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CHA2DS2-VASC Score and this score components in predicting radial artery complications of among patients who underwent elective transradial coronary angiogram

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Abstract

Transradial approach (TRA) has been more and more accepted for cardiovascular operations. TRA uncommonly leads to hemorrhagic and vascular complications. CHA2DS2-VASc score is utilized to estimation the risk of thrombosis in patients with atrial fibrillation. We intended to assess the relationship between the CHA2DS2-VASc score or components of this score and radial artery complications after transradial coronary angiography. A total of 412 consecutive patients who underwent a TRA were evaluated in this study. Patients were divided into two groups as total complications (n= 73) and no-complications (n= 339) groups. The CHA2DS2-VASc score was higher in patients who had total complications group yet it was not statistically significant (p=.149). Total complication group were older compared to control group (p=.017). As the radial artery diameter decreased, and sheath/radial artery diameter increased, the risk of the total complication group higher significantly (for all; p<.001). Known coronary artery disease (OR: 2.230, 95% CI: 1.007- 4.975, p= .048) was independent risk factors for predictor of radial artery thrombosis, DM was an independent predictor of radial artery pseudoaneurysm (OR: 4.746, 95% CI: 1.269- 17.747, p= .021), age was an independent predictor of radial artery hematoma (OR: 1.054, 95% CI: 1.005- 1.106, p= .029) and radial artery total complications (OR: 1.047, 95% CI: 1.005- 1.087, p= .015). The CHA2DS2-VASc score alone is not connected with the risk of radial artery complications after transradial catheterization but CHA2DS2-VASc score components may help to predict complications the risk of in radial interventions.

Keywords: CHA2DS2-VASC, radial artery complications, transradial coronary angiogram

Introduction

Transradial approach (TRA) has been more and more accepted for cardiovascular operations [1]. TRA has been exhibited that the ratio of vascular access complications is few compared with transfemoral access [2,3]. Therefore, in our cardiac catheter laboratory, TRA is utilized in over 80% of the procedures.

TRA uncommonly leads to hemorrhagic and vascular complications, including pseudoaneurysm, , perforation, access site bleeding and arteriovenous fistula [4]. Radial artery occlusion (RAO) is a well-known complication and occurs in 2% to 18% of TRA procedures [5]. Many of these complications are silent and asymptomatic.

CHA2DS2-VASc score is utilized to estimation the risk of thrombosis in patients with atrial fibrillation and CHA2DS2-VASc score includes the parameters such as heart failure, hypertension, age, diabetes mellitus (DM), cerebrovascular event, gender, peripheral vascular disease [6, 7]. On the other hand, it has more recently been practised for different diseases. Moreover, it was shown to be a predictor of thrombosis different patient groups. For instance, it has been utilized to predict the risk of development of thrombosis and stroke in patients with chronic heart failure and assessment risk of the cerebrovascular event after bypass graft surgery who are in sinus rhythm [8-10]. The relationship between comorbid diseases and radial artery thrombosis is not clear. There is insufficient data on the effect of comorbid conditions or high risk of thrombosis on radial artery occlusion due to thrombosis after radial intervention. According to data obtained from many studies, CHA2DS2-VASC score may help in the prediction of complication risk in TRA.

We intended to assess the relationship between the CHA2DS2-VASc score or components of this score and radial artery complications after transradial coronary angiography (TRCA).

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Material and Methods

This prospectively study enrolled 412 patients aged 40 to 80 years who underwent TRCA from January 2011 to January 2014. Patients who participated in the study has been examined complications such as hematoma, thrombosis and pseudoaneurysm. Patient's data was obtained from our previous study data [11]. Patients were grouped as patients with no complications and those with at least one complication, and the groups were compared with each other. In this study, an optimal radial artery pulsation was most important condition for the elective TRA; otherwise, physicians preferred with a transfemoral approach. All of the patients in the study were performed TRCA by experienced physicians.

Patients with emergent procedures, nonpalpable radial pulse, abnormal Allen test, oral anticoagulant therapy, bleeding diathesis, thrombocytopenia, coagulation disorder, severe hepatic disease, known of coronary artery by-pass graft surgery (CABG), ad hoc percutaneous coronary intervention and chronic renal disease on hemodialysis were excluded from in this study. Written informed consent was obtained from all patients who accepted to participate in the study. The local ethics committee approved the study protocol. The Allen test was applied and the existence of duple blood flow and openness of the palmar bridge was approved. Following sterilized preparing and injection of 2% lidocaine at puncturing location, a 20-gauge catheter was inserted into the radial artery from the 4 to 6 cm upper crease of the wrist, utilization Seldinger's technique. A guidewire was positioned in the centre of the catheter, and the mechanism was slowly removed. A 6F radio focus radial sheath was forwarded through the guidewire into the radial artery. A combination of 5 mg Diltiazem, 200 mcg nitroglycerin and 5000 IU unfractionated heparin was administered intraarterially. Six French diagnostic coronary artery catheters (Boston Scientific, Maple Grove, MN, USA) were used during elective TRCA. After the ending of the angiography, radial sheaths were extracted and regional pressure was put on with a bandage. The procedure duration was admitted time between the entry of the radial sheath and withdrawal of the sheath. Following 45 or 60 minutes, the tampon bandage was unloosed and maintained for three or four hours [12].

For each patient, we enrolled baseline characteristic and demographic features on sex, age, DM, hypertension, smoking, known coronary and peripheral artery diseases, unfractionated heparin dose, radial sheath external diameter/radial artery inside diameter, procedural time and all complications. DM was assigned as using of oral hypoglycemic drug or insulin or known diagnosis of DM. Hypertension was assigned as known diagnosis of hypertension or using of antihypertensive agent. The definition of heart failure is a previously known diagnosis of heart failure. Stenosis of ≥ 50% in peripheral arteries was described as peripheral arterial disease and stenosis of ≥ 50% in coronary arteries was described as coronary arterial disease. Hypercholesterolemia has depend on the existence of a total cholesterol level of ≥200 mg/dL or usage of medical therapy. Total complication group was defined as occurring radial artery thrombus, hematoma and pseudoaneurysm after TRCA. All patients receive ultrasound evaluations of the radial artery one day after the TRCA. The ultrasound dimensions were performed by an experienced physician, usage a duplex ultrasound system (Siemens Ultrasonography Systems, Tokyo, Japan) with 5 to 10 MHz. The patients had repose 15 minutes ago evaluations and after that radial artery variable was quantified at the location 2-3 cm near to the radial styloid. Additionally, the radial artery was evaluated from the radial styloid process to the brachial artery. Radial artery pseudoaneurysm, thrombus, hematoma and radial artery diameter were enrolled by ultrasound and doppler ultrasound.

Complete occlusion was defined as no flow in the radial artery. Partial occlusion was defined as a low flow velocity in the radial artery lumen that a partly obstructed in the radial artery [11]. The pseudoaneurysm was described as a pulsatile mass with existed turbulent flow aneurysmal sac at the entry location [4]. CHA2DS2-VASc score includes the parameters such as gender, age, heart failure, DM, hypertension, stroke, predicts atheroembolic events and peripheral vascular disease [6]. The CHA2DS2-VASc score was calculated according to inclusion 2 points for ≥ 75 years of age and stroke, and 1 point for other components.

Statistical Analysis

Data were analyzed with the SPSS 22.0 statistics package for Windows. All datas were presented as means ± standard deviation and percentage. Student t-test was utilized for comparison of mean values and Chi-square test for comparative of percentages. The Mann-Whitney U test was utilized to compare continuous variables that were not distributed normally. The differences between groups were statistically significant with a p value of < 0.05. To explore the association between the components of CHA2DS2-VASc score and total radial artery complications, an univariate logistic regression analysis was used and variables with P-value of less than 0.05 were utilized in the multivariate logistic regression analysis. The results of regression analysis are displayed as adjusted odds ratio and 95% confidence interval. The predictive value of the CHA2DS2-VASc score was tested using receiver operating characteristic analysis for radial artery complications. A p-value lower than 0.05 was regarded as statistically significant.

Results

Baseline clinical, demographic echocardiographic and laboratory characteristics of the study population were showed Table 1. The study population consisted of 412 patients (mean age 59.7 ± 0.4 years, 245 men [72.3%]), of whom 339 patients were in the no-complications group (control group) and 73 patients (17.7%) were in the total complication group. There were no significant difference in the incidence of hypertension, DM, dyslipidemia, known coronary and peripheral artery disease, known diagnosis of heart failure and smoking between the two groups. Compared to control group, total complication group were older (63 ± 0.04 vs 59 ± 0.4, p=.017). Median body surface area was higher in the total complication group compared to control group (p=.019). The procedure duration was significantly more in have total complication group compared to no-complication group (11.2 ± 0.3 vs 14.2 ± 1.1, p=.019). As the radial artery diameter decreased, and sheath/radial artery diameter increased, the risk of the total complication group higher significantly (for all; p<.001). The observed incidence was 17.7% (73 of 412 patients) for hemorrhagic and vascular complications. Of these 73 patients; 40 patients (54.7% of all complications, 9.7% of all patients) presented hematoma, 27 patients (36.9% of all complications, 6.5% of all patients) presented with thrombosis, and 15 patients

(20.5% of all complications, 3.6% of all patients) presented with radial artery pseudoaneurysm (Figure1). In the regression analysis were separately evaluated the possible risk factors of radial artery complications. (Table 2-3-4-5). Known coronary artery disease (OR: 2.230, 95% CI: 1.007- 4.975, p= .048) was independent risk factors for predictor of radial artery thrombosis, DM was an independent predictor of radial artery pseudoaneurysm (OR: 4.746, 95% CI: 1.269- 17.747, p= .021), age was an independent predictor of radial artery hematoma (OR: 1.054, 95% CI: 1.005- 1.106, p= .029) and radial artery total complications (OR: 1.047, 95% CI: 1.005- 1.087, p= .015).

Table 1. Baseline Characteristics of the Study Population.

	No Complication n = 339	Total Complication n = 73	p-Value
Age (year)	59.7 ± 0.4	63.04 ± 1.1	0.017
Male/Female, n (%)	245/94 (72.3%- 27.7%)	55/24 (67.1%- 32.9%)	0.459
Body surface area (m²)	28.1 ± 0.2	29.2 ± 0.5	0.019
Current Smoking	149 (85.1 %)	31 (14.9 %)	0.239
EF, %	59.6 ± 0.3	59.6 ± 0.5	0.264
Past medical history			
Diabetes mellitus, n (%)	103 (30.4 %)	29 (39.7 %)	0.158
Hypertension, n (%)	152 (44 %)	29 (39.7 %)	0.423
Dyslipidemia, n (%)	173 (51 %)	45 (61.6 %)	0.129
Known peripheral artery disease	24 (7.1 %)	3 (4.1 %)	0.503
Known coronary artery disease	133 (39.2 %)	35 (20.8 %)	0.127
Previous heart failure	15 (4.4 %)	0 (0 %)	0.137
Laboratory values			
Creatinine (mg/dl)	0.9 ± 0.01	0.9 ± 0.03	0.048
LDL (mg/dL)	121.3 ± 2.0	125.7 ± 4.2	0.323
Total cholesterol (mg/dl)	201.0 ± 2.2	202.1 ± 4.7	0.776
Wbc (x10³/uL)	7.0 ± 0.09	7.5 ± 0.2	0.045
Hemoglobin (mg/dL)	14.4 ± 0.07	13.7 ± 0.1	<0.001
Platelet (x10³/ul)	272.9 ± 4.3	282.2 ± 12.6	0.656
Fasting plasma glucose (mg/dl)	113.7 ± 1.9	110.3 ± 3.4	0.416
Procedural properties			
Peak activated clotting time (seconds)	286.9 ± 2.6	258.7 ± 7.1	0.134
Procedure duration (minutes)	11.2 ± 0.3	14.2 ± 1.1	0.019
Radial artery diameter (mm)	2.6 ± 0.01	2.4 ± 0.03	<0.001
Sheath diameter/radial artery diameter	0.75 ± 0.04	0.81 ± 0.01	<0.001
CHA2DS2-VASc score	2.1 ± 0.08		0.149

Table 2. Multivariate Predictors of Total Complications.

	Univariate		Multivariate	
	Odds Ratio (95% confidence interval)	**p-Value**	**Odds Ratio (95% confidence interval)**	**p-Value**
Age	1.040 (1.011- 1.069)	0.006	1.047 (1.005- 1.087)	0.015
Diabetes mellitus	1.510 (0.895- 2.547)	0.122		
Hypertension	0.811 (0.484- 1.358)	0.425		
Hyperlipidemia	1.542 (0.919- 2.588)	0.101		
Known coronary artery disease	1.427 (0.858- 2.372)	0.171		
Known peripheral artery disease	0.563 (0.165- 1.920)	0.358		
CHA2DS2VASC score	1.179 (1.006- 1.382)	0.042		

Table 3. Multivariate Predictors of Radial Artery Trombosis

	Univariate		Multivariate	
	Odds Ratio (95% confidence interval)	**p-Value**	**Odds Ratio (95% confidence interval)**	**p-Value**
Age	1.024 (0.981- 1.068)	0.278		
Diabetes mellitus	0.886 (0.378- 2.080)	0.781		
Hypertension	0.869 (0.393- 1.923)	0.730		
Hyperlipidemia	0.815 (0.373- 1.780)	0.608		
Known coronary artery disease	2.230 (1.007- 4.975)	0.048	2.230 (1.007- 4.975)	0.048
Known peripheral artery disease	1.880 (0.528- 6.691)	0.330		
CHA2DS2VASC score	1.043 (0.814- 1.336)	0.741		

Table 4. Multivariate Predictors of Radial Artery Pseudoanurysm

	Univariate		Multivariate	
	Odds Ratio (95% confidence interval)	**p-Value**	**Odds Ratio (95% confidence interval)**	**p-Value**
Age	1.037 (0.980- 1.098)	0.202		
Diabetes mellitus	6.273 (1.953- 20.093)	0.002	4.746 (1.269- 17.747)	0.021
Hypertension	1.480 (0.526- 4.160)	0.457		
Hyperlipidemia	2.524 (0.790- 8.061)	0.118		
Known coronary artery disease	1.693 (0.602- 4.761)	0.318		
Known peripheral artery disease	0.00 (0.00-)	0.998		
CHA2DS2VASC score	1.491 (1.095- 2.029)	0.011		

Table 5. Multivariate Predictors of Hematoma

	Univariate		Multivariate	
	Odds Ratio (95% confidence interval)	**p-Value**	**Odds Ratio (95% confidence interval)**	**p-Value**
Age	1.058 (1.019- 1.098)	0.003	1.054 (1.005- 1.106)	0.029
Diabetes mellitus	1.652 (0.850- 3.210)	0.278		
Hypertension	0.937 (0.485- 1.813)	0.848		
Hyperlipidemia	2.235 (1.103- 4.529)	0.026	2.126 (0.997- 4.531)	0.051
Known coronary artery disease	0.859 (0.438- 1.683)	0.657		
Known peripheral artery disease	0.000 (0.000-)	0.998		
CHA2DS2VASC score	1.303 (1.066- 1.592)	0.010		

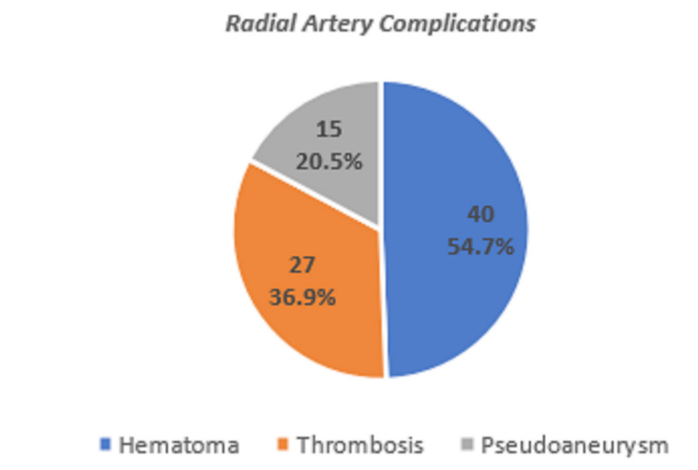

Figure 1. Vasculer and Hemorrhagic Complications

Discussion

In this study, although the CHA2DS2–VASc score was higher in the total complication group; this was not statistically significant. Nevertheless, the components of the CHA2DS2–VASc score has been related with radial artery complications. Age has been associated with radial artery hematoma and total complication. In addition, known coronary disease has been associated with hematoma; DM has been associated with pseudoaneurysm.

TRA for coronary angiography has been progressively widespread owing to its reduced ratio of major adverse complications [13, 14]. Previous studies showed the ratio of vascular complications after radial artery catheterization between 1.5% and 30.5% [15]. All patients included in our study, whether symptomatic or not, were evaluated with ultrasound proceeding of the radial artery one day after TRCA. Therefore, total complication rate was found to be 18.3% in our study.

The CHA2DS2-VASc score is a cheap, easy and generalizable risk scoring system that is based on non-laboratory parameters and can be easily applied by physicians. The CHA2DS2-VASC score was firstly formulated for cerebrovascular ischemic event risk estimation in patients with AF [7, 16]. Recent studies have demonstrated that the CHA2DS2-VASc score could forecast major adverse clinical outcomes in stable coronary artery disease, acute coronary syndrome [17-19]. Ünal et al reported the CHA2DS2-VASc score of >2 had established to be an independent predictor for stent thrombosis [20]. Ipek et al showed in the study the utility of CHA2DS2–VASc score in forecasting no-reflow phenomenon after primary percutaneous coronary intervention in an acute ST-elevation myocardial infarction patients [21]. In this study, the effectiveness of the CHA2DS2-VASc score was assessed in forecast radial artery complications among patients undergoing elective diagnostic TRCA.

The components of CHA2DS2-VASc score are widespread risk factors of microvascular dysfunction, vascular spasm, thromboembolic events and stroke.[7, 22] DM is a component of the CHA2DS2-VASc score and has risen the propensity to thrombosis and endothelial vasoconstriction [23, 24]. DM, female gender and hypertension were proved to be risk factors of microvascular disorder [25, 26]. Prior studies showed, insulin-requiring DM increases the possibility of developing pseudoaneurysm [27]. Pseudoaneurysm is an unusual complication of intervention through TRA with an incidence ranging between less than 0.1% to 0.4% [4, 28]. Our study has shown; DM an independent predictor of radial artery pseudoaneurysm.

Microvascular dysfunction, vascular spasm and thromboembolism are risk factors that increase the ratio of complications after TRCA. CHA2DS2-VASc score covered the various diseases associated with the common risk factors in radial artery complications. While singly CHA2DS2-VASc score was not associated radial artery thrombosis, presence of coronary artery disease, which is a component of the CHA2DS2-VASc score was an independent predictor of radial artery thrombosis. Process of atherosclerosis in coronary arterial disease has been connected to flow and shear stress, local wall stress following damage to the vessel wall [29, 30]. Thrombosis can be occurred by rupture or erosion of atherosclerotic plaque, and subtotal or total occlusion may be developed in the artery.

In the vascular system, age-related decline in function comprise continuous pathological remodelling with stiffening, typically related with alterations in collagen and elastin [31, 32]. Cardiovascular aging is defined by a progressive deterioration of endothelial function [33]. In this instance, when all components of CHA2DS2-VASc score were evaluated, age was an independent predictor of radial artery total complications.

Since the risk of vascular spasm, atherosclerosis and microvascular dysfunction increased at high CHA2DS2-VASc score, radial complications were expected to increase. Although high CHA2DS2-VASc score alone is not related with the risk of radial artery complications after TRCA, CHA2DS2-VASc score components may help to indicate the risk of complications in radial interventions.

Conclusion

The CHA2DS2-VASc score is an easy, cheap, generalizable risk scoring system and predictor for thromboembolic events. The components of CHA2DS2-VASc score may be used risk factors in radial artery complications after transradial catheterization. In additions, prospective more studies may be needed for the relationship between radial artery complications after TRA and the CHA2DS2-VASc score.

Limitations

Firstly, the number of patients included in the study is limited. Some complications may not be diagnosed, as the pain threshold may differ between patients. There were absent control ultrasound or Doppler ultrasound measurements in patients during the follow-up time.

Conflict of interests
The authors report no financial relationships or conflicts of interest regarding the content herein.

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Ethical approval

This article was approved by the Türkiye Yüksek İhtisas Training and Research Hospital Ethics Committee on 11/20/2012 (no. 295)

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