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Percutaneous Coronary Intervention in Saphenous Vein Grafting Failure: A Case Report

A.Tenri Syahirah[1], Sidhi laksono[2*]

[1]Siloam Heart Center, Cinere, Indonesia
[2]Department of Cardiology and Vascular Medicine, Siloam Heart Center, Cinere, Indonesia
[2]Faculty of Medicine, Universitas Muhammadiyah Prof Dr Hamka, Tangerang, Indonesia

Email: sidhilaksono@uhamka.ac.id

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Abstract

Bypass graft surgery for coronary arteries is an essential therapy for those diagnosed with multivessel arterial stenosis, particularly in patients with diabetes. Internal thoracic artery grafts are the most suitable choice for revascularizing severe arterial disease due to their durability and longevity. However, complete revascularization is challenging to achieve only with grafts from the artery, which means it requires using saphenous vein grafts (SVGs). Unfortunately, saphenous vein grafts lack the same level of structural integrity, and their malfunction is associated with substantial negative cardiac consequences and higher death rates. In this case, the patient is an 80-year-old male suffering from CABG surgery 13 years prior. He had cold sweats and frequent chest pain that shot up his back. Diabetes, hypertension, and smoking were among his risks. Electrocardiography showed significant ischaemia, and echocardiography indicated mild diastolic dysfunction and impaired left ventricular systolic function with a 48% ejection fraction. Laboratory results indicated increased troponin I production and random blood glucose. After percutaneous coronary intervention and DES implantation into the diagonal saphenous vein grafts, the patient was given beta-blockers, nitrates, and statins as dual antiplatelet treatment.

Keywords: Saphenous Vein Graft Stenosis, Percutaneous Coronary Intervention

Abstrak

Penanganan pasien yang terdiagnosis penyakit multivessel arteri koroner utamanya dengan riwayat diabetes saat ini adalah dengan cangkok arteri coroner bypass (CABG) sebagai terapi utama. Cangkok arteri toraks internal secara luas dianggap sebagai cara terbaik untuk merevaskularisasi penyakit arteri koroner lanjut karena bekerja dengan sangat baik dan bertahan lama. Namun, revaskularisasi penuh sulit dicapai dengan hanya penggunaan cangkok arteri saja, sehingga memerlukan cangkok vena saphena (SVG). Namun sebaliknya, SVG tidak memiliki tingkat integritas struktural yang sama, dan malfungsi mereka dikaitkan dengan outcome gejala jantung yang buruk dan tingkat kematian yang lebih tinggi. Pada kasus ini, pasien seorang pria berusia 80 tahun yang memiliki riwayat operasi CABG 13 tahun lalu merasakan nyeri dada yang menjalar hingga ke punggung disertai keringat dingin. Selain diabetes, pasien juga memiliki riwayat hipertensi dan merokok. Pada elektrokardiografi, ditemukan tanda iskemia dan hasil ekokardiogram menunjukkan disfungsi diastolik ringan disertai penurunan fungsi sistolik ventrikel kiri dengan ejection fraction 48%. Hasil laboratorium menunjukkan peningkatan kadar troponin dan peningkatan glukosa darah sewaktu. Setelah dilakukan pemasangan stent dengan drug-eluting stent (DES) pada cangkok vena saphena diagonal, pasien diterapi dengan terapi double antiplatelet, beta-blocker, nitrat, dan statin.

Kata kunci: Stenosis Cangkok Vena Saphena, Intervensi Koroner Perkutaneus

Introduction

Coronary artery bypass grafting (CABG) is the definitive treatment for multivessel coronary artery disease. Although comprehensive clinical research, the long-term efficacy of CABG remains constrained by the limited durability of saphenous vein grafts (SVG), the most prevalent type of conduit.[1–6] SVGs show elevated percentages of failure, with 3% to 12% obstructing before getting out of the hospital, 8% to 25% collapsing within one year, and just 50% to 60% sustaining patency after 10 years.[1,7,8] Improvements in surgical procedures and medication have enhanced mid- and long-term SVG integrity rates, with recent research indicating that composite grafts show patency rates equivalent to arterial grafts after 5-year and 8-year SVG patency rates reaching as high as 91%. Notwithstanding these advancements, 13% of patients undergoing CABG necessitate repeat revascularization within a decade, 18% of all percutaneous coronary interventions (PCIs) are conducted in individuals with prior CABG, and 6% of all PCIs are executed on saphenous vein grafts (SVGs), highlighting the recurrent requirement for repeat revascularization post-CABG.[9,10] We presented 80 an 80-year-old man with SVG stenosis, and we did SVG PCI; PCI remained one of the strategies to manage SVG failure.

Case Report

An 80-year-old man had been experiencing cold sweats and chest discomfort radiating to his back for 14 hours before admitting to the emergency department. Risk factors are diabetes, hypertension, and tobacco use. Thirteen years ago, he underwent a coronary artery bypass graft procedure. The surgeon used the left internal mammary artery as a graft for the left anterior descending coronary artery and a saphenous vein graft for the diagonal artery.

From the vital examination found during the initial evaluation, the patient displayed signs of awareness, including a blood pressure reading of 132/81 mmHg, a pulse rate of 71 times per minute, a steady ventilatory rate, and an oxygen saturation rate of 99% while breathing normal air. The other physical examination was within the normal limit. The echocardiography showed dilatation of the left atrium, reduced contractility of the left ventricle with ejection fraction (EF) of 48%, grade I diastolic dysfunction, and hypokinetic in the anterolateral wall. A 12-led electrocardiogram indicated extensive ischemia. The laboratory data analysis revealed elevated troponin I levels of 196 ng/L, creatinine levels of 1.23 mg/dl, and basic blood glucose levels of 338 mg/dl (HbA1C 10.9). Chest X-ray found atherosclerosis and pulmonary congestion. Medical history includes the use of clopidogrel, bisoprolol, candesartan, nitroglycerin, simvastatin, gliquidone, and acarbose. We performed revascularization on the second day of hospitalization after moving the patient to the critical care unit.

Coronary angiography was performed via the right femoral artery, which showed a normal left main artery and total occlusion at the ostial segment of the left anterior descending arteries. The left circumflex was severe stenosis in the distal segment. Furthermore, the right coronary artery had 80% stenosis in the prox and mid. Additionally, the saphenous vein graft was stenosis in mid, ranging from 80% to 90%. BMW guidewire was administered to distal SVG. We did direct stenting with drug-eluting stent (DES) Eucalimus 2.75 x 16 mm at 10 atmospheric pressure in the distal part of SVG. Then, we put the second stent overlapping from the previous stent with DES Eucalimus 2.75 x 16 mm at 12 atmospheric pressure. We achieved a remarkable angiographic result without significant complications during or after the surgery, and the hemodynamics remained stable.

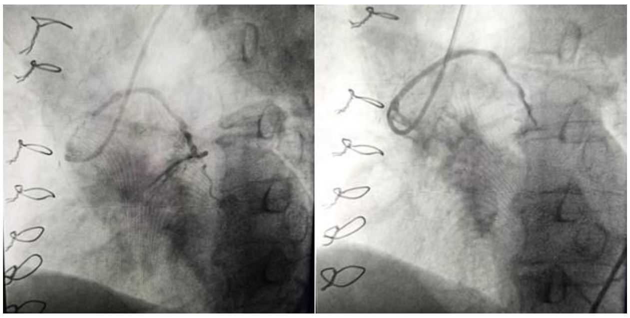

Figure 1. Displays the Right Image Prior to Stent Insertion and The Left Image Following Stent Insertion

The chest pain resolved completely over the last 12 hours following the surgery. The patient underwent further monitoring for 48 hours prior to discharge. We plan to perform a percutaneous coronary intervention on the left circumflex arteries a few months later.

Discussion

The predominant routes utilized for coronary artery bypass grafting (CABG) are the left internal thoracic artery (LITA) and the long saphenous vein (LSV). Although the LITA has demonstrated a high long-term patency rate, its length often precludes it from being used for several grafts. The LSV, however, is accessible in extended lengths for the construction of multiple grafts and can be harvested concurrently with the LITA. Consequently, the LSV continues to be one of CABG's most frequently utilized conduits. The radial artery and the right internal thoracic artery are other conduits that are not often utilized. Notwithstanding its widespread application, the LSV graft has short-term failures. It shows a diminished long-term durability rate, leading to reduced long-term survival and event-free survival compared to arterial grafts.[2,11] In this patient, LIMA was used for the LAD and SVG for LCX and RCA.

SVG disease presents in three phases: acute (before hospital release), middle (1 month to 1 year), and chronic (post-hospital discharge, above 1 year). Thrombotic obstruction happens initially in the anastomosis process as a result of vasospasm. Technical issues related to surgery, such as insufficient distal drainage, graft kinking, and small distal arteries, increase the potential of early graft thrombosis. One month later, a localized injury leads to hyperplasia upon the vein, experiencing arterialized pressure and flow, resulting in localized plaque formation characterized by platelet aggregation and smooth muscle proliferation, contributing to disease development. The primary cause of graft failure above the first year is severe atherosclerotic narrowing over the previously compromised endothelium. Graft failure is primarily caused by atherosclerosis. It has been demonstrated that the primary underlying pathophysiology of SVG illness is endothelial damage, particularly uncontrolled hypertension and diabetes, which are risk factors for atherosclerotic disease.[9,12]

Reintervention is frequently required following CABG due to the formation or worsening of bypass graft lesions or native atherosclerosis. SVG lesions are primarily addressed through

PCI, which has two significant limitations: (1) distal embolization and no-reflow during the acute stage and (2) elevated rates of restenosis and progression of SVG disease during follow-up.[9,13]

In some CABG patients, redoing CABG is not feasible due to older age and increased mortality risk. Consequently, physicians frequently approve PCI due to its lower morbidity and mortality rates than repeat CABG. In patients with previous CABG surgery, PCI can be conducted on both native and graft vessels; however, performing PCI on graft vessels is challenging and associated with insufficient long-term clinical results. The presence of restenotic lesions and multiple stents is linked to an increased risk of morbidity and mortality, suggesting a diminished survival benefit.[5,14]

Figure 2 illustrates a decision tree outlining treatment alternatives for failed SVG based on the intricacy of the graft and the associated native coronary artery lesions. Alongside acute native vessel PCI, the notion of acute SVG PCI with sequential native vessel PCI (where intricate) has been suggested, potentially offering a further method to achieve more sustainable outcomes, especially in patients with a history of numerous treatments inside the graft.[15]

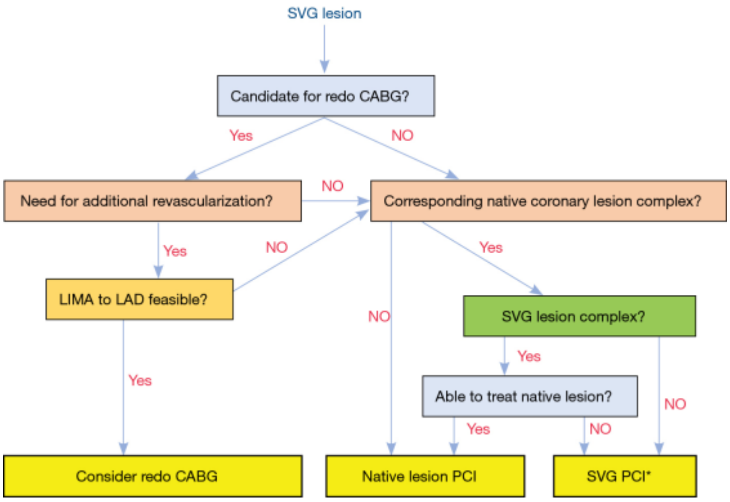

Figure 2. Current Treatment of SVG Lesions. Complex Native Lesions Include Chronic Complete Occlusions, Significant Calcification, Tortuosity, Bifurcations, And Small Vessel Size. SVG, Saphenous Vein Graft; CABG, Coronary Bypass Graft Surgery; LIMA, Left Internal Mammary Artery; LAD, Left Anterior Descending Artery; PCI, Percutaneous Coronary Intervention

In instances of SVG failure, PCI may be conducted on either the offending SVG or the associated native vessel. While no randomized controlled trials have evaluated the outcomes of these strategies, research studies indicate enhanced short- and long-term results with native vessel percutaneous coronary intervention (PCI). The 2018 ESC/EACTS guideline on myocardial revascularization recommends percutaneous coronary intervention (PCI) to a native vessel rather than PCI to a bypass graft (class IIa, level of evidence C). Recanalization of native vessels is not consistently achievable, as lesions in these vessels are frequently complicated, with chronic total occlusions (CTOs) observed in up to 89% of patients who have undergone previous CABG, partly due to the accelerated progression of native coronary atherosclerosis following CABG.[3,9]

Various medical treatments have been proven to enhance SVG patency following CABG. Aspirin administration immediately following CABG is essential for enhancing graft integrity, as patients not receiving postoperative treatment show a failure rate up to five times higher. The use of P2Y12 inhibitors, vitamin K antagonists, or novel anticoagulant therapy alongside aspirin has not shown consistent advantages for SVG integrity and is not commonly implemented in clinical settings. Statin therapy has been shown to decrease SVG thrombosis rates and serious cardiac complications post-CABG. The incorporation of ezetimibe in patients with a history of CABG might reduce the advantages of statin therapy concerning SVG failure. There is increasing concern about the intensity of lipid-lowering treatment, its impact on saphenous vein graft failure, and the potential advantages of PCSK9 inhibition. Low-density lipids (LDL) levels, in particular, play a role in the atherosclerotic process and have, therefore, become the focus of research to determine the association between cholesterol and vein graft failure. An extreme LDL target of <2.6 mmol/L was determined to prevent SVG disease in the post-coronary artery bypass graft trial and was corroborated by a post hoc analysis of the clopidogrel after surgery for coronary artery disease (CASCADE) trial.[3,16,17]

The 80-year-old patient in this case had a past medical history of diabetes, high blood pressure, and smoking, as well as a history of CABG surgery 13 years ago and worsening chronic coronary syndrome. Percutaneous coronary intervention (PCI) has a very low chance of causing the patient's death within a year. This is because of their history of coronary structure, a patent LIMA-LAD graft, stenosis of the SVG-diagonal artery, and a left ventricle ejection fraction function of 48%. Due to his health condition, this patient was eligible for percutaneous coronary intervention (PCI) on SVG with stenosis. The right femoral artery was the chosen access point. We successfully conducted a percutaneous coronary intervention (PCI) on the SVG-diagonal artery. We plan a PCI procedure for the left circumflex artery (LCx) a few months later.

Conclusion

SVGs continue to be the predominant grafts utilized in CABG. Despite advances in surgical procedures and medication, the incidence of failure in SVG is significant, frequently necessitating repeat procedures, particularly in patients with uncontrolled hypertension, DM, and a history of smoking. The SVG PCI protocol is complicated. However, complications during the procedure and restenosis occur more frequently than with native coronary artery percutaneous coronary intervention. This shows how important it is to prevent these problems and instead perform PCI on the native conduit if at all possible. The novelty is that highly effective antiplatelet drugs and lipid-lowering medications have the potential to slow down the rapid growth of SVG atherosclerosis and decrease the incidence of SVG failure.

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