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ORIGINAL ARTICLE

The Relationship between CHA_2DS_2-VASc Score and Reperfusion Success in Elective Percutaneous Saphenous Vein Graft Interventions

Yücel Kanal,[1] Kevser Gülcihan Balci,[1] Nezaket Merye Yaman,[1] İdris Yakut,[1] Mustafa Bilal Ozbay,[1] Orhan Maden[2]

Ankara City Hospital Cardiovascular Hospital,[1] Cankaya, Ankara – Turkey
Ministry of Health Ankara City Hospital Cardiovascular Hospital,[2] Ankara – Turkey

Abstract

Background: Patients with degenerated saphenous vein grafts (SVG) have a higher risk of developing no-reflow. The CHA_2DS_2-VASc score was established as a no-reflow predictor in patients with acute coronary syndrome (ACS).

Objectives: In our study, we aimed to assess the association between CHA_2DS_2-VASc score and no-reflow after the procedure and short-term mortality in patients with SVG who underwent elective percutaneous coronary intervention (PCI).

Methods: Our retrospective study comprised 118 patients who were divided into two groups according to the occurrence of the no-reflow phenomenon. The groups were compared on the basis of demographic characteristics, angiographic parameters, CHA_2DS_2-VASc scores, and outcome. A logistic regression analysis was additionally performed to determine the predictors of no-reflow. A p value of < 0.05 was considered statistically significant.

Results: Mean age of the participants was 66.4 ± 9.2 years, and 25.4% of them were female. Apart from the history of diabetes ($p = 0.032$), demographic data, blood parameters, ejection fraction, total stent length and diameter, medication use, median CHA_2DS_2-VASc score, and adverse cardiac events did not differ between the groups. In univariate logistic regression analysis, the presence of diabetes and stent length appeared to be associated with no-reflow, but not in multivariate analysis. The median CHA_2DS_2-VASc score was higher in non-survivors at 1-year follow-up (4.5 versus 3, $p = 0.047$).

Conclusions: In our study, we did not observe a significant relationship between no-reflow and CHA_2DS_2-VASc score. Larger studies are needed to reveal the indicators of improved post-intervention reperfusion in elective SVG PCI.

Keywords: No-Reflow; Coronary Artery Disease; Saphenous Vein; Percutaneous Coronary Intervention.

Introduction

Coronary artery disease (CAD) is a significant cause of mortality and morbidity in developed countries. Although the CAD-related mortality rate has decreased over the last 4 decades worldwide, it continues to be the cause of more than one third of all deaths in individuals over 35 years of age.[1-3]

Lifestyle changes and medical treatments are the mainstay of the treatment of stable CAD. Coronary artery bypass grafting (CABG) and percutaneous coronary intervention (PCI) treatments can be performed in patients with angina resistant to medical treatment or in cases of severe stenosis as evidenced by anatomical imaging methods.[4] The main determinant factor for CABG's short- and long-term efficacy in the treatment of stable CAD is the graft patency rate. The saphenous vein graft (SVG) is the most commonly used venous graft. The patency rates of SVGs are low compared to arterial grafts. About 10% to 15% of SVGs are occluded within

Mailing Address: Yücel Kanal
Tokat Devlet Hastanesi. Tokat Devlet Hastanesi Center. Postal code: 60100. Tokat – Turkey.
E-mail: yucel_kanal@hotmail.com

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Central Illustration: The Relationship between CHA_2DS_2-VASc Score and Reperfusion Success in Elective Percutaneous Saphenous Vein Graft Interventions

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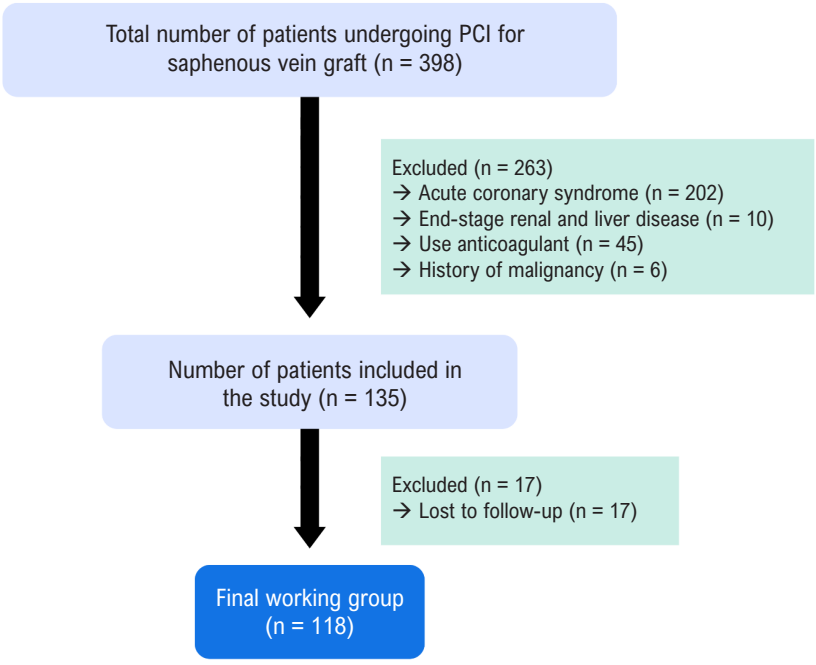

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PCI: percutaneous coronary intervention

the first year, while nearly half of them are occluded within 10 years.[5-7] The causes of early occlusion of SVGs after surgery are related to surgical technical failure and distal flow of the connected native vessel. In contrast, occlusion following 12 to 18 months is associated with atherosclerotic-like plaque formation due to lipid accumulation in the intimal hyperplasia areas.[8]

Even in cases of technically uneventful PCI, flow loss may be present after stenting. In acute coronary syndrome (ACS), thrombus formation or no-reflow due to distal embolism is high in patients with a high thrombus burden, long and diffuse lesions, and degenerated vein grafts.[9] This situation, which develops after the operation, is usually associated with a high mortality rate.

The risk of stroke increases with the increase in the estimated CHA_2DS_2-VASc score, a risk score used to predict thromboembolism in atrial fibrillation (AF). The association of the CHA_2DS_2-VASc score with mortality and acute myocardial infarction has been demonstrated in previous studies.[10] The predictive value of the CHA_2DS_2-VASc score in stent thrombosis has also been shown in a recent study.[11] There is no evidence regarding the relationship between CHA_2DS_2-VASc score, postprocedural flow loss, and mortality in patients with SVG undergoing elective PCI in the literature. Therefore, in the present study, we aimed to investigate the possible relationship between CHA_2DS_2-VASc score, postprocedural flow loss, and mortality in patients with SVG undergoing elective PCI.

Methods and Materials

Patient selection

In this study, patients who underwent coronary angiography due to the presence of angina resistant to medical treatment or the detection of ischemia in stress test or non-invasive functional imaging tests between January 2012 and January 2018 were retrospectively analyzed at our cardiology clinic. Among 18,823 patients with accessible archive data, patients with previous CABG who underwent SVG PCI were selected. Patients who underwent PCI for SVG were excluded from the study if they had ACS within the last 6 months, were

admitted to our hospital with ACS diagnosis, had a history of malignancy, had end-stage renal and liver disease, were under anticoagulant treatment for AF or any other reason, or if their 1-year follow-up data could not be accessed from the hospital registry system. Finally, the remaining 118 patients were included in the study (Central Illustration). The institutional review board approved the study protocol, and permission to present the data was granted by ethics committee. The study was conducted in accordance with the principles of the Declaration of Helsinki.

Variables

Age, sex, risk factors for CAD (hypertension, diabetes mellitus, dyslipidemia, smoking history, or family history), left ventricular ejection fraction (LVEF) before PCI, fasting blood glucose, and fasting lipid levels were recorded for all the patients. Medical treatments given before and after the procedure were recorded. The location of the grafts in the vessels and the date of CABG were recorded. The SVG, which was stented, diameter and length of the stent, and stent type (bare-metal stent or drug-eluting stent) were also noted. The use of glycoprotein (GP IIb/IIIa) inhibitors, the length of hospital stay, and in-hospital mortality rate after the procedure were evaluated. Adverse cardiac events (target vessel revascularization [TVR] + death) within 1 year of the procedure were recorded.

Laboratory findings were also noted, including serum creatinine, urea, fasting blood glucose, lipid profile, hemoglobin, platelet count, white blood cell count, neutrophil, lymphocyte, monocyte counts, and percentages at the time of admission, evaluating the venous blood sample taken before PCI.

Method

Patient data were retrieved from the hospital database of our cardiology clinic. For missing 1-year mortality data, the patients were reached via mobile phones or in person.

Images of SVG PCI procedures of all patients were displayed. According to the Thrombolysis in Myocardial Infarction (TIMI) flow grade, the reperfusion rates after PCI were evaluated. The patients with a TIMI flow score of < 3 were considered no-reflow. The TIMI flow score is graded as follows: TIMI 0 flow (no perfusion) refers to the absence of any antegrade flow beyond a coronary occlusion; TIMI 1 flow (penetration without perfusion) is faint antegrade coronary flow beyond the occlusion, with incomplete filling of the distal coronary bed; in TIMI 2, contrast material fills the distal bed, but contrast material filling or coronary bed washing is slower than normal; and TIMI 3 is normal flow which fills the distal coronary bed completely.[12] Following the procedure, those with an angiographic TIMI flow grade of ≤ 2 were considered no-reflow. After evaluating the saphenous flow from these images, the patients were divided into 2 groups: no-reflow and normal flow. The CHA_2DS_2-VASc score of all the patients was estimated according to the data obtained from the hospital database. The CHA_2DS_2-VASc score was calculated as follows: congestive heart failure, hypertension, diabetes mellitus, age between 65 and 75 years, vascular disease, and female sex (1 point for each parameter) and 2 points for stroke/transient ischemic attack and age over 75 years. The patients' baseline, procedural, and treatment characteristics were compared between the patients with a score of ≤ 2 and > 2. The relationship of no-reflow with the CHA_2DS_2-VASc score and other variables was evaluated. In addition, adverse cardiac events in these patients over a 1-year period were evaluated.

Heart failure was diagnosed according to the European Society of Cardiology Acute and Chronic Heart Failure guidelines.[13] Transthoracic echocardiography was performed in the left lateral decubitus position guided using a Vivid 7 (Dimension Cardiovascular Ultrasound Systems, GE Medical Systems, USA) device. The LVEF was estimated using the modified Simpson's method. Hypertension was defined as the presence of a history of antihypertensive treatment or no prior diagnosis of hypertension with systolic blood pressure of ≥ 140 mmHg and/or diastolic blood pressure of ≥ 90 mmHg by a standard measurement. Diabetes mellitus was defined as being under oral anti-diabetic or insulin therapy or having no previous diagnosis of diabetes mellitus with a fasting blood glucose of > 126 mg/dl at 2 occasions or with a post-prandial blood glucose of > 200 mg/dL at 2 occasions. Transient ischemic attack was defined as a neurological event of a sudden onset which completely disappeared within 24 hours, regardless of whether or not infarction was present on neurological imaging. Vascular diseases included myocardial infarction, complex aortic plaques, previous revascularization, and presence of peripheral artery disease. Dyslipidemia was defined as values above the target low-density lipoprotein values specified in the European Society

of Cardiology/European Society of Hypertension guidelines and receiving any lipid-lowering therapy at admission.[14]

Selective left and right coronary angiography and CABG angiography were performed using the Judkins technique in all patients. Coronary angiography and PCI were performed by experienced (> 75 cases/year) interventional cardiologists. Coronary angiography was performed through either radial or femoral approach, depending on the operator's preference. Additional images were obtained from SVGs in right and left oblique positions and in cranial and caudal angles, if required. The severity of stenosis was determined by angiographic images and calibration techniques of the monitored vessels. Stenosis over 70% in the SVG was considered severe stenosis. Patients with significant lesions were re-scheduled for PCI in another session after explaining the risk of the procedure and obtaining their consent. A 600-mg loading dose of clopidogrel before the PCI procedure was administered to the patients. The patients who were not under acetylsalicylic acid were loaded with a 300-mg chewable tablet before the procedure. The PCI approach to be used was left to the operator's preference (radial or femoral). During the procedure, intravenous unfractionated heparin at a dose of 70 to 100 U/kg was administered. The type of stent to be used was left to the operator's preference. During the procedure, 25 μg/kg intravenous loading of tirofiban (GP IIb/IIIa inhibitor in our laboratory) was applied to the patients who developed no-reflow. Tirofiban infusion at a dose of 0.15 μg/kg/min 18 hours after the procedure was administrated to the patients who were given bolus tirofiban during the procedure. Unfractionated heparin maintenance therapy was applied to maintain the activated partial thromboplastin time 1.5 to 2 times higher during tirofiban infusion.

Erythrocyte count, hemoglobin, and hematocrit were analyzed using an automatic hematology analyzer (XE-1200; Sysmex, Kobe, Japan), while biochemical measurements were estimated with a molecular analyzer (Roche Diagnostics, Manheim, Germany).

Statistical analysis

Statistical analysis was performed using the SPSS version 11.5 package program (SPSS Inc., Chicago, IL, USA). Continuous variables were defined as mean ± standard deviation or median (interquartile range [IQR]), and categorical variables were expressed as percentages. Normal distribution of variables was evaluated with the Kolmogorov-Smirnov test. Categorical variables were compared with the chi-square test, and continuous variables were compared with the Mann-Whitney U test or unpaired t-test. Logistic regression analysis was performed to identify predictors of no-reflow, TVR, 1-year mortality, and total adverse cardiac events. Variables with a p value of < 0.25 were included in the multiple logistic regression analysis. A p value of < 0.05 was considered statistically significant.

Results

A total of 118 patients were included in this study. Of the patients, 25.4% were females, and the mean age was 66.4 ± 9.2 years. In addition, 66.1% of the patients had hypertension; 40.7% had diabetes mellitus, and 22.8% had heart failure. The mean age of SVGs was 14 ± 5.8 years. The median CHA_2DS_2-VASc score was 3 (IQR, 2 to 4). Before coronary angiography, acetylsalicylic acid (100 to 300 mg) was used in 90%, clopidogrel in 10%, statin in 50%, angiotensin-converting enzyme inhibitor/angiotensin II receptor blocker in 45%, beta blocker in 70%, and long-acting nitrates in 20% of the patients. When the SVGs of the patients who underwent PCI were examined, 57 (48%) of them were in the right coronary artery, 41 (34%) in the circumflex artery, 15 (12%) in the diagonal, and 5 (4%) in the left anterior descending artery.

The patients were divided into 2 groups: no-reflow and normal flow. No-reflow was developed in 19 (16.1%) of the patients. There was no significant difference in demographic characteristics such as age and sex between normal flow and no-reflow groups, while the number of patients with diabetes mellitus in the no-reflow was significantly higher ([36% versus 63%], p = 0.032). Both groups were similar in terms of the mean SVG ages. There was no significant difference between the groups in terms of CHA_2DS_2-VASc scores. The median CHA_2DS_2-VASc was 4 in the no-reflow group and 3 in the normal flow group, and this difference was not statistically significant (p = 0.504). No significant difference was found in the LVEF values between the two groups (Table 1).

When the patients were classified as CHA_2DS_2-VASc > 2 and CHA_2DS_2-VASc ≤ 2, the presence of no-reflow did not differ significantly between the groups (Table 1). The CHA_2DS_2-VASc scores of the study groups in terms of their reperfusion status are shown in Table 1.

There was no significant difference in the hematological and biochemical parameters between the groups (Table 1).

Table 1 – Distribution of baseline characteristics of the study patients according to postprocedural reperfusion status

Variables	Normal flow n: 99	No-reflow n: 19	p value
Age, years	66.4 ±9 .9	64.0 ± 6.8	0.951
Female sex, n (%)	27 (27.2%)	3 (15.7%)	0.394
Bypass age, years	13.2 ± 5.2	13.7 ± 6.7	0.330
Hypertension, n (%)	65 (65.6%)	13 (68.4%)	0.859
Diabetes, n (%)	36 (36.0%)	12 (63.0%)	0.032
Tobacco use, n (%)	20 (20.2%)	6 (31.5%)	0.343
Stroke, n (%)	4 (4.0%)	2 (10.5%)	0.251
Heart failure, n (%)	21 (21.2%)	6 (31.5%)	0.363
LVEF, %	50.0 (45.0-55.0)	47.0 (35.0-50.0)	0.092
CHA_2DS_2-VASc score	3.0 (2.0-4.0)	4.0 (2.0-5.0)	0.504
CHA_2DS_2-VASc score > 2, n (%)	71 (71.7%)	12 (63.1)	0.454
Blood parameters			
Urea, mg/dl	38.0 (32.0-51.0)	34.0 (29.5-52.5)	0.382
Creatinine, mg/dl	1.0 (0.8-1.2)	1.0 (0.8-1.2)	0.740
Fasting blood glucose, mg/dl	113.0 (94.0-159.0)	122.5 (106.0-160.0)	0.330
Total cholesterol, mg/dl	241.9 ± 58.1	197.6 ± 82.2	0.515
LDL cholesterol, mg/dl	115.1 ± 75.1	138.8 ± 44.2	0.223
HDL cholesterol, mg/dl	42.0 (37.5-49.0)	48.0 (37.5-51.5)	0.482
Triglyceride, mg/dl	145.0 (110.0-248.0)	174.0 (123.5-257.5)	0.287
Hemoglobin, g/dl	13.4 ± 1.8	13.9 ± 1.4	0.094
Platelet, × 10^3/uL	224.3 ± 63.2	217.6 ± 59.0	0.809
White blood cell, × 10^3/uL	8.5 ± 6.6	9.3 ± 2.4	0.681
SVG with lesion, n (%)			0.189
RCA	45 (45.4%)	12 (63.1%)	
CX	37 (37.3%)	4 (21.0%)	
Diagonal	13 (13.1%)	2 (10.5%)	
LAD	4 (4.0%)	1 (5.2%)	
Stent length, mm	20.0 (15.0-25.0)	24.0 (16.0-38.0)	0.061
Stent diameter, mm	3.0 (2.7-3.5)	3.5 (2.8-4.0)	0.272
Tirofiban on PCI	5 (5.0%)	15 (78.9%)	<0.001

CX: circumflex artery; HDL: high-density lipoprotein; LAD: left anterior descending artery; LDL: low-density lipoprotein; LVEF: left ventricle ejection fraction; PCI: percutaneous coronary intervention; RCA: right coronary artery; SVG: saphenous vein graft. P <0.05 is statistically significan.

According to the procedural data, no significant difference was found in the age of SVG for PCI, the vessel in which SVG was applied, the total stent length used in the procedure, and the stent diameter between the no-reflow and normal flow groups. The use of tirofiban during PCI was significantly higher in the no-reflow group than in the normal flow group (Table 1).

There was no significant difference in the no-reflow and normal flow groups' medical treatments after the procedure. Furthermore, there was no statistically significant difference in the early postprocedural adverse events, i.e., in-hospital mortality, 1-year mortality, TVR, and total 1-year adverse cardiac events (TVR + 1-year death) (Table 2). However, the median CHA_2DS_2-VASc score was higher in deceased patients during 1-year follow-up (4.5 [IQR, 4 to 6] and 3 [IQR, 2 to 4], p = 0.047).

According to the regression analysis, although diabetes mellitus and stent length seemed to be associated with no-reflow, they were not statistically significant in the multivariate analysis (Table 3). The logistic regression analysis, which was performed to identify the predictors of total adverse cardiac events, TVR, and 1-year mortality, revealed that none of the variables were statistically significant.

Discussion

Our study investigated the association of CHA_2DS_2-VASc score with postprocedural reperfusion success and short-term mortality in patients with CABG who underwent PCI for the SVG following elective coronary angiography. To the best of our knowledge, this study is the first to investigate the relationship between CHA_2DS_2-VASc score, no-reflow, and short-term mortality in patients who underwent elective PCI for SVG. In our study, no significant difference was detected between the groups when the patients were classified as CHA_2DS_2-VASc > 2 and CHA_2DS_2-VASc ≤ 2, according to the presence of no-reflow. In the group with no-reflow, the mean CHA_2DS_2-VASc score was 4, while it was 3 in the normal flow group. Although there was a difference in the scores, it did not reach statistical significance. We think that this may be due to the low number of total patients in the study and the low number of patients who developed no-reflow. Although diabetes mellitus and stent length appeared to be significant variables in univariate regression analysis, no statistically significant difference was found in the multivariate regression analysis. Additionally high CHA_2DS_2-VASc scores were found to be significantly associated with 1-year mortality.

No-reflow is defined as an acute reduction in blood flow, despite the patent epicardial coronary artery.[15] Microvascular occlusion, microvascular spasm, and thrombus secondary to distal embolization of the clot play a role in the pathophysiology of no-reflow. No-reflow can lead to heart failure, malignant arrhythmia, cardiogenic shock, and death.

In a study including 497 patients with ST-elevation myocardial infarction (STEMI) conducted by Avci et al.,[16] the CHA_2DS_2-VASc score was the strongest predictor of no-reflow. Similarly, studies involving more patients with STEMI showed that hypertension, smoking, dyslipidemia, diabetes, and other inflammatory processes, which are known to be risk factors for cardiovascular diseases, were also risk factors of no-reflow.[15]

Previous studies investigating the relationship between the CHA_2DS_2-VASc score and no-reflow in

Table 2 – Comparison of reperfusion groups in terms of mortality and cardiac adverse events

Cardiac event, n (%)	Normal flow	No-reflow	p value
In-hospital death	0 (0.0%)	1 (5.2%)	0.164
1-year follow-up death	5 (5.0%)	1 (5.2%)	0.969
1-year follow-up TVR	7 (0.07%)	0 (0.0%)	0.597
1-year follow-up total adverse cardiac events	12 (12.1%)	1(5.2%)	0.690

Adverse cardiac event definition: TVR + death. TVR: target vessel revascularization. P <0.05 shows statistical significance.

Table 3 – Univariate and multivariate logistic regression analysis for predictors of no-reflow

	Univariate			Multivariate		
Variables	OR	95% CI	p value	OR	95% CI	p value
Age	1.002	0.950-1.056	0.951			
Males	0.500	0.135-1.853	0.300			
Diabetes	3.000	1.084-8.304	0.034	3.655	0.837-15.962	0.085
Hypertension	1.100	0.383-3.157	0.859			
Tobacco	2.000	0.633-6.318	0.238	1.937	0.442-8.481	0.380
Heart failure	1.810	0.607-5.396	0.287			
Stroke	2.735	0.464-16.129	0.266			
CHA_2DS_2-VASc	1.243	0.856-1.807	0.253			
Clopidogrel administration	0.545	0.133-2.237	0.400			
Statin administration	0.618	0.073-5.251	0.659			
Fasting blood glucose	1.001	0.992-1.011	0.796			
LDL	1.004	0.997-1.011	0.261			
Bypass age	1.043	0.958-1.136	0.328			
Stent length	1.041	1.001-1.083	0.044	1.032	0.910-1.017	0.171
Stent diameter	0.518	0.172-1.563	0.243	0.632	0.150-2.656	0.581

CI: confidence interval; LDL: Low density lipoprotein; OR: odds ratio. P < 0.05 shows statistical significance.

the literature included mostly patients with ACS.[16] Mirbolouk et al.[17] reported that 102 patients developed no-reflow, and there was a significant relationship between high CHA_2DS_2-VASc scores and no-reflow among 396 patients with STEMI. In addition, patients with no-reflow were reported to have a high in-hospital mortality rate. Another study by Barman et al.[18] demonstrated that there was a significant relationship between high CHA_2DS_2-VASc scores and no-reflow among 391 patients with non-STEMI, and hypertension, diabetes mellitus, heart failure, and previous stroke were significantly associated with no-reflow in this patient group. The in-hospital mortality rate of the no-reflow patient group was also significantly higher.

ACS is a condition that represents the pathological process, including arterial vasoconstriction, characterized by hyperactivation of thrombocytes as a result of rupture or erosion of atherosclerotic plaques and associated thrombus formation. As a result, it is a dynamic syndrome which causes luminal narrowing or total obstruction and creates a supply-demand imbalance.[19] In our study, the entire patient population had stable CAD. Therefore, the lesions in these patients are in the form of atherosclerotic plaque formation that causes significant stenosis in the SVG, and these lesions usually do not contain thrombus.[8] This situation leads us to think as this may be the underlying reason for the lack of a relationship between CHA_2DS_2-VASc score and no-reflow in our study. In previous studies, the no-reflow rate in SVGs during PCI has been reported as 15% to 42%.[20-21] These data mostly indicate the no-reflow rates after PCI in studies involving patients with ACS. In our study, the no-reflow rate was 16%. The reason for this value, which is close to the lower limit of no-reflow rates reported in the literature, may be explained by the fact that our patient group consists of those with a stable clinical presentation. In addition, the mean age of the SVGs was about 14 years in our study. Although it is thought that the increase in the graft age would increase the no-reflow rates in PCI, the no-reflow rate in our patients was lower

than expected. Another reason for this situation may be that the procedures were performed by operators experienced in SVG PCI in our center, and a high rate of the patients used antiaggregant and statin therapy before the procedure. In a study conducted with patients with non-STEMI, the in-hospital mortality rate was significantly higher in the no-reflow patient group.[18] In contrast, no-reflow was not associated with the adverse events of in-hospital deaths, 1-year TVR, and death in our study. This can be attributed to the fact that all the patients in our study had stable CAD, the use of GP IIb/IIIa inhibitors or vasodilators in the patients who developed no-reflow during the procedure, and administration of optimal medical treatment (dual antiplatelet therapy, beta blockers, or angiotensin-converting enzyme inhibitors/angiotensin II receptor blockers) to nearly all patients after the procedure. Of note, there are no studies investigating long-term mortality in patients with no-reflow. Our further attempt is to evaluate the long-term (5-year) mortality of this patient population in the future.

In the present study, the CHA_2DS_2-VASc score was significantly higher in the patients who died at 1-year follow-up than survivors. To the best of our knowledge, there is no study investigating the relationship between CHA_2DS_2-VASc score and mortality in patients with stable CAD without AF. It is well known that the CHA_2DS_2-VASc score increases with mortality in patients with AF. However, there is only a limited amount of data on this subject in the patient group without AF. A study in patients with ACS showed that a high CHA_2DS_2-VASc score was associated with a significant increase in adverse events, including recurrent myocardial infarction, stroke, heart failure, and death in patients without AF.[22] When diabetes mellitus, hypertension, heart failure, and other components of the score are evaluated separately, it is not unexpected that the CHA_2DS_2-VASc score, which expresses their combination, would also be associated with mortality, since each of them is associated with mortality.

In our study, a distal embolic protection device (EPD) was not used in any patients who underwent elective PCI for SVG. In the 2018 European Society of Cardiology revascularization guideline, it is recommended to use EPD as Class 2a, Evidence Level B in PCI for SVG.[23] Despite the guideline recommendation, in a recent meta-analysis, the use of EPD in SVG PCI did not reduce cardiac adverse events in patients receiving an EPD compared to those without, and the benefit of routine EPD use should be reviewed.[24] In another study by Shoaib et al.,[25] the use of EPDs increased no-reflow, procedure-related complications (i.e., aortic dissection, coronary perforation, or heart block requiring pacemaker), and cardiogenic shock associated with the procedure. In our clinic, EPD is not routinely performed in SVG PCI procedures due to hesitations in terms of both cost and effectiveness.

Limitations

The study's main limitations are its retrospective nature, relatively small sample size, and limited follow-up period for mortality analysis. Therefore, further large-scale, long-term, prospective studies are needed to confirm these findings.

Conclusion

No-reflow is of vital importance in the short- and long-term prognosis of patients undergoing SVG PCI. Hence, the risk of no-reflow should be assessed before the procedure, which may alter the treatment strategy. In this context, our study is the first to involve the CHA_2DS_2-VASc score as a distinct component of no-reflow risk analysis in patients undergoing elective PCI for SVG. However, none of the study variables were found to be associated with no-reflow. Still, it is worth noting that further investigations with larger sample populations are required to identify the determinants of postprocedural reperfusion status in patients undergoing SVG PCI, who are highly prone to the development of flow impairment and consequent adverse cardiovascular events.

The CHA_2DS_2-VASc score has a high predictive performance for mortality in patients with AF; its precision for the occurrence of thromboembolic events in patients without AF is still being researched. We found that the CHA_2DS_2-VASc score was significantly higher in patients who developed mortality at 1-year follow-up compared to patients who did not.

Author Contributions

Conception and design of the research: Kanal Y, Balci KG, Maden O, Ozbay MB; acquisition of data: Kanal Y, Balci KG, Yaman NM, Yakut I, Ozbay MB; analysis and

interpretation of the data: Kanal Y, Balci KG, Yaman NM, Yakut I; statistical analysis: Kanal Y, Balci KG; writing of the manuscript: Kanal Y; critical revision of the manuscript for intellectual content: Maden O.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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Study Association

This article is part of the thesis of Associate Professor submitted by Yükel Kanal, from Ankara City Hospital.

Ethics Approval and Consent to Participate

This study was approved by the Ethics Committee of the Ankara City Hospital under the protocol number E1-23-3465. All the procedures in this study were in accordance with the 1975 Helsinki Declaration, updated in 2013. Informed consent was obtained from all participants included in the study.

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