The association between asymptomatic coronary artery disease and $CHADS_2$/CHA_2DS_2-VAS_C scores in patients with stroke

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Directed by Professor Ji Hoe Heo

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ABSTRACT

The association between asymptomatic coronary artery disease and $CHADS_2/CHA_2DS_2$-VAS_C scores in patients with stroke

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Background: $CHADS_2$ and CHA_2DS_2-VASc scores are measurement tools that stratify thromboembolic risk in patients with nonvalvular atrial fibrillation, and are predictive of cerebral atherosclerosis, fatal stroke, and ischaemic heart disease. Patients with higher $CHADS_2/CHA_2DS_2$-VASc scores are more likely to have had an akinetic/hypokinetic left ventricular segment, or a recent myocardial infarction, all of which are associated with coronary artery disease (CAD). Most of the $CHADS_2$ score components are also risk factors for atherosclerosis. Thus, $CHADS_2$ / CHA_2DS_2-VASc scores may be predictive of CAD.

Methods: We enrolled 1733 consecutive patients with acute ischaemic stroke who underwent multi-slice computed tomography coronary angiography. We investigated the association of $CHADS_2$ and CHA_2DS_2-VASc scores with the presence and severity of CAD.

Results: Among 1733 patients, 1220 patients (70.4%) had any degree of CAD, and 576 (33.3%) had significant CAD (≥50% stenosis in at least one coronary artery). As the $CHADS_2$ and CHA_2DS_2-VASc scores increased, the presence of CAD also increased (p<0.001). The severity of CAD was correlated with $CHADS_2$ (Spearman coefficient 0.229, p<0.001) and CHA_2DS_2-VASc scores (Spearman coefficient 0.261, p<0.001). In multivariate analysis, after adjusting for confounding factors, $CHADS_2$ and CHA_2DS_2-VASc scores ≥2 were independently associated with CAD. The CHA_2DS_2-VASc score was a better predictor of the presence of CAD than the $CHADS_2$ score on area under the curve analysis.

Conclusion: $CHADS_2$ and CHA_2DS_2-VASc scores were predictive of the presence and severity of CAD in patients with stroke. When a patient has high $CHADS_2$ or CHA_2DS_2-VASc scores, physicians should consider coronary artery evaluation.

Key words : coronary artery disease, $CHADS_2$ score, CHA_2DS_2-VAScscore, stroke

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I. INTRODUCTION

$CHADS_2$ and CHA_2DS_2-VASc scores are simple and sound tools that stratify embolic risks in patients with nonvalvular atrial fibrillation (NVAF) [1,2]. $CHADS_2$ score also predicts cerebral atherosclerosis, fatal ischaemic stroke, fatal ischaemic heart disease and early neurologic outcome in stroke patients with NVAF [3-5]. We recently have shown that concomitant potential cardiac sources of embolism (PSCE) were more frequent in stroke patients with higher $CHADS_2/CHA_2DS_2$-VASc scores, which may, in part, account for the increased risk of stroke in patients with high $CHADS_2/CHA_2DS_2$-VASc scores [6]. Of note, among PCSE, an akinetic left ventricular segment, a hypokinetic left ventricular segment, and a myocardial infarction <4 weeks prior were associated with higher $CHADS_2/CHA_2DS_2$-VASc scores [6]. These PCSE are associated with coronary artery disease (CAD). Most components of the

$CHADS_2$/CHA_2DS_2-VASc scores are also risk factors for atherosclerosis, and clustering of those factors is associated with cardiovascular mortality [7-11]. Thus, $CHADS_2$/CHA_2DS_2-VASc scores may be predictive of CAD. Therefore, we investigated the association between $CHADS_2$/CHA_2DS_2-VASc scores and the presence and severity of asymptomatic CAD in patients with stroke.

II. MATERIALS AND METHODS

1. Patients and enrollment

We enrolled consecutive patients with acute ischaemic stroke or transient ischaemic attack (TIA) who were admitted to the neurology department from July 2006 to June 2011 and who had undergone multi-slice computed tomography (MSCT) coronary angiography. All patients underwent brain CT scan and/or magnetic resonance imaging (MRI) and a cerebral angiographic study (digital subtraction angiography, CT angiography, or MR angiography). Every patient was evaluated with 12-lead electrocardiography, chest x-ray, and standard blood tests including lipid profile. Transesophageal echocardiography was a part of standard evaluation except in patients with poor cooperation due to decreased consciousness, impending brain herniation, swallowing difficulty, tracheal intubation, or lack of informed consent [12]. Transthoracic echocardiography and Holter monitoring were performed in the selected patients. Patients who were admitted to the stroke unit were monitored continuously with electrocardiography during their stay in the stroke unit. Ankle-brachial index was also performed as screening for peripheral artery disease (PAD). This study was approved by the Institutional Review Board of Severance Hospital, Yonsei University Health System, and all patients provided informed consent.

2. Calculation of $CHADS_2$ and CHA_2DS_2-VASc scores

The $CHADS_2$ score was calculated as the sum of points assigned to each of the following items: one point each for congestive heart failure (CHF), hypertension, aged ≥75, diabetes mellitus, and two points for a history of stroke or TIA. The CHA_2DS_2-VASc score was also calculated as the sum of points assigned to each of the following: one point each for a history of CHF, hypertension, aged 65-74 years, diabetes mellitus, female sex, vascular diseases [previous myocardial infarction, PAD, or complex aortic plaques] and two points for aged ≥75 and a history of stroke or TIA. Index stroke or TIA was not considered for the calculation of $CHADS_2$ and CHA_2DS_2-VASc scores.

3. MSCT Coronary Angiography

Patients underwent MSCT coronary angiography during admission when they had at least one of the following: (1) angiographically confirmed atherosclerosis in intracranial or extracranial cerebral arteries or peripheral arteries; (2) ≥2 risk factors for CAD, such as hypertension, diabetes mellitus, dyslipidemia, smoking, and central obesity; and (3) age (female >55 years, male >45 years). Exclusion criteria for MSCT coronary angiography included: (1) known CAD (angiographically confirmed CAD, unstable angina, coronary artery stent, or prior angioplasty or coronary artery bypass graft); (2) heart rate >64/min at the time of test; (3) poor general condition; (4) impaired renal function; (5) failure to obtain informed consent [13].

Coronary CT angiography was performed using 64 multi-slice CT (Sensation 64; Siemens Medical Solutions, Forchheim, Germany) as reported previously [13]. Experienced cardiac radiologists, who were blinded to the clinical information, reviewed and interpreted all MSCT coronary angiographies. The severity of atherosclerosis was evaluated by the degree of stenosis. CAD was diagnosed when any degree of coronary artery stenosis was present at any of the three main coronary branches, including the left anterior descending, left circumflex, and right coronary arteries. Atherosclerotic stenosis was classified as no CAD (no plaque), mild CAD (<50% stenosis in at least one coronary artery), and significant CAD (≥50% stenosis in at least one coronary artery). The significant (≥50%) CAD was further categorized into 1-vessel disease, 2-vessel disease, and 3-vessel disease.

4. Risk factors

Hypertension was defined as resting blood pressures with high systolic pressure ≥140 mmHg or diastolic pressure ≥90 mmHg on repeated measurements during admission or a history of having used any antihypertensive drug after diagnosis of hypertension [14]. Diabetes mellitus was defined as a fasting plasma glucose ≥7.0 mmol/l or a history of having used oral hypoglycemic agents or insulin [15]. Hyperlipidemia was defined as fasting serum total cholesterol level ≥6.2 mmol/l, LDL-cholesterol ≥4.1 mmol/l, or a history of having used lipid-lowering drugs after a diagnosis of dyslipidemia [16]. CHF was defined as a previous history of CHF or detection of CHF during admission based on the medical records or a hospital diagnosis code (*International Classification of Disease, 10th Revision* ICD-10-CM codes I50). Current smoking was defined as having smoked a cigarette in the year prior to admission. PAD was defined at ankle-brachial index <0.9. Aortic plaques were diagnosed based on the findings of transesophageal echocardiography.

5. Data and statistical analysis

The Windows SPSS package version 19.0 (SPSS Inc., Chicago, IL, USA) was used for statistical analysis. Variables were expressed as mean ± standard deviation or median [interquartile range (IQR)] as appropriate. Demographic characteristics and risk factors were compared using independent sample t-tests or chi-square tests for categorical variables between the CAD and non-CAD groups. The association of $CHADS_2$/CHA_2DS_2-VASc scores with the presence of CAD was analyzed using linear by linear association (Chi-square for trend). Correlation between the severity of CAD and $CHADS_2$/CHA_2DS_2-VASc scores was assessed using the Spearman rank correlation coefficients. Confounding factors such as age, sex, smoking, AF, hyperlipidemia, and the components of $CHADS_2$/CHA_2DS_2-VASc scores were analyzed by univariate analysis, and the variables with p values <0.10 were entered for multiple logistic regression. The results were presented as odds ratio (OR) and 95% confidence intervals (CI). We compared the ability to predict presence of CAD between the $CHADS_2$ score and the CHA_2DS_2-VASc score as well as their components using area under curve (AUC) analysis.

III. RESULTS

1. Demographic characteristics

There were 3490 patients with acute cerebral infarction or TIA during the study period. Among them, 2357 patients were eligible for MSCT coronary CT angiography. After excluding 617 patients who could not complete coronary CT angiography due to various reasons and 7 patients with uninterpretable images, 1733 consecutive patients were included in this study. The complete numbers and reasons of exclusion were illustrated (Fig. 1).

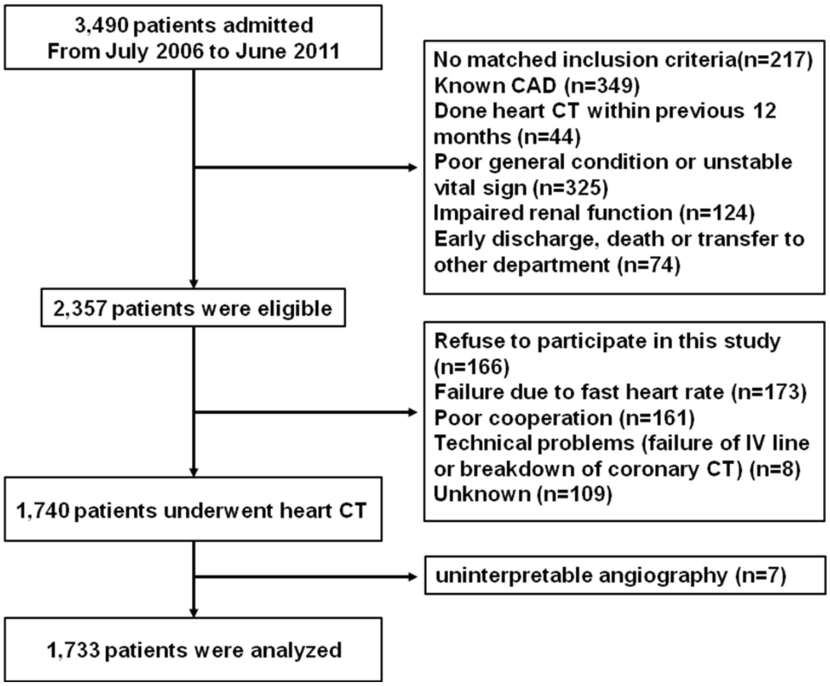

Figure 1 Flowchart showing patient inclusion and exclusion.

Among them, 1220 (70.4%) patients had any degree of CAD [mild CAD in 644 patients (37.2%), and significant CAD in 576 patients (33.3%)]. Of those with significant CAD, there were 320 patients with 1-vessel disease (18.5%), 166 patients with 2-vessel disease (9.6%), and 90 patients with 3-vessel disease (5.2%). When compared to patients without CAD, those with CAD were older, more likely to be male and smokers, and more frequently had hypertension, diabetes, PAD, TIA/ infarction and aortic plaques (table 1). When compared to patients without AF, patients with AF were older and less frequently smokers (table 2).

table 1 Characteristics of patients with and without CAD at baseline.

	CAD (N=1220)	Non-CAD (N=513)	p-value
Age, yr, mean ± SD	66.02±10.37	57.82±12.74	<0.001
Sex, men	827 (67.8)	278 (54.2)	<0.001
Hypertension	970 (79.5)	317 (61.8)	<0.001
Diabetes mellitus	434 (35.6)	103 (20.1)	<0.001
Atrial fibrillation	168 (13.8)	74 (14.4)	0.720
Smoking	545 (44.7)	181 (35.3)	<0.001
Hyperlipidemia	119 (9.8)	37 (7.2)	0.091
History of PAD	32 (2.6)	1 (0.2)	<0.001
Aortic plaques	543 (44.5)	164 (32.0)	<0.001
Previous TIA/infarction	218 (17.9)	63 (12.3)	0.004
$CHADS_2$ score			<0.001
0	126 (10.3)	143 (27.9)	
1	457 (37.5)	211 (41.1)	
2	374 (30.7)	107 (20.9)	
3	137 (11.2)	37 (7.2)	
4	115 (9.4)	12 (2.3)	
5	11 (0.9)	3 (0.6)	
CHA_2DS_2-VASc score			<0.001
0	33 (2.7)	55 (10.7)	
1	114 (9.3)	130 (25.3)	
2	259 (21.2)	115 (22.4)	
3	298 (24.4)	106 (20.7)	
4	269 (22.0)	64 (12.5)	
5	143 (11.7)	28 (5.5)	
6	77 (6.3)	7 (1.4)	
7	26 (2.1)	8 (1.6)	
8	1 (0.1)	0	

Numbers in parentheses are percentages. CAD, coronary artery disease; PAD, peripheral artery disease; TIA, transient ischaemic attack.

table 2 Characteristics of patients with and without AF at baseline.

	AF (N=242)	Non-AF (N=1491)	p-value
Age, yr, mean ± SD	66.91±9.81	63.05±11.93	<0.001
Sex, men	150 (62)	955 (64.1)	0.535
Hypertension	178 (73.6)	1109 (74.4)	0.785
Diabetes mellitus	63 (26.0)	474 (31.8)	0.072
Smoking	71 (29.3)	655 (43.9)	<0.001
Hyperlipidemia	16 (6.6)	140 (9.4)	0.161
Aortic plaques	104 (43.0)	603 (40.4)	0.457
Previous TIA/infarction	43 (17.8)	238 (16.0)	0.480

Numbers in parentheses are percentages.

AF, atrial fibrillation; TIA, transient ischaemic attack.

2. Association between the presence and severity of CAD and $CHADS_2$/CHA_2DS_2-VASc scores

The median $CHADS_2$ score was higher in the CAD group (2, IQR 0-2) than in the non-CAD group (1, IQR 1-2, $p<0.001$). As the $CHADS_2$ score increased, the presence of CAD increased ($p<0.001$). The number of patients with significant CAD also increased as the $CHADS_2$ score increased ($p<0.001$). The median CHA_2DS_2-VASc score was higher in the CAD group (3, IQR 2-4) than the non-CAD group (2, IQR 1-3, $p<0.001$). As the CHA_2DS_2-VASc score increased, the presence of CAD increased ($p<0.001$). The severity of CAD was correlated with $CHADS_2$ (Spearman coefficient 0.229, $p<0.001$) and CHA_2DS_2-VASc scores (Spearman coefficient 0.261, $p<0.001$) (Fig. 2).

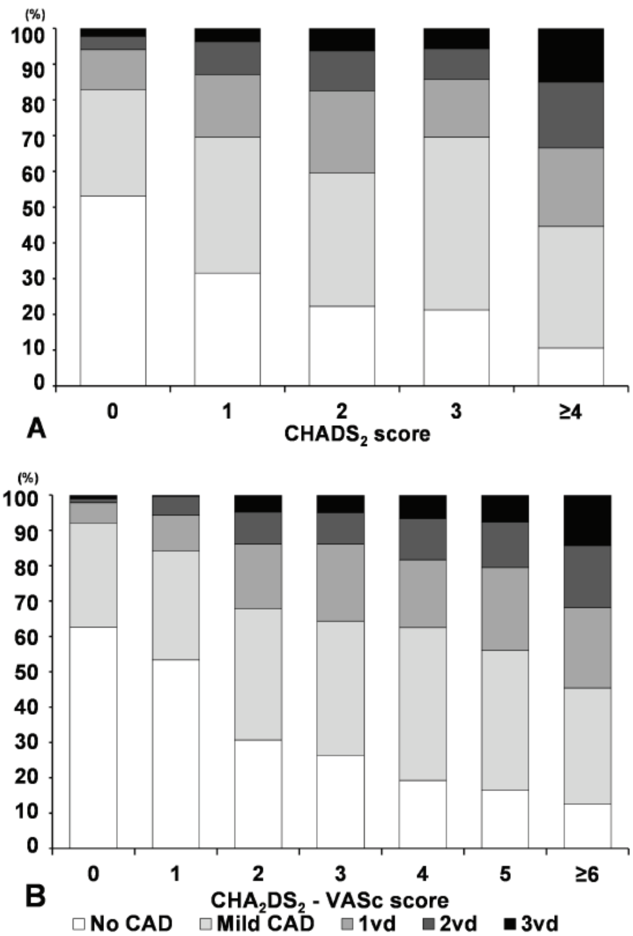

Figure 2 Association of the presence and severity of CAD with the $CHADS_2$ score (A) or CHA_2DS_2-VASc score (B). As the $CHADS_2$ or CHA_2DS_2-VASc score increased, the presence of CAD increased (p<0.001). The severity of CAD was correlated with $CHADS_2$ (Spearman coefficient 0.229, p<0.001) and CHA_2DS_2-VASc scores (Spearman coefficient 0.261, p<0.001).

3. Association between the presence and severity of CAD and $CHADS_2$/CHA_2DS_2-VASc scores in AF patients

Because $CHADS_2$/CHA_2DS_2-VASc scores are used for stratification of embolic risks in patients with AF, we conducted subgroup analysis in patients with AF. Among 1733 patients, 242 patients had AF. The presence of CAD increased as the $CHADS_2$ or CHA_2DS_2-VASc score increased (p=0.003 and p<0.001, respectively). The severity of CAD was also correlated with $CHADS_2$ (Spearman coefficient 0.188, p=0.003) and CHA_2DS_2-VASc scores (Spearman coefficient 0.237, p<0.001) (Fig. 3).

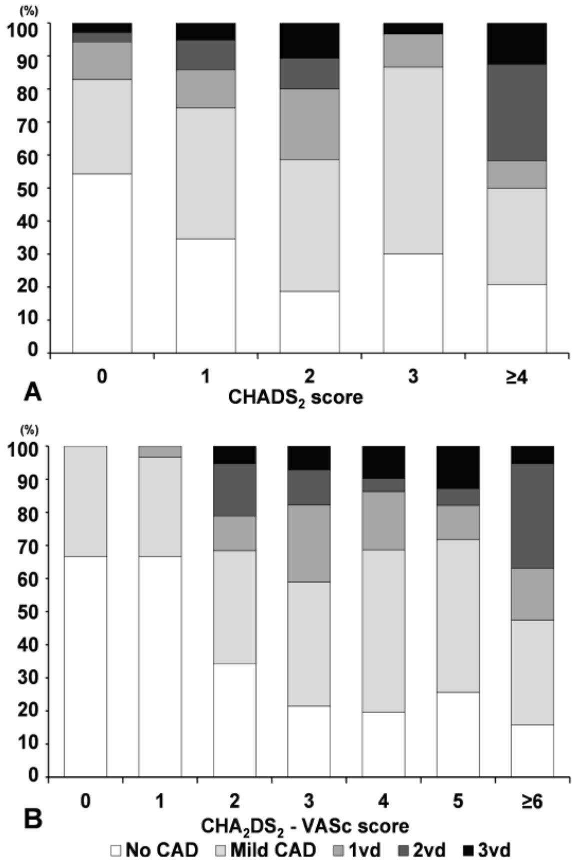

Figure 3 Association of the presence and severity of CAD with the $CHADS_2$ score (A) or CHA_2DS_2-VASc score (B) in patients with atrial fibrillation. As the $CHADS_2$ or CHA_2DS_2-VASc score increased, the presence of CAD increased (*p*=0.003 and *p*<0.001, respectively). The severity of CAD was correlated with $CHADS_2$ (Spearman coefficient 0.188, *p*=0.003) and CHA_2DS_2-VASc scores (Spearman coefficient 0.237, *p*<0.001).

4. Factors associated with coronary artery disease

Univariate analysis showed that aged 65-74, aged ≥75, female sex, hypertension, diabetes mellitus, stroke, vascular disease, aortic plaques, smoking, and $CHADS_2$ and CHA_2DS_2-VASc scores were significantly associated with the presence of CAD (Table 3). On multivariate analysis, after adjustment for smoking and hyperlipidemia, higher $CHADS_2$ (≥2) or CHA_2DS_2-VASc scores (≥2) were independently associated with CAD. Among the components of the $CHADS_2$ score, hypertension, aged ≥75, and diabetes mellitus were related to CAD (Table 4), and among the components of the CHA_2DS_2-VASc score, hypertension, aged 65-74, aged ≥75, diabetes mellitus, vascular disease, and female sex were associated with CAD (Table 5).

Table 3 Association between risk factors and components of $CHADS_2$/CHA_2DS_2-VASc scores and coronary artery disease (univariate analysis)

	OR (95% CI)	p-value
Age I		
<75	Reference	
≥75	3.093 (2.160-4.430)	<0.001
Age II		
≤64	Reference	
65-74	2.524 (1.994-3.196)	<0.001
≥75	4.423 (3.059-6.396)	<0.001
Sex(Female)	1.779 (1.440-2.197)	<0.001
Congestive heart failure	1.389 (0.772-2.501)	0.273
Hypertension	2.399 (1.914-3.007)	<0.001
Diabetes mellitus	2.198 (1.719-2.810)	<0.001
Previous TIA/infarction	1.554 (1.149-2.101)	0.004
vascular disease	2.970 (2.390-3.690)	<0.001
Aortic plaques	1.707 (1.374-2.121)	<0.001
Smoking	1.481 (1.196-1.833)	<0.001
Atrial fibrillation	0.947 (0.705-1.273)	0.72
Hyperlipidemia	1.390 (0.947-2.042)	0.093
$CHADS_2$ score		
0	Reference	
1	2.458 (1.840-3.284)	<0.001
2	3.967 (2.876-5.473)	<0.001
3	4.202 (2.720-6.492)	<0.001
4-6	9.527 (5.300-17.123)	<0.001
CHA_2DS_2-VASc score		
0	Reference	
1	1.462 (0.887-2.408)	0.137
2	3.754 (2.313-6.092)	<0.001

3	4.686 (2.884-7.611)	<0.001
4	7.005 (4.205-11.671)	<0.001
5	8.512 (4.709-15.384)	<0.001
6-8	11.554 (5.782-23.087)	<0.001

Table 4 Association between risk factors and components of $CHADS_2$ score and coronary artery disease (multivariate analysis)

	Adjusted OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Smoking	1.702(1.360-2.129)	<0.001	1.806(1.440-2.264)	<0.001
Hyperlipidemia	1.383(0.927-2.062)	0.112	1.431(0.959-2.136)	0.079
$CHADS_2$ score				
0	1			
1	2.520(1.880-3.379)	<0.001		
2	4.292(3.095-5.952)	<0.001		
3	4.547(2.929-7.059)	<0.001		
4-6	10.349(5.730-18.690)	<0.001		
$CHADS_2$ score component				
Congestive heart failure			1.562(0.842-2.897)	0.157
Hypertension			2.131(1.683-2.698)	<0.001
Age ≥75			3.392(2.342-4.913)	<0.001
Diabetes mellitus			2.190(1.699-2.824)	<0.001
Previous TIA/ infarction			1.365(0.995-1.871)	0.054

OR, odd ratio; CI, confidence interval; TIA, transient ischaemic attack.

Table 5 Association between risk factors and components of CHA_2DS_2-VASc score and coronary artery disease (multivariate analysis)

	Adjusted OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Smoking	2.484(1.943-3.175)	<0.001	1.371(1.022-1.839)	0.035
Hyperlipidemia	1.357(0.902-2.041)	0.143	1.422(0.937-2.159)	0.098
CHA_2DS_2-VASc score				
0	1			
1	1.643(0.985-2.740)	0.057		
2	4.474(2.717-7.368)	<0.001		
3	6.640(3.996-11.032)	<0.001		
4	10.604(6.202-18.129)	<0.001		
5	13.489(7.270-25.028)	<0.001		
6-8	19.213(9.379-39.356)	<0.001		
CHA_2DS_2-VASc score component				
Congestive heart failure			1.580(0.837-2.985)	0.158
Hypertension			1.924(1.498-2.470)	<0.001
Age 65-74			2.365(1.829-3.060)	<0.001
Age ≥75			4.918(3.315-7.296)	<0.001
Diabetes mellitus			2.113(1.622-2.752)	<0.001
Previous TIA/ infarction			1.231(0.885-1.711)	0.217
Vascular disease			2.470(1.959-3.113)	<0.001
Female			0.519(0.387-0.695)	<0.001

OR, odd ratio; CI, confidence interval; TIA, transient ischaemic attack.

When we compared the ability to predict the presence of CAD between the $CHADS_2$ and CHA_2DS_2-VASc scores using AUC analysis, the latter was a better predictor of the presence of CAD [$CHADS_2$ score AUC = 0.668 (0.641-0.696), CHA_2DS_2-VASc AUC = 0.710 (0.683-0.736), $p<0.001$]. Components of the CHA_2DS_2-VASc score also showed a better predictive value than those of the $CHADS_2$ score [$CHADS_2$ components AUC = 0.696 (0.669-0.723), CHA_2DS_2-VASc AUC = 0.755 (0.730-0.780), $p<0.001$] (Fig. 4).

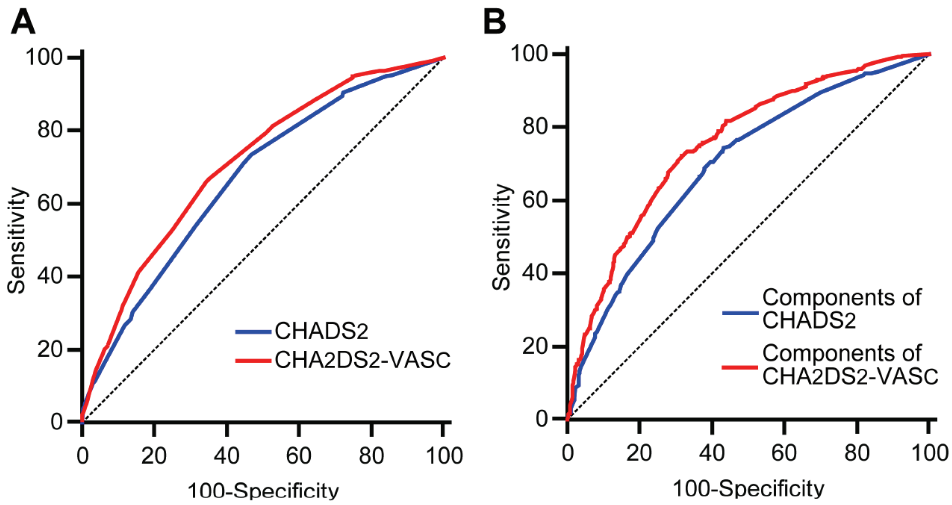

Figure 4 The predictability of the presence of CAD using AUC analysis between the $CHADS_2$ and CHA_2DS_2-VASc scores (A) and between the components of $CHADS_2$ and CHA_2DS_2-VASc scores (B). CHA_2DS_2-VASc score and components of the CHA_2DS_2-VASc score were better predictors of the presence of CAD [$CHADS_2$ score AUC =0.668 (0.641-0.696), CHA_2DS_2-VASc AUC =0.710 (0.683-0.7367), p<0.001 and $CHADS_2$ components AUC =0.696 (0.669-0.723), CHA_2DS_2-VASc AUC =0.755 (0.730-0.780), p<0.001].

We also determined AUC in the subgroup of patients with AF and those without AF. When comparing with the $CHADS_2$ score, the CHA_2DS_2-VASc score was also better predictive of the presence of CAD in patients with AF [$CHADS_2$ AUC = 0.651 (0.578-0.725), CHA_2DS_2-VASc AUC = 0.704 (0.633-0.776), p<0.001], and in patients without [$CHADS_2$ AUC = 0.676 (0.646-0.706), CHA_2DS_2-VASc AUC = 0.715 (0.686-0.743), p<0.001].

IV. DISCUSSION

In this study, we demonstrated that $CHADS_2$ and CHA_2DS_2-VASc scores were predictive of CAD in patients with stroke. As the $CHADS_2$ or CHA_2DS_2-VASc score increased, CAD was found more frequently and was more severe. These findings are in line with our previous observations demonstrating higher frequencies of an akinetic left ventricular segment, a hypokinetic left ventricular segment or a recent myocardial infarction in patients with higher $CHADS_2$ scores [6], because those cardiac conditions are associated with CAD [17,18].

$CHADS_2$ and CHA_2DS_2-VASc scores were developed to stratify embolic risks in NVAF. However, accumulating evidence suggests that those scoring systems are also predictive of various cardiovascular and cerebrovascular outcomes. All causes and cardiovascular mortality were higher in AF patients with higher $CHADS_2$ score [5, 19, 20]. The mortality study in stroke patients with NVAF also showed that $CHADS_2$ and CHA_2DS_2-VASc scores were predictive of the occurrence of not only fatal ischaemic stroke but also fatal ischaemic heart disease [5, 21]. In patients with acute coronary syndromes, $CHADS_2$ score was useful in identifying patients with a high risk of mortality and subsequent stroke [22]. $CHADS_2$ and CHA_2DS_2-VASc scores were a predictor of early neurological deterioration and correlated with early stroke severity [3].

$CHADS_2$ and CHA_2DS_2-VASc scores are also predictive of atherosclerosis. The frequency and burden of cerebral atherosclerosis increased as $CHADS_2$ score increased in patients with stroke [4]. Considering that some components of $CHADS_2$ and CHA_2DS_2-VASc scores are also risk factors for atherosclerosis, the association of $CHADS_2$ and CHA_2DS_2-VASc scores with atherosclerosis in the cerebral and coronary arteries is expected [7-9]. In this study, $CHADS_2$ and CHA_2DS_2-VASc scores were predictive of the presence and severity of CAD in patients with stroke or TIA regardless of the presence of AF. Therefore, a predictive role of $CHADS_2$ and CHA_2DS_2-VASc scores for cardiovascular outcomes and cerebral or coronary atherosclerosis is not limited to patients with AF but is also applicable to those without AF, as was shown in this study. Among components of the $CHADS_2$ and CHA_2DS_2-VASc scores, age, hypertension, diabetes mellitus, vascular diseases, and female sex were associated with CAD. These are well-known risk factors for CAD. Though previous TIA/infarction was given 2 points in both scores, it came borderline significantly with $CHADS_2$ score but not with CHA_2DS_2-VASc score. Stroke and TIA develop not only due to atherosclerosis, but also due to non-atherosclerotic diseases including cardiac diseases, small artery disease, coagulopathy, dissection, etc. This may be responsible for borderline or no significance of the previous stroke/TIA with CAD. The CHA_2DS_2-VASc score had a better predictive value for the presence of CAD than the $CHADS_2$ score, possibly because the CHA_2DS_2-VASc score contains more components that are associated with CAD than does the $CHADS_2$ score.

This study has limitations. The subjects of our study were patients with stroke. Therefore, it is uncertain whether the association of the $CHADS_2$ and CHA_2DS_2-VASc scores with CAD can be generalized to other populations. The diagnosis of CAD was based on MSCT coronary angiography, while conventional coronary angiography is the gold standard. Although MSCT coronary angiography has a sensitivity of >85% and a specificity of >90% to detect ≥50% CAD, as compared with conventional coronary angiography [23, 24], MSCT coronary angiography may overestimate stenotic lesions.

V. CONCLUSION

Our study demonstrated that $CHADS_2$ and CHA_2DS_2-VASc scores were predictive of the presence and severity of CAD. Along with findings in previous studies, our findings suggest that the value of the $CHADS_2$ and CHA_2DS_2-VASc scores may not be limited to their role in prediction for embolic risks in patients with NVAF. When a patient has a higher $CHADS_2$ or CHA_2DS_2-VASc score, physicians should consider that that patient may also have high risks for other vascular outcomes, including CAD.

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ABSTRACT(IN KOREAN)

뇌경색 환자들에서 무증상 관상동맥질환과 $CHADS_2$/CHA_2DS_2-VAS_C scores와의 연관성

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차명진

배경 : $CHADS_2$ 와 CHA_2DS_2-VASc score는 비판막성 심방세동 환자에서 혈전색전증의 위험을 분류하고, 대뇌의 동맥경화증, 치명적인 뇌졸중, 허혈성 심장 질환을 예측하는 측정 도구이다. 높은 $CHADS_2$ 와 CHA_2DS_2-VASc score를 가진 환자들은 관상동맥질환과 관련된 무운동/저운동 좌심실과 최근 발생한 심근경색을 더 많이 가지고 있다. $CHADS_2$ score 구성요소의 대부분은 동맥경화의 위험 인자이다. 그러므로 $CHADS_2$ / CHA_2DS_2-VASc score는 관상동맥 질환을 예측한다.

방법 : 본 연구는 다채널 전산화단층촬영 관상동맥조영술을 시행한 급성 허혈성 뇌졸중 환자 1733명을 대상으로 하였다. 우리는 $CHADS_2$ / CHA_2DS_2-VASc score와 관상동맥질환의 유무와 심각도와의 관련성을 연구하였다.

결과 : 1733명 중 1220명(70.4%)에서 정도와 관련없이 관상동맥질환을 보였고 575명 (33.3%)이 의미있는 관상동맥질환(적어도 하나의 관상동맥에서 50% 이상의 협착)을 보였다. $CHADS_2$ / CHA_2DS_2-VASc score가 증가할수록 관상동맥질환의 존재도 또한 증가하였다 ($p<0.001$). 관상동맥질환의 심각도는 $CHADS_2$ score (Spearman coefficient 0.229, $p<0.001$)와 CHA_2DS_2-VASc score (Spearman coefficient 0.261, $p<0.001$)와 관련이 있었다. 다변량 분석에서 혼란변수를 보정하였을 때 $CHADS_2$ 와 CHA_2DS_2-VASc score가 2 이상인 것은 관상동맥질환과 독립적으로 관련이 있었다. CHA_2DS_2-VASc score는 area under the curve 분석에서 관상동맥질환의 존재에 있어서 $CHADS_2$ score보다 더 나은 예측인자였다.

결론 : $CHADS_2$ 와 CHA_2DS_2-VASc score는 뇌졸중 환자에서 관상동맥질환의 존재와 심각도를 예측하였다. $CHADS_2$ / CHA_2DS_2-VASc score가 높은 환자의 경우에 의사들은 관상동맥평가를 고려해야 한다.

핵심되는 말 : 관상동맥질환, $CHADS_2$ score, CHA_2DS_2-VAScscore, 뇌경색

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