Pulmonary outflow stenosis due to saphenous vein graft aneurysm: a rare case report and review of literature

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Abstract

Saphenous Vein Graft Aneurysms (SVGA) have been reported as a rare complication of post-coronary artery bypass grafting (CABG) in the literature. Complications typically arise 10 to 20 years post CABG. Acquired pulmonary artery trunk stenosis in adults is another rare entity that may be caused by a SVGA, among other etiologies. The finding was incidentally discovered on CTA performed to rule out pulmonary embolism on a post hip-fracture repair patient who was experiencing shortness of breath. The diagnosis was confirmed by CTA coronary study with multiple 3-D rotational volumetric-surface shaded images. Therefore cross sectional imaging can give early and accurate measurements of the size of an aneurysm and its relationship to adjacent structures, emphasizing its added value in early diagnosis of SVGA.

Introduction

Saphenous Vein Graft Aneurysms (SVGA) have been reported as a rare complication of post coronary artery bypass grafting (CABG) in the literature. Complications typically arise 10 to 20 years post CABG, with common etiologies being vessel wall ischemia, atherosclerotic degeneration, among other causes [1]. In 1975, Riahi described the first reports of such a phenomenon [2] and distinguished that the incidence of a minor dilation of saphenous vein grafts varies up to 14%, whereas the significant aneurysm is unusual at merely 0.07% [3,4]. Since that time, SVGA has become increasingly encountered as the advances in medicine have prolonged the life expectancy of bypass graft recipients. SVGA most often presents as chest pain, but can possibly present with symptoms of abdominal pain as well [5]. Optimal methods for diagnosing SVGA include the use of computed tomography (CT) and or magnetic resonance imaging (MRI), as both are more effective than coronary angiography in terms of estimating the true size of the aneurysm [1]. Treatment algorithms include exclusion of the aneurysm with a stent, or open surgery if the former is not a viable option [6].

Acquired pulmonary artery trunk stenosis in adults is another rare entity. Reviews have suggested multiple intrinsic and extrinsic causes, including: bronchial carcinoma, mediastinal neoplasms and fibrosis, ascending aortic aneurysms, Takayasu arteritis, intraluminal filling defects due to pulmonary thromboembolism, and pulmonary artery sarcomas [7].

We present the rare case of a large aortocoronary bypass saphenous vein graft aneurysm causing significant extrinsic compression on the main pulmonary artery trunk outflow. The finding was incidentally discovered on CTA performed to rule out a pulmonary embolism on a post hip-fracture repair patient who was experiencing shortness of breath. The diagnosis was confirmed by a CTA coronary study with multiple 3-D rotational volumetric-surface shaded images and angiography. In a review of the literature, we found only six cases that describe SVGA causing pulmonary trunk stenosis.

Case report

A 79-year-old Caucasian male presented to our service for evaluation of progressively worsening shortness of breath after undergoing open reduction and internal fixation of an intertrochanteric fracture of the right hip. On the third post-operative day, the patient developed acute progressive shortness of breath with cough. His past medical history included hypertension, hyperlipidemia, chronic kidney disease stage III, recent diagnosis of prostate cancer undergoing treatment, and coronary artery disease. Seventeen years earlier he had undergone aortocoronary grafting using three saphenous vein grafts to the obtuse marginal artery (OM), posterior descending artery (PDA) and diagonal artery and a fourth left internal mammary artery (LIMA) graft to the left anterior descending artery (LAD). The patient was non-compliant with his medication after the operation. The patient has a nine-pack year history but had quit 54 years ago.

On physical examination, the patient’s blood pressure was 159/76 mm Hg, his pulse was normal and regular, his respiratory rate was eighteen breaths per minute, and he had a normal temperature. Oxygen saturation measured 93% on two liters nasal cannula. The patient had a soft systolic ejection murmur at the right upper sternal border, and his lung sounds were clear on auscultation except for scant crackles at the bases.

A work-up was initiated to rule out myocardial infarct, pulmonary embolism, and CHF. Initial cardiac markers were normal, and the electrocardiogram demonstrated sinus rhythm with an old inferior
infarct pattern and nonspecific ST changes. Echocardiogram revealed inferior wall akinesis, an ejection fraction estimated at 35-40%, and an elevated right ventricular systolic pressure measuring 40-50mmHg. A chest radiograph demonstrated a 5.5 cm x 6 cm anterior left hilar mass (Figure 1). A chest CT scan with contrast was concerning for a SVGA (Figure 2). A large aneurysm of the diagonal artery bypass vein graft which measured 5.5 cm x 5.9 cm was confirmed by coronary CTA study (Figure 3) with multiple 3-D rotational volumetric surface shaded image (Figure 4). The aneurysm was located anterolateral to the aortopulmonic window region and was compressing the adjacent pulmonary outflow with a transverse dimension of 2 cm. It was predominantly filled with thrombus and about 30% of its lumen opacified with contrast medium (Figure 3). Further workup included a pulmonary function test, which revealed a mild degree of restrictive and obstructive ventilatory impairment, along with a decrease in diffusion capacity and a moderate impairment of gas transfer capacity. Pulmonary embolism studies were consequently ordered.

The patient underwent a cardiac catheterization demonstrating a pseudoaneurysm of the saphenous vein graft bypassing the diagonal artery. The study also found minimal blood flow distal to the aneurysm. Given the patient’s comorbidities, he was not a candidate for repeat CABG. A percutaneous coil-embolization was successfully performed to occlude flow to the aneurysm due to its high risk of rupture. A Cook 2 mm x 3 cm embolization coil was placed into the distal portions of the proximal limb of the saphenous vein graft, completely stopping flow in an anterograde fashion. The patient did have a subsequent mild non-ST elevation MI, but was stable hemodynamically and clinically. The patient did well after the procedure and was discharged after a few days. In a follow up visit three months later, he did not develop any

![Figure 1. AP and lateral chest X-ray demonstrating a large left perihilar mass anteriorly (red arrow)](image1)

![Figure 2. Chest computed tomography with contrast, pulmonary embolism protocol, showing anterior mediastinal mass (red arrow) compressing and narrowing the pulmonary outflow tract](image2)

![Figure 3. Gated coronary computed tomography angiogram showing saphenous vein graft aneurysm (red arrow) with contrast-filled small 2 cm true lumen surrounded by large thrombus.](image3)
diameter compared to the normal expected diameter of the vascular wall, resulting in at least a 50% increase in arterial or venous diameter. Aneurysms are defined as a permanent localized dilatation that contains the entire arterial or venous wall. The differentiation between a pseudoaneurysm and true aneurysm is important. True aneurysms caused by atherosclerosis, are more subclinical and chronic in nature. It is also important to note that true aneurysms are more common than pseudoaneurysms by a ratio of 6:1 [13]. Because the differentiation between a pseudoaneurysm and true aneurysm is pathologically determined and not always delineated, the term “aneurysm” will be used in the remainder of this report.

A large SVG aneurysm is described as being 4 cm or more in diameter [14]. They are mostly asymptomatic and discovered incidentally on routine chest radiographic examinations [14]. Patients with graft aneurysms have also been reported to present with myocardial ischemia; aneurysms are often thrombus-filled and may lead to occlusion and periodic emboli. Multiple life-threatening complications in SVGAs have been reported including myocardial infarction [15], rupture [16], fistula formation to different heart chambers and adjacent major vessels, and even death when they go undetected [14]. Other reported complications from the compressive effects of SVGAs include acute superior vena cava obstruction [17] cardiac tamponade [7] and pulmonary artery stenosis [18,19].

In our review of the literature, we found only six reports of SVGAs causing pulmonary trunk compression. The first case was discovered incidentally by routine chest radiography and showed a large mass adjacent to the left heart border. A contrast-enhanced multi-detector row spiral CT scan confirmed the diagnosis of a large true SVGAn. The first aneurysm was found in a bypass graft to the circumflex coronary artery measuring 8 x 9 x 8 cm with considerable compression on pulmonary trunk. The second one was an aneurysm of the bypass grafts to the right coronary artery. The patient died suddenly from an acute infarct arising in the SVGAn before any management of the SVGAn could be done [19].

The second case was a large aneurysm seen in a SVG feeding a diagonal artery. The aneurysm compressed the patient’s pulmonary trunk, causing angina on exertion followed by right-sided heart failure three months later. CT scan confirmed a 7 cm aneurysm and surgical intervention including thrombus removal, re-grafting and pulmonary artery repair was undergone with an uneventful recovery [20].

In the next report, a patient presents with a non-ST elevation myocardial infarction and exertional dyspnea nineteen years after a CABG surgery. A CT scan and reconstructed CTA coronary showed an 8 cm in diameter SVGAn arising from the OM graft and compressing the main pulmonary artery. Surgical intervention including thrombus removal and re-grafting was successfully done [21].

The patient in the fourth reported case presented with non-resolving resting chest pain and chest radiograph revealed a mass in the middle mediastinum. Coronary angiography revealed total occlusion of the SVG to the LAD artery with an aneurysmal sac. Intraoperative contrast transesophageal echocardiography identified a large SVG aneurysm with diameters of 5.5 x 6.0 cm compressing the main pulmonary artery. The patient underwent surgical resection of the aneurysm followed by replacement of the bypass graft [22].

A fifth patient was admitted with a lower respiratory tract infection when a chest x ray incidentally suggested a large anterior mediastinal mass. Subsequent CT and cardiovascular MRI demonstrated a 10.6 x 9 cm SVGAn of the graft to the OM artery causing significant compression of the aorta and pulmonary artery. The patient was conservatively managed [23].

The last reported case is of a patient admitted for worsening chest pain. Chest X-ray revealed a left anterior mediastinal mass. Subsequent CT and cardiovascular MRI demonstrated a 10.6 x 9 cm SVGAn of the graft to the OM artery causing significant compression of the aorta and pulmonary artery. The patient was conservatively managed [23].

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have undergone CABG and present with a mediastinal mass on chest x-ray. They further suggested that SVGAs radiographically visualized in the right sternal border mainly represent SVGAs bypassing the right coronary artery and that SVGAs seen in the left upper sternal border seem to typically bypass the left anterior descending artery. Ones seen in the left lower sternal border were found to be bypassing the LAD and left circumflex artery or both [13].

In the cases of pulmonary trunk stenosis reviewed, including our own, the SVGAs causing pulmonary stenosis were predominantly visualized in the left upper sternal border on Chest X-ray. However, there was greater variance in the artery being bypassed. 2 cases SVGAs to the circumflex artery, 2 were of the OM artery, 2 of the diagonal artery including our case, and 1 was of the LAD artery.

In our case a large 5.5 cm x 5.9 cm aneurysm was seen in the SVG bypassing the diagonal artery. The aneurysm caused significant pulmonary artery trunk outflow stenosis and was significant enough to mimic the symptomatology of pulmonary thromboembolism. The absolute size of a SVGA can correlate with symptomatology and is useful in deciding a management plan. Coronary angiography can help in the diagnosis of SVGAs; however it seems to underestimate size due to the fact that most of SVGAs are filled with thrombus as was seen in our case. On the other hand, cross sectional imaging seems to provide precise estimates of the size of an aneurysm, its location, and its relation to surrounding structures making it more useful [9,21].

The patient in our case presented with shortness of breath upon exertion preoperatively. His shortness of breath progressively worsened postoperatively and this was thought to be due to further compromise of lung functions from general anesthesia and atelectasis.

Treatment options of SVG aneurysm include medical therapy with surveillance, surgical therapy, and percutaneous intervention [25]. Larger SVG aneurysms appear to benefit mainly from aggressive intervention, due to increased rates of rupture and cardiac death [10]. A conservative or interventional approach to treatment of a SVGA should be based upon the size and rate of growth in association with the patient’s health status [4].

While the optimal timing of surgery is unknown, in cases of symptomatic aneurysms, fistula formation, suspected mycotic aneurysm, urgent surgical intervention is strongly recommended. The traditional surgical approach has been ligation of the aneurysm-aneurysm, urgent surgical intervention is strongly recommended. With conservative or surgical management of the symptomatic SVG, more dire complications such as rupture can be prevented.

References
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