The CHA$_2$DS$_2$-VASc Score as a Predictor of Left Atrial Thrombus in Patients with Non-Valvular Atrial Fibrillation

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Abstract

Objective: To investigate whether or not the CHA$_2$DS$_2$-VASc score predicts left atrial (LA) thrombus detected on pre-cardioversion transoesophageal echocardiography (TEE). **Materials and Methods:** The medical records of patients who had undergone TEE were reviewed to assess the presence of LA thrombus prior to direct-current cardioversion for atrial fibrillation (AF). The CHA$_2$DS$_2$-VASc score was calculated for each patient. Clinical TEE reports were reviewed for the presence of LA thrombus. Patients with a valve prosthesis or rheumatic mitral valve disease were excluded from this study. **Results:** A total of 309 patients were identified. The mean age was 70.1 ± 9.8 years and 151 (49%) patients were males and 158 (51%) were females. LA thrombus was seen in 32 (10.3%) of the 309 patients. Fifty (16.2%) patients had a low CHA$_2$DS$_2$-VASc score (0–1), 230 (74.4%) had an intermediate score (2–4) and 29 (9.4%) had a high score (5–9). The incidence of LA thrombus in the low, intermediate and high CHA$_2$DS$_2$-VASc score groups was 0, 4.4 and 68.7%, respectively. The LA thrombus risk increased with increasing CHA$_2$DS$_2$-VASc scores. On multivariate logistic analysis, the CHA$_2$DS$_2$-VASc score (OR 3.26, 95% CI 2.3–4.65; p = 0.001) and age (OR 0.93, 95% CI 0.88–0.98; p = 0.004) were independent risk factors for LA thrombus in patients with non-valvular AF. **Conclusion:** A high CHA$_2$DS$_2$-VASc score was independently associated with the presence of LA thrombus in patients with non-valvular AF.

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Introduction

Atrial fibrillation (AF) is the most common arrhythmia and it is associated with significant morbidity and mortality, especially in elderly people [1]. It represents a major risk factor for thromboembolic events, accounting for approximately 15% of all ischaemic strokes [2]. The risk of thromboembolic events in patients with non-valvular AF is evaluated using various clinical risk stratification schemes. The CHADS$_2$ score is a simple scoring system which is calculated by assigning 1 point for each recent cardiac failure, hypertension, age >75 years and diabetes mellitus and 2 points for a history of stroke or transient ischaemic attack (TIA). It is used widely in clin-

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ical practice to categorize patients into low-, moderate- and high-risk groups [3]. Recently, the $CHADS_2$ scoring system was modified into the CHA_2DS_2-VASc score to include additional clinical risk factors [4] (2 points each for age ≥75 years and a history of stroke or TIA, and 1 point for cardiac failure, hypertension, diabetes mellitus, vascular diseases such as myocardial infarction, complex aortic plaque and peripheral artery disease, age between 65 and 74 years and female sex). There is a growing body of evidence of the association between this new scoring system and transoesophageal echocardiography (TEE) findings of high embolic risk, such as left atrial (LA) thrombus and spontaneous echo contrast (SEC) [5, 6]. Hence, in this study we aimed to determine the ability of the CHA_2DS_2-VASc score to predict the presence of LA thrombus on pre-cardioversion TEE in patients with non-valvular AF.

Materials and Methods

A total of 878 consecutive TEE examinations performed at our hospital between January 2009 and September 2012 were reviewed. All patients with non-valvular AF who underwent TEE-guided direct-current cardioversion (DCC) were included in this study. Exclusion criteria were: concomitant chronic kidney disease, malignancy, connective tissue diseases, a prosthesis valve and rheumatic mitral valve diseases.

Transoesophageal Echocardiography

TEE examinations were performed in a standard manner, with all subjects in the lateral decubitus position, using the VingMed System Five with a multiplane TEE probe (GE Medical Systems, Hortan, Norway). TEE was performed after anaesthetizing the posterior pharynx and providing conscious sedation. Multiple views were obtained and reviewed by two cardiologists (M.U. and Z.I.). Written informed consent was obtained from all patients prior to TEE.

The CHA_2DS_2-VASc score of each patient was calculated using clinical data obtained from our hospital database by accessing the ICD-10 diagnosis coding system. Two points were assigned for a history of stroke or TIA and age >75years, and 1 point was assigned for age between 65 and 74 years, hypertension, diabetes mellitus, a recent cardiac failure, vascular disease (myocardial infarction, complex aortic plaque and peripheral arterial disease) and female sex.

Heart failure was defined as clinical heart failure (stage C or D) according to the 2009 Focused Update: ACC/AHA Guidelines for the Diagnosis and Management of Heart Failure in Adults [7]. Hypertension was defined as high blood pressure (>140/90 mm Hg) or being on treatment with anti-hypertensive drugs. Diabetes mellitus was diagnosed if the fasting plasma glucose level was >126 mg/dl or if the patient was taking oral anti-diabetic drugs or insulin. Stroke was defined as a neurologic deficit lasting <24 h (TIA) or longer (stroke) and caused by ischaemia. Patients were categorized into low- (0–1 point), intermediate- (2–4 points) and high-score (>5 points) groups.

Table 1. Patient characteristics and risk factors

| Parameter	Value
Congestive heart failure	77 (25)
Hypertension	250 (81)
Mean age, years	70.1±9.8
Age 65–74 years	115 (37)
Age ≥75 years	96 (31)
Diabetes	102 (33)
Stroke	68 (22)
Peripheral embolism	37 (12)
Male sex	151 (49)
Female sex	158 (51)
CAD	96 (31)
Thrombus	32 (10.3)
SEC	38 (12)
Warfarin consumption	98 (32)
ASA consumption	207 (67)

Values are presented as numbers (%) unless otherwise stated. CAD = Coronary artery disease; ASA = acetylsalicylic acid.

Statistical Analysis

Continuous variables are expressed as means ± SD. Categorical variables are expressed as percentages. Spearman's correlation coefficient was used to calculate correlations, and multivariate logistic regression analysis was performed to evaluate the relations between parameters. $p < 0.05$ was considered statistically significant. Statistical analysis was performed using a commercially available statistical package (SPSS for Windows 16.0; SPSS Inc., Chicago, Ill., USA).

Results

A total of 309 patients with a mean age of 70.1 ± 9.8 years were identified [151 (49%) males and 158 (51%) females]. The characteristics and risk factors of the 309 patients enrolled into this study are shown in table 1. Of the 309 patients, 50 (16%) were in the low-score group while 230 (74%) were in the intermediate-score group and 29 (10%) were in the high-score group. LA SEC was identified in 38 (12%) patients and LA thrombus was identified in 32 (10.3%) patients. The prevalence of SEC and LA thrombus increased with elevated CHA_2DS_2-VASc scores as follows: low score, 7.7 and 0%; intermediate score, 9.9 and 4.4%, and high score, 40 and 68.8%, respectively. The incidence of LA thrombus increased with higher CHA_2DS_2-VASc scores ($p = 0.001$). The difference between groups was statistically significant ($p = 0.002$).
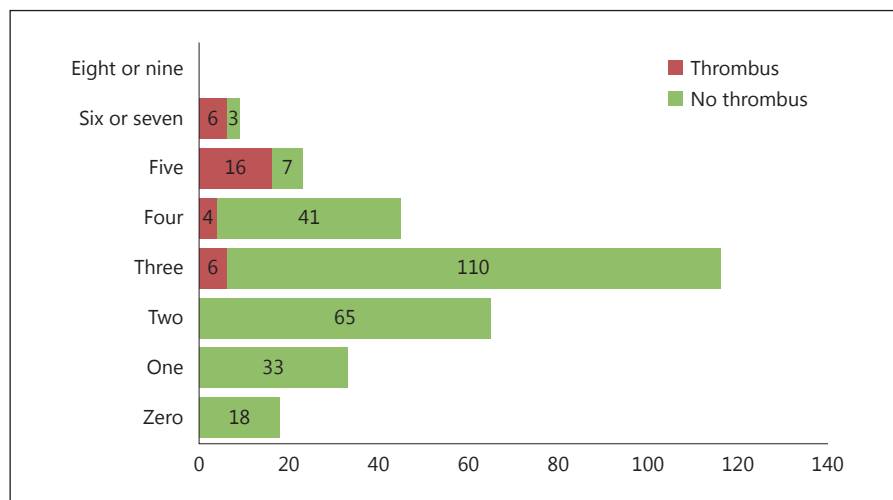
Fig. 1. Prevalence of LA thrombus by CHA$_2$DS$_2$-VASc score.

There were no thrombi in patients with a CHA$_2$DS$_2$-VASc score of 0. The main characteristics of patients with LA thrombus are shown in figure 1.

The effects of multiple variables on LA thrombus were analysed using univariate and multivariate logistic regression analyses. The variables for which the unadjusted p value was <0.10 on univariate analysis were identified as potential risk markers for LA thrombus and were included in the full model. On univariate logistic regression analysis, the CHA$_2$DS$_2$-VASc score, age, left ventricular ejection fraction and hypertension were found to be predictive of LA thrombus. Only the CHA$_2$DS$_2$-VASc score (OR 3.26, 95% CI 2.3–4.65; p < 0.001) and age (OR 0.93, 95% CI 0.88–0.98; p = 0.004) were found to be independent predictors of LA thrombus in the multivariate logistic analysis.

Discussion

The prevalence of LA thrombus was 10.3% in all patients with non-valvular AF before undergoing DCC, which is within the range (10–13%) of rates previously reported for patients who were not fully anti-coagulated [8, 9]. The CHA$_2$DS$_2$-VASc score was independently associated with the presence of LA thrombus in patients with non-valvular AF.

The decision to start anti-coagulation is a pivotal one in the management of patients with non-valvular AF and it is usually made with the help of the CHA$_2$DS$_2$-VASc scoring system. It has been shown that using the CHA$_2$DS$_2$-VASc score instead of CHADS$_2$ increases the

sensitivity for detecting TEE risk factors at the cost of decreased specificity [5, 6, 10]. The latest guidelines for the management of AF recommend anti-coagulation for patients with a CHA$_2$DS$_2$-VASc score ≥1 [11]. Patients with a CHA$_2$DS$_2$-VASc score of 0 or 1 should be evaluated carefully as candidates for anti-coagulation therapy. Previous studies have reported varying frequencies of LA thrombus and SEC in patients with CHA$_2$DS$_2$-VASc scores of 0 and 1 [8, 12–14]. It has been shown that the CHADS$_2$ score has limited value for predicting the presence of LA thrombus in AF patients in low-risk categories [8]. In a meta-analysis, Keogh et al. [15] reported the predictive value of CHADS$_2$ and concluded that the CHADS$_2$ score had minimal clinical utility for predicting ischaemic stroke across all risk strata.

However, in two different studies it was demonstrated that the incidence of LA thrombus and SEC increased with increasing CHADS$_2$ scores [16, 17]. In this study, we found the same relationship between the CHA$_2$DS$_2$-VASc score and LA thrombus and SEC. Our results support the value of the clinically evaluated CHA$_2$DS$_2$-VASc score for the decision of starting anti-coagulation in patients with AF. Tang et al. [18] reported that the CHA$_2$DS$_2$-VASc score (but not CHADS$_2$) was an independent predictor of LA thrombus. They also emphasized that there were no LA thrombi in patients with a CHA$_2$DS$_2$-VASc score of 0.

Using the CHADS$_2$ score in cases of newly detected LA thrombi, Wasmer et al. [12] reported that 35% of patients were in the low-risk group, but only 19% of patients were found to be in the low-risk group using the CHA$_2$DS$_2$-VASc score. In another study, patients with a CHADS$_2$

score of 1 were reclassified using the CHA_2DS_2-VASc score and 74% had a CHA_2DS_2-VASc score ≥2 with an increased annual incidence of stroke or systemic embolus compared to patients with a CHA_2DS_2-VASc score of 1 [19]. However, Kleemann et al. [13] demonstrated that, despite a low $CHADS_2$ score (0–1), 3% of patients had thrombus and 8% had SEC. Similarly, Yarmohammadi et al. [8] showed that 10% of patients had LA thrombus with a $CHADS_2$ score of 0. In our study, we detected a slightly lower prevalence (3.9%) of SEC among patients with low CHA_2DS_2-VASc (0–1) scores and no patients with LA thrombus. Our findings are similar to those of a study by Decker et al. [14] in which no patients had LA thrombus with a $CHADS_2$ score of 0. One possible important reason for this difference may be the fact that a $CHADS_2$ score of 0 is not equal to a CHA_2DS_2-VASc score of 0 [17]. Potpara et al. [20] showed that only a CHA_2DS_2-VASc score of 0 was significantly related to the absence of stroke in a cohort of 'lone' AF patients compared to the $CHADS_2$ and van Walvaren risk stratification schemes. Olesen et al. [21] suggested that use of the CHA_2DS_2-VASc score would significantly improve the classification of AF patients at low and intermediate risks for stroke compared to the commonly used $CHADS_2$ score. In our study, there were no LA thrombi, which is an echocardiographic finding of high thromboembolic risk, in patients with a CHA_2DS_2-VASc score of 0. Thus, we showed that a CHA_2DS_2-VASc score of 0 can identify patients with non-valvular AF who possess a truly low thromboembolic risk.

There is no definitive recommendation for TEE prior to DCC in low-risk patients. Although the major-compli-cation rate of TEE is very low (<0.02%), it still presents some risk for the patient and is an uncomfortable and expensive procedure. Our results confirmed that TEE prior to DCC in the low-risk group may be unnecessary because none of the patients in the low-risk group had LA thrombus on TEE in our study as previously reported [14, 22].

The limitation of this study is that it is a retrospective study carried out in a single centre. A prospective study would be more valuable; however, we think that this study is still valuable because of the considerable number of subjects and the data obtained from computerized patient files.

Conclusion

The CHA_2DS_2-VASc score was independently associated with the presence of high-thromboembolic-risk findings on echocardiography such as LA thrombus and SEC in patients with non-valvular AF. In light of our findings, we suggest that the anti-coagulation status be questioned in patients undergoing TEE to assess the presence of LA thrombus prior to DCC for AF if the CHA_2DS_2-VASc score is ≥5 (high-score group). If the patient is not taking effective anti-coagulants, TEE should be postponed until 3 weeks of effective anti-coagulant therapy have been completed. In addition, we conclude that DCC can be performed without prior TEE in low-risk patients after effective anti-coagulation therapy.

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