJ Open 2014;4:e004700. doi: 10.1136/bmjopen-2013-004700.
23. Marijon E, Le Heuzey JY, Connolly S, Yang S, Pogue J, Brueckmann M, et al. Causes of death and influencing factors in patients with atrial fibrillation: A competing-risk analysis from the randomized evaluation of long-term anticoagulant therapy study. Circulation 2013;128:2192-201. doi: 10.1161/CIRCULATIONAHA.112.000491.
24. Camm AJ, Amarenco P, Haas S, Hess S, Kirchhof P, Kuhls S, et al. XANTUS: A real-world, prospective, observational study of patients treated with rivaroxaban for stroke prevention in atrial fibrillation. Eur Heart J 2016;37:1145-53. doi: 10.1093/eurheartj/ehv466.
25. Warming PE, Garcia R, Hansen CJ, Simons SO, Torp-Pedersen C, Linz D, et al. Atrial fibrillation and chronic obstructive pulmonary disease: Diagnostic sequence and mortality risk. Eur Heart J Qual Care Clin Outcomes 2023;9:128-34. doi: 10.1093/ehjqcco/qcac059.
26. Ye J, Yao P, Shi X, Yu X. A systematic literature review and meta-analysis on the impact of COPD on atrial fibrillation patient outcome. Heart Lung 2022;51:67-74. doi: 10.1016/j.hrtlng.2021.09.001.