A 75-year-old man presented with dyspnea requiring home oxygen, on a background of partial colectomy for colon cancer, chronic renal failure, and coronary artery bypass graft surgery in 1978 (left internal mammary artery to left anterior descending graft and saphenous vein grafts [SVG] to the right coronary artery [RCA] and left circumflex artery). Clinically, he had jugular venous distension and bibasilar crepitations, without overt ascites or peripheral edema. Chest x-ray demonstrated remote postoperative changes, cardiomegaly, mild pericardial calcification, and other radiographic findings of congestive heart failure, without apparent mediastinal mass (Figure 1). However, echocardiography revealed a large (9.4×8.7 cm), apparently extracardiac, mass compressing the right ventricle with severe functional tricuspid stenosis (mean gradient, 10 mm Hg) and turbulence of forward tricuspid flow on color Doppler imaging (Figures 2A, 2B, and 3; Movie IA and IB in the online-only Data Supplement). Noncontrast cardiac MRI revealed a large (10.9×7.4×6.5 cm), relatively homogenous structure adjacent to the atroventricular groove anteriorly, which was compressing the right heart and obstructing the tricuspid valve. The mass was distinct from adipose tissue, well circumscribed by overlying pericardium, and had no invasive characteristics. Cine imaging demonstrated flow within the mass. The structure location and characteristics were consistent with a partially thrombosed SVG aneurysm (Figure 4; Movie II in the online-only Data Supplement).

Coronary angiography showed a proximally patent SVG to RCA, which terminated in a 14-mm focal aneurysm with absence of distal filling of the native RCA. Contrast was noted washing out of the aneurysm into a large, partially calcified, adjacent pseudoaneurysm (Figure 5; Movie III in the online-only Data Supplement). At surgery, a large 10-cm pseudoaneurysm, arising from an aneurysmal SVG to the RCA, was found compressing the right heart. The pseudoaneurysm was opened with removal of extensive organized thrombus (Figure 6). The proximal graft and distal native RCA were identified and both ostia were oversewn, enabling resection of the aneurysmal SVG graft (Figure 7). Redo SVG bypass was then performed. The patient made an uneventful recovery with significant improvement in his presenting symptoms.

Postoperative echocardiography demonstrated normal tricuspid valve morphology, with mild (1–2+) tricuspid regurgitation and no intrinsic valvular or residual functional stenosis (Figure 8A and 8B; Movie IVA and IVB in the online-only Data Supplement).

SVG aneurysms and pseudoaneurysms are rare and typically late complications of coronary artery bypass graft surgery. Incidence is reported at 0.07% with a mean time to presentation of 13 years.1,2 The prevalence of true aneurysms (SVG-A) is twice that of pseudoaneurysms (SVG-PA), which are typically larger.3 Chest pain is typically the reason for presentation, especially in subjects with SVG-PA, because a large proportion of subjects with SVG-A are asymptomatic and diagnosed incidentally on chest x-ray.4 Chronic aneurysm development is generally attributed to vein graft athroesclerotic degeneration, endothelial changes, or increased wall stress from arterial pressures.2 Acutely, surgical technical failure or anastomosis disruption attributable to infection can result in SVG-PA.5 As in this case, aneurysmal grafts are most commonly anastomosed to the RCA, largely related to preferential use of arterial grafts for the left coronary system.2 Complications of SVG-A/SVG-PA include compression of adjacent vascular and cardiac structures, along with rupture, embolization of mural thrombus, and fistula formation.

Accurate identification of SVG-A/SVG-PA is particularly important, given the high likelihood of symptom reversal with surgical resection. This case of giant SVG-A causing symptomatic, functional tricuspid stenosis illustrates the benefits of multimodality cardiac imaging. In particular, cardiac MRI provides tissue characterization, assessment of aneurysm dimensions, relationship with surrounding structures, patency of grafts/coronaries, and data regarding ventricular and valvular function, which may be relevant for redo cardiac surgery. Although coronary angiography remains important to determine graft patency and aneurysm location, it may underestimate SVG-A size because of intramural mural thrombus or poor appreciation of an associated SVG-PA. Surgical graft ligation and aneurysm resection with or without redo bypass surgery has been the typical treatment, especially when surrounding structures are intimately involved. However,
percutaneous intervention by using vascular plugs, covered stents, and embolization with arterial coiling now provide alternative management strategies.

Disclosures

None.

References


Figure 1. Pseudoaneurysm chest x-ray film discloses postoperative changes of remote median sternotomy and coronary artery bypass graft surgery. There is cardiomegaly with a degree of upper lobe vascular redistribution consistent with congestive heart failure and mild pericardial calcification (arrow).

Figure 2. Transesophageal echocardiography midesophageal 60° short-axis view at the level of the aortic valve. A. External compression from the SVG aneurysm (yellow arrow) is causing almost complete obstruction of the right heart at the level of the tricuspid valve, which cannot be visualized. B. On color Doppler imaging, a small jet of turbulent diastolic forward flow (white arrow) is noted across the tricuspid valve, suggestive of severe functional tricuspid stenosis. LA indicates left atrium; RA, right atrium; RVOT, right ventricular outflow tract; and SVG, saphenous vein graft.
Figure 3. Continuous wave spectral Doppler through the tricuspid valve, adjacent to the mass, confirms functional tricuspid stenosis ($V_{max}$, 203 cm/s; mean gradient, 10 mm Hg).

Figure 4. Noncontrast cardiac magnetic resonance steady-state free precession imaging in a horizontal long axis reveals the giant SVG aneurysm adjacent the atrioventricular groove anteriorly (yellow arrow). Dimensions, signal characteristics, relationship of the mass to surrounding structures, and flow within the true aneurysm (white arrow) could be demonstrated to confirm diagnosis. SVG indicates saphenous vein graft.

Figure 5. Coronary angiography demonstrated a proximally patent, aneurysmal SVG to RCA graft which terminated in a larger (14 mm) focal true aneurysm with absence of distal flow (white arrow). Contrast could be seen faintly washing into the large, partially calcified, associated pseudoaneurysm (yellow arrow). RCA indicates right coronary artery; and SVG, saphenous vein graft.

Figure 6. Overlying pericardium was resected (arrow) and the pseudoaneurysm opened to enable removal of extensive organized thrombus.
Figure 7. The proximal graft and distal native RCA were identified (arrows) and oversewn to enable complete resection of the true SVG aneurysm. RCA indicates right coronary artery; and SVG, saphenous vein graft.

Figure 8. Postoperative transesophageal echocardiography midesophageal 0° 4-chamber view. A, On 2-dimensional imaging, the tricuspid valve is morphologically normal, with normal diastolic leaflet excursion and no residual valvular or functional stenosis (*). B, On color Doppler imaging, mild (1–2+) regurgitation is noted during systole (white arrow). LA indicates left atrium; LV, left ventricle; RA, right atrium; and RV, right ventricle.
Severe Functional Tricuspid Stenosis Secondary to a Giant Saphenous Vein Bypass Graft Aneurysm
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