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Comparison of percutaneous coronary intervention of saphenous venous graft versus native artery in acute myocardial infarction

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Abstract

Aim: Percutaneus coronary intervention (PCI) is recommended as the first choice in saphenous vein graft (SVG) occlusions because of the high mortality linked with repeated coronary artery by-pass grafting (CABG). We observed percutaneous interventions performed in patients presenting with acute myocardial infarction (AMI) with a CABG history in terms of both short- and long-term efficacy and safety.

Materials and Methods: The study was conducted retrospectively at a single center. In total, 95 patients with a CABG history who were admitted to our hospital with an AMI and received PCI were included in the study.

Results: In-hospital deaths occurred in 4 (4.2%) patients, 30-day major adverse cardiac event (MACE) were present in 8 (8.4%) patients, and 6 (6.3%) patients experienced first-year target vessel revascularization (TVR). A significant difference was not observed in in-hospital death, 30-days MACE, 1-year TVR and 1-year MACE rates among the patient groups who had PCI in the graft vessel or native vessel.

Conclusion: Our study revealed that a significant difference was not present in terms of MACE in the intervention of SVGs or native coronary arteries. Diabetes mellitus (DM) should be kept in mind as a predictive factor.

Introduction

Coronary artery disease (CAD) is one of the most common causes of mortality. Medical treatments, percutaneous coronary interventions (PCI) and coronary artery bypass grafting (CABG) are used in CAD. Today, CABG using a saphenous vein graft (SVG) remains the most widely utilized method. Despite the treatment methods and precautions, only about 50% of SVGs remain open/patent for up to 10 years. PCI is recommended as the first choice in SVG occlusions because of the high mortality linked with repeated CABG. It is still unclear whether SVG lesions or natural coronary artery lesions should be treated in patients presenting with SVG occlusion, and there is currently no consensus on this issue. In terms of the choice of the procedure, the suitability of the vessels for percutaneous intervention is decisive. For this reason, we observed percutaneous interventions performed in patients presenting with acute myocardial infarction (AMI) with a CABG history in terms of both short- and long-term efficacy and safety [1-4].

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Materials and Methods

The study complies with the Declaration of Helsinki. The Health Sciences University, Gazi Yaşargil Training and Research Hospital approved the study protocol on 09/07/2021 (approval number: 857), and informed consent was obtained from all study participants.

Study Population

The study was conducted retrospectively at a single center. In total, 95 patients with a CABG history who were admitted to our hospital with an AMI and received PCI were included in the study. Lesions with a reference vessel diameter ≥2.5 mm and causing more than 50% stenosis were included in the study. Exclusion criteria for this study include multivessel lesions, true bifurcation lesions and patients with a stent requirement of < 2.5 mm or > 4.0 mm. All follow-ups after the procedure were recorded.

Procedure

After coronary angiography was performed on patients presenting with acute coronary syndrome, the decision for

intervention was made primarily based on whether the SVG was occluded by thrombus. If the responsible lesion was an acute thrombus in the SVG and a TIMI 1–2 flow was fortuitously present, we considered graft intervention the primary treatment. However, if a relatively subacute or near-chronic 'total' occlusion of the SVG was found, an intervention of the native artery (with TIMI 1, 2, or 3 flow) was deemed more appropriate. The stents we used in the intervention were zotarolimus-eluting coronary stents and bare metal stents. All interventions were performed in the order of post-dilatation as needed following stent implantation after mandatory balloon pre-dilatation. The post-dilatation balloon diameter was chosen to be equal to or 0.5 mm larger than the diameter of the implanted stent. Patients who did not take aspirin were given a 300-mg loading dose before PCI, followed by 100 mg of daily oral aspirin. Patients not receiving antiplatelet therapy were given ticagrelor or prasugrel before and after PCI.

Study Endpoints and Definitions

In-hospital death and death, stroke, acute stent thrombosis events within the first 30 days and 1-year were recorded as 30-day major adverse cardiac events (MACE). The recurrent need for vascular intervention of the same vessel within the first year led to recording and evaluating the target vessel revascularization (TVR) rate as the effectiveness point.

Statistical analysis

In statistical analysis, categorical variables were expressed in numbers and percentages. Continuous variables are expressed as a mean±SD or as a median and 25–75% interquartile range (IQR). Parameters were tested using univariate regression analysis, and values with $p < 0.1$ were included in the multivariate analysis. Significant values of the multivariate analysis are given by stating the p-values and 95% confidence intervals (CIs). IBM SPSS (Version 22.0; IBM Inc., Chicago, IL, USA) was used for statistical analysis.

Results

A total of 95 patients meeting the criteria were included in the study. While PCI was performed in the graft vessels in 39 (41.1%) patients and native vessels in 56 (58.9%) patients, no significant differences in demographic characteristics between study groups with SVG PCI and native artery PCI were observed in this study. While the ejection fraction ratio had a median of 60 (50–65 IQR) in the SVG group, it was 50 (45–55 IQR) in the native artery group; a p=0.001 value was calculated (Table 1).

Out of the 95 cases which underwent PCI, 5 (5.3%) were left anterior descending artery (LAD), 23 (24.2%) were circumflex artery (CX), 29 (30.5%) were right coronary artery (RCA), 7 (7.4%) were) consisted of aorto-diagonal, 13 (13.7%) aorto-RCA, 12 (12.6%) aorto-CX, and 6 (6.3%) left internal mammary artery-LAD (Table 2).

Age, gender, clinic (STEMI), group (graft), hypertension, diabetes mellitus, heart failure, chronic renal failure and stent type were used in the regression analysis. Diabetes mellitus was observed as an independent factor of 30-day MACE (respectively; OR: 10.73, 95% CI: 2.00–57.56, p=0.006; Table 3).

In-hospital deaths occurred in 4 (4.2%) patients, 30-day MACE were present in 8 (8.4%) patients, and 6 (6.3%) patients experienced first-year TVR. A significant difference was not observed in in-hospital death, 30-days MACE, 1-year TVR and 1-year MACE rates among the patient groups who had PCI in the graft vessel or native vessel (Table 4).

In survival analysis, a significant difference was not observed between the graft and native vessel interventions (p=0.677; Figure 1).

Table 1. Clinical differences between SVG-Native groups

Variables	SVG	Native	P value
Number of patients, n/%	39 (41.1%)	56 (58.9%)	
Age	69.33±9,97	66.66±8.30	0.159
Gender (Male), n/%	31 (79.5%)	42 (75%)	0.400
Hypertension, n/%	38 (97.4%)	54 (96.4%)	0.634
Diabetes Mellitus, n/%	13 (33.3%)	12 (21.4%)	0.145
Pulmonary diseases, n/%	3 (7.7%)	6 (10.7%)	0.452
Heart Failure, n/%	10 (25.6%)	9 (16.1%)	0.251
Atrial Fibrillation, n/%	2 (5.1%)	2 (3.6%)	0.545
Renal Failure, n/%	1 (2.6%)	3 (5.4%)	0.455
DES stent rate, n/%	33 (84.6%)	52 (92.9%)	0.171
EF	Median 60 (50-65 IQR)	Median 50 (45-55 IQR)	0.001*
STEMI, n/%	13 (23.2%)	7 (17.9%)	0.536

DES:Drug Eluting Stent, EF: Ejection Fraction, STEMI: ST-elevation myocardial infarction

Table 2. Lesions

Lesion	Number (%)n:95
LAD	5 (5.3%)
CX	23 (24.2%)
RCA	29 (30.5%)
Ao-Diagonal	7 (7.4%)
Ao-RCA	13 (13.7%)
Ao-Cx	12 (12.6%)
LIMA-LAD	6 (6.3%)

LAD: Left anterior descending artery, CX: Circumflex artery, RCA: Right coronary artery, Ao-D1: Aorto-diagonal, Ao-RCA: Aorto-Right coronary artery, Ao-Cx : Aorto- Circumflex artery, LIMA-LAD: Left internal mammarian artery-Left anterior descending artery

Discussion

In our study, we observed that successful percutaneous interventions to graft vessels had similar results to interventions of native vessels. Diabetes mellitus (DM) proved to be an independent prognostic predictor after recurrent acute myocardial infarction and successful PCI in patients with CABG history.

In PCI performed in patients with MI, stents with smaller diameters to normal sizes due to vasospasm and malposition due to thrombus formation under stent struts were

Table 3. 30-day MACE regression analysis

Parametre	Univariate			Multivariate		
	Odds	%95 CI	P value	Odds	%95 CI	P value
Age	1.050	0.965-1.142	0.257			
Gender	0.896	0.168-4.788	0.897			
Clinic(STEMI)	1.278	0.238-6.872	0.775			
Group(SVG)	2.598	0.583-11.582	0.211			
Hypertension	6.071	0.488-75.546	0.161			
Diabetes Mellitus	10.737	2.003-57.562	0.006	10.737	2.003-57.562	0.006
Heart failure	1.238	0.136-11.242	0.850			
Chronic renal failure	4.000	0.366-43.694	0.256			
Stent type (DES)	0.808	0.089-7.333	0.850			

Table 4. Clinical outcomes

Parameters	SVG PCI	Native PCI	P value
In-hospital deaths	2 (5.1%)	2 (3.6%)	0.545
30-days MACE	5 (12.8%)	3 (5.4%)	0.180
First year TVR	2 (5.1%)	3 (7.1%)	0.522
One year MACE	11 (19.6%)	13 (33.3%)	0.131

MACE, major adverse cardiac event; TVR, target vessel revascularization

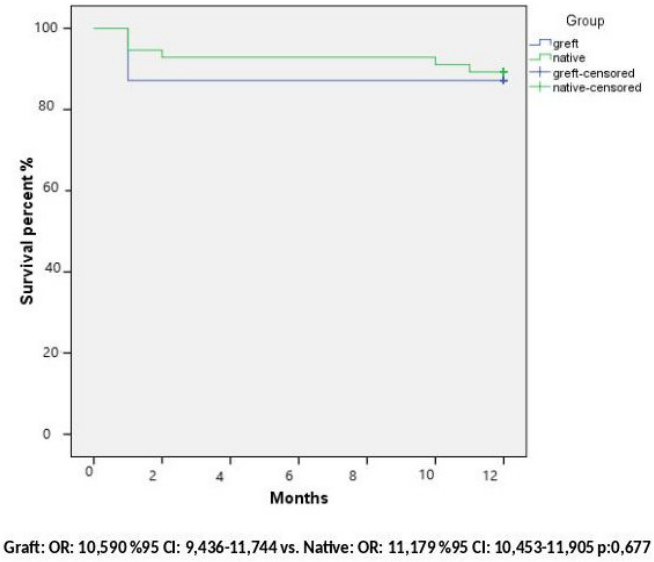

Figure 1. Survival analysis

preferred; however, patients with MI had a greater risk of stent thrombosis (early or late) than stable coronary patients [5, 6].

There may be several reasons why there was no significant difference in long-term clinical outcomes between SVG PCI and native artery PCI in patients presenting with ST-segment elevation MI (STEMI) who had undergone previous CABG. The small number of patients, study of a single center, and exclusion of patients requiring complex native intervention are some of these reasons. In electrocardiographic analyses of patients with CABGs presenting with STEMI, because the responsible vessel may have been the SVG or native vessel, this situation cannot be clearly predicted, which complicates the diagnosis and treatment strategy of the procedure [7, 8]. Additionally, optimal patency may not be sufficient in patients with SVG occlusion. In some cases, such as the inability to intervene during SVG occlusion, intervention may proceed in chronic total occlusion of native vessels [9, 10]. Cardiogenic shock often develops in patients with AMI [11, 12]. Therefore, it is recommended to provide rapid revascularisation and keep the procedure time brief. After the resolution of the acute problem, it would be more accurate to plan a complex intervention for chronically occluded vessels [13, 14].

In a published analysis similar to our study, it was reported that DM might increase the incidence of MACE after PCI in patients with prior CABG and presenting with AMI. DM has also been shown to be a negative predictor of graft PCI in previous studies. Additionally, as noted in a previous study, patients presenting with STEMI have higher 90-day mortality following primary PCI, especially when the responsible vessel is an SVG [15, 16, 17]. Another reason for our results being similar may be that we used new antiplatelets (e.g., ticagrelor and prasugrel) to treat the patients. Studies have shown that these drugs significantly reduce the risk of early and late thrombosis. The fact that our patient group consisted of patients presenting with acute MI provided an opportunity for the use of these drugs [18, 19, 20].

Conclusion

Our study revealed that a significant difference was not present in terms of MACE in the intervention of SVGs or native coronary arteries. DM should be kept in mind as a predictive factor.

Limitations

In our study, coronary lesions could not be identified by matching the vessels feeding the myocardial region. The small number of patients in our study and the fact that our study was conducted at a single center are other important limitations. Another limitation was that we could not make decisions as a 'heart team' since cardiovascular surgery did not actively work in our center and CABG was not performed. Furthermore, since we did not have the possibility to perform an intravascular ultrasound or

optical coherence tomography, we also could not present objective data about lesion characteristics.

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