

## Should Surgical or Percutaneous Revascularization be Preferred for Concomitantly Diffuse Aneurysmal and Stenotic Coronary Artery Disease? A Case Report

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### Abstract

Percutaneous coronary intervention (PCI) and coronary artery bypass graft (CABG) have both proven to be effective in treatment of coronary artery disease (CAD). Surgery was traditionally reserved for treatment of patients with three-vessel coronary artery disease or left main disease. Technical obstacles, as well as the high risk of restenosis related to the procedure, limited PCI applicability to this kind of patients. The advent of drug-eluting stents (DES) has radically changed the practice of interventional cardiology, allowing the treatment of complex lesions, once the exclusive domain of surgery. We hereby report the case of a patient with previous myocardial infarction and concomitantly diffuse aneurysmal and stenotic coronary artery disease. After consultation with cardiac surgeons and interventional cardiologists, surgical revascularization was considered the most suitable choice. This clinical case highlights the importance of a multidisciplinary approach for the management of the patients with CAD. The heart team indeed plays a crucial role for the optimal assessment of the cardiac disease ensuring the best therapeutic strategy for the patients.

### Keypoints

Aneurysm; Coronary artery bypass grafting; Coronary artery disease; Heart team; Percutaneous coronary intervention.

### Abbreviations

PCI: Percutaneous Coronary Intervention; CABG: Coronary Artery Bypass Graft; CAD: Coronary Artery Disease; DES: Drug-Eluting Stents; ECG: Electrocardiogram; TTE: Transthoracic Echocardiogram; EF: Ejection Fraction; CT: Coronary Computed Tomography; TEE: Transesophageal Echocardiogram

## Introduction

The treatment of coronary artery disease has seen huge progress in recent years. Since the advent of drug eluting stents (DES), percutaneous coronary intervention (PCI) is challenging coronary artery bypass graft surgery (CABG) as an alternative for myocardial revascularization also in patients with multivessel coronary artery disease or left main disease [1,3]. Sometimes determining the best revascularization strategy for this kind of patients may not be straightforward. Aneurysmal coronary artery disease is seen in 0.3% to 5% of patients undergoing coronary angiography [2,5]. The most frequent cause of coronary aneurysms is atherosclerosis, although it may be also associated with congenital heart disease, connective-tissue disease, vasculitis or infectious processes such as Kawasaki disease [2,4]. Complications associated with coronary artery aneurysms include acute coronary syndrome, thrombosis, embolization, rupture and vasospasm [6]. The management of coronary artery aneurysms, particularly in the setting of acute coronary syndromes and when combined with stenotic lesions, is still subject of debate. [7,8]. There have been reported cases where coronary artery aneurysms has been treated with a conservative management or antiplatelet and anticoagulation therapy [9] but most cases in the literature involve surgical intervention [10]. We report a case of a 45-year-old male with dilated cardiomyopathy and concomitantly diffuse aneurysmal and stenotic coronary artery disease successfully treated with surgical myocardial revascularization.

## Case Presentation

A 45-year-old male was admitted at our institution for the recent onset of exertional dyspnea. His medical history was notable for arterial hypertension and family history of coronary artery disease. He referred smoking status for about forty years. He also reported previous brain hemorrhage occurring almost 20 years before from a ruptured brain aneurysm, submitted to surgical treatment without sequelae (except for mild paresthesia to the little finger of the right hand). Over the period of one month, the patient developed chest pain with dyspnea and cold sweats, which would be brought on by exertion and would regress spontaneously. Since then, the patient reported worsening of dyspnea. On admission, the patient was found to be in good general condition. The electrocardiogram (ECG) revealed sinus rhythm at 86 bpm, with signs of previous anteroseptal myocardial infarction. The transthoracic echocardiogram (TTE) showed a significant dilatation and systolic dysfunction of the left ventricle (ejection fraction [EF] 39%) and a mitral regurgitation of at least moderate degree. After assessment of clinical presentation it was considered appropriate to perform a coronary angiography which documented critical three-vessel disease, widely aneurysmal (Figure 1,2,3). The patient had no history of connective-tissue disease, vasculitis or infectious processes. Therefore, atherosclerotic disease was considered to be most likely cause of coronary aneurysms. In order to assess myocardial vitality a dobutamine stress echocardiography was performed, showing a positive result at the level of the apical and medium septum and at the level of the inferior wall of left ventricle. Myocardial revascularization was decided on after consulting with a cardiac surgeon. Lipid lowering therapy and high-dose anticoagulant therapy (low molecular weight heparin) were also introduced.

The patient underwent surgical revascularization by quadruple coronary artery bypass grafting (CABG), with a left internal mammary artery graft to the left anterior descending and a sequential

saphenous vein graft to the diagonal branch, the obtuse marginal branch, and the posterior descending artery. In addition, mitral valve and tricuspid valve repair was performed. Weaning from cardiopulmonary bypass was without difficulties and the transesophageal echocardiogram (TEE) performed in the operating room showed a significant improvement of the EF.

Postoperative hospital stay in intensive care unit was uneventful and the patient was transferred to the cardiac surgery unit in the second post-operative day. The patient was then discharged ten days after admission. The patient was given antiplatelet therapy, beta-blockers and lipid-lowering therapy after discharge. Clinical follow-up 3 months after CABG confirmed the satisfactory clinical outlook, as the patient remained free of symptoms and with a healthy and active lifestyle.

## Discussion

In most patients with CAD it is reasonable to admit that PCI and CABG are both effective and safe. Data from randomized trials have however indicated an advantage of CABG over PCI for left main and three-vessel coronary artery disease [11]. For this reason CABG still remains the standard of care for patients with this kind of lesions [12,13]. The main factor limiting the use of PCI is the increased need for subsequent revascularization, due to restenosis within the target lesion or vessel. In addition, it is probable that CABG may protect from disease progression in apparently healthy coronary segments.

The advent of drug-eluting stents has dramatically reduced the incidence of restenosis although data on the use of DES in the treatment of three-vessel disease and left main disease are relatively limited, and still cannot match those in support of CABG [14,15]. Additionally, CABG has also progressed and improved techniques with minimally invasive and off-pump surgery [16]. So, the treatment of patients with multivessel coronary artery disease is still a challenge for cardiologists and cardiac surgeons and the debate about the optimal treatment choice in these kind of patients is still open.

Several randomized clinical trials have compared the outcomes of PCI with CABG for treatment of multivessel coronary artery disease. The SYNTAX trial is the most recent randomized controlled study comparing current surgical and percutaneous techniques in patients with three-vessel or left main coronary artery disease (or both) [17]. The results of this trial showed that CABG, as compared with PCI, resulted in lower rates of the combined end point of major adverse cardiac or cerebrovascular events at 1 year (12.4% vs 17.8%,  $p=0.002$ ; relative risk with PCI 1.44 [1.15-1.81], 95% confidence interval [CI]). For this reason surgery should remain the standard of care for such patients. The SYNTAX score was designed to predict outcomes related to anatomical characteristics and the functional risk of occlusion for any segment of the coronary-artery bed. The SYNTAX trial has shown survival benefit in favor of CABG, especially in patients with SYNTAX scores  $>22$ . Patients with three-vessels disease with moderate to high SYNTAX scores who undergo CABG have better clinical outcomes than those undergoing PCI with first-generation DES. So, the percutaneous approach should be avoided in patients with high SYNTAX scores [18].

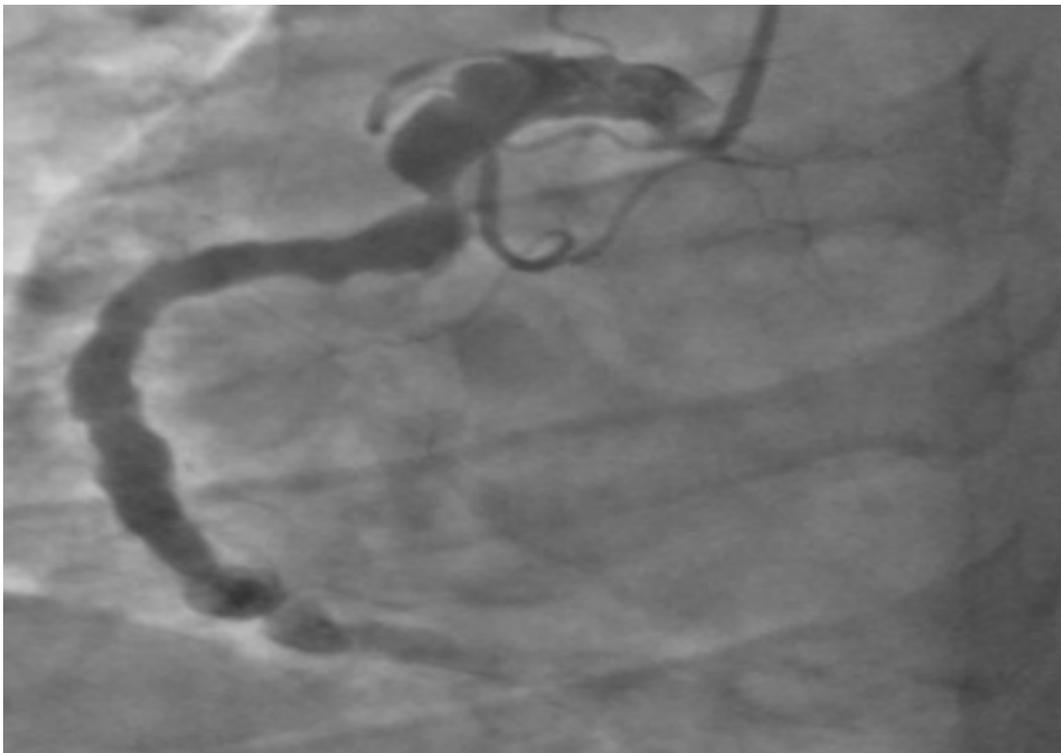
The case described above was that of a patient with a critical three-vessel disease and widespread coronary artery aneurysms. The management of coronary artery aneurysms still debated. Both surgery and percutaneous intervention may be playing a role in this condition. Yet, potential complications of PCI include distal embolization, the presence of a thrombus, and stent malapposition. The placement of a

stent in an aneurysmal segment represents a technical challenge and may not be feasible. Surgery is indicated in the presence of giant aneurysms (three to four times the original vessel diameter) involving the left main, bifurcation lesions, or multivessel involvement [19]. Surgical treatment includes CABG with or without aneurysm ligation or resection, isolated CABG, aneurysm plication and saphenous vein patch repair of the aneurysm. It is very important to involve specialists in endovascular and surgical specialties to provide a balanced knowledge into optimal revascularization strategy. For the case reported above, after a consultation with experienced specialists of different skills, surgical revascularization was considered the most suitable treatment strategy for the patient. The favorable outlook of our case supports the validity of our decision.

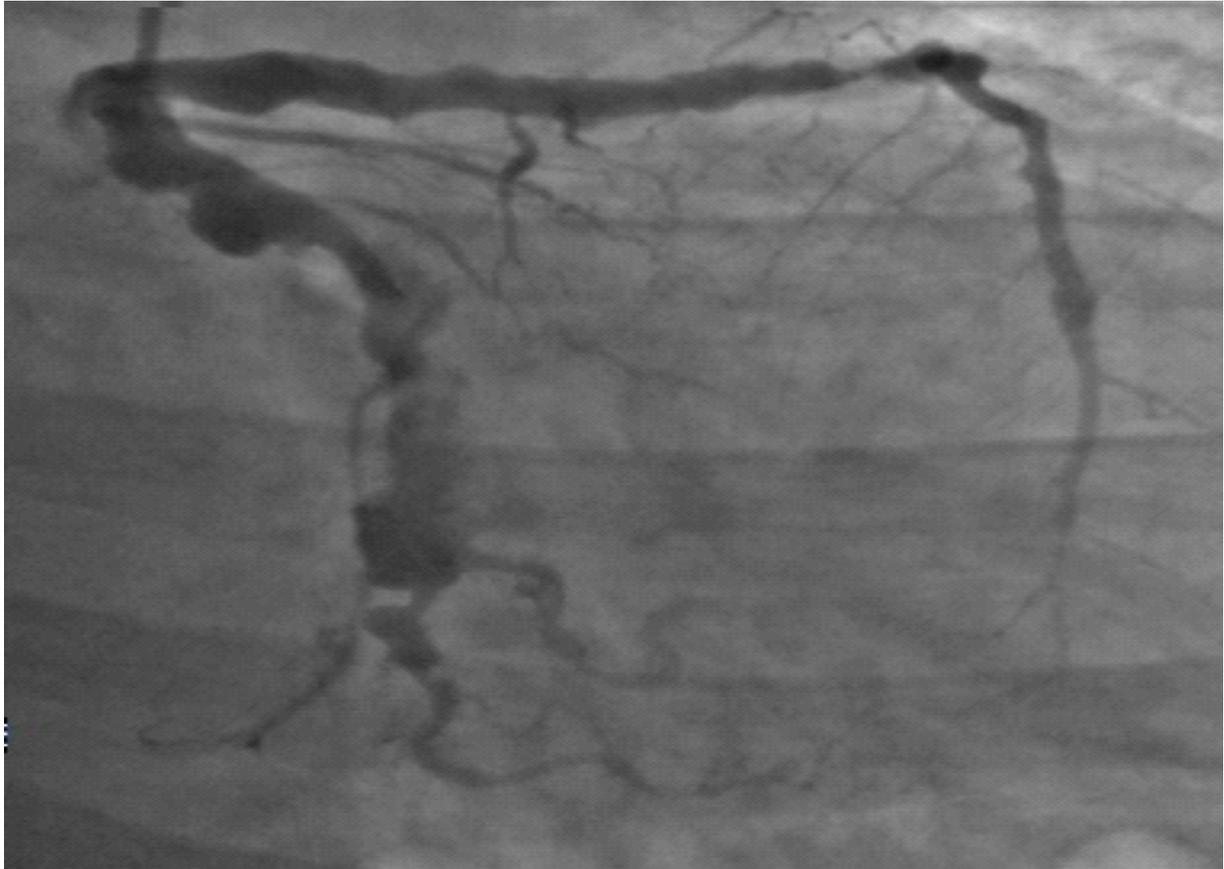
In conclusion, decision-making in patients with multivessel coronary artery disease may not always be easy. In this regard, the heart team plays a key role [20] as established by SYNTAX and incorporated in the European [21] and American guidelines [22]. In fact, the major contribution of the SYNTAX trial is the development of the multidisciplinary heart team (cardiologists, surgeons, and nurses) to assist in making individualized management decisions based on each patient's clinical and angiographic findings. In addition, the heart team ensures proper patient information and consent, including providing patients with adequate discussion of alternatives, risks and benefits, and short-term and long-term results [23].

Surely, in decision making, the role of the patient is strongly relevant, as he or she should be well-educated about the available evidence and properly informed about the risks related to any kind of procedure, in order to be consciously involved in decision process that will lead to the choice of the best therapeutic strategy.

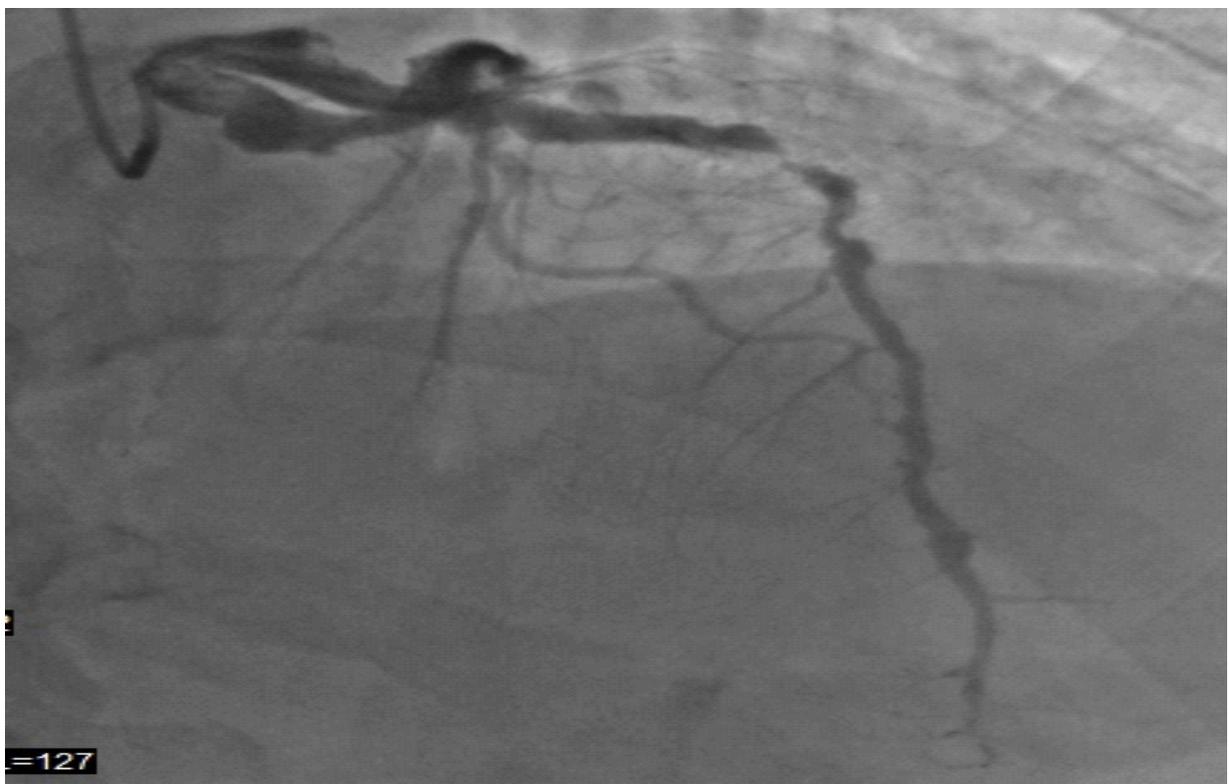
## Figures



**Figure 1:** Coronary angiography showing a right coronary artery widely aneurysmatic.



**Figure 2:** Coronary angiography showing diffuse aneurysmal and stenotic disease of the left anterior descending artery and circumflex artery.



**Figure 3:** Coronary angiography showing diffuse aneurysmal and stenotic disease of the left anterior descending artery

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