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CASE REPORT
Coronary intervention

Percutaneous closure of giant saphenous vein graft aneurysm

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Background Aneurysmal dilatation of saphenous vein grafts used for coronary artery bypass grafting is a rare complication. These aneurysms are often large in calibre and pose a risk of rupture with significant haemorrhage.

Case summary We describe a case whereby a large saphenous vein graft aneurysm is closed percutaneously using a vascular plug to cease flow and promote thrombosis of the aneurysm whilst reconstructing the occluded native artery to negate ischaemia.

Conclusion Saphenous vein graft aneurysms following coronary artery bypass graft are rare and late complications. The preferred modality of closure is via percutaneous approach that requires meticulous planning to achieve a good outcome.

Keywords Coronary artery disease • Percutaneous coronary intervention • Coronary artery bypass graft • Coronary aneurysm • saphenous vein graft • Complications • Closure device • Vascular plug • Case report

ESC curriculum 3.1 Coronary artery disease • 3.4 Coronary angiography • 7.5 Cardiac surgery • 7.4 Percutaneous cardiovascular post-procedure • 2.4 Cardiac computed tomography

Learning points

- Saphenous vein graft aneurysms are rare and late complication following coronary artery bypass surgery.
- The main concern is compression of adjacent structures or rupture and catastrophic bleeding
- Percutaneous occlusion with vascular plugs or coils may be the preferred option particularly in high-risk surgical patients.
- Meticulous and careful planning and execution is paramount in avoiding complications and achieving a favourable outcome.

Introduction

Saphenous vein graft (SVG) aneurysms are a rare complication of coronary artery bypass grafting (CABG). They often present late in degenerative old vein grafts.[1] They are typically identified as an incidental finding or in patients presenting as a consequence of complications relating to the aneurysm itself. Management of these aneurysms can be quite difficult with redo surgery particularly when challenged with retrosternal fibrosis and adhesions. A percutaneous approach to SVG aneurysm closure is a less invasive option but requires meticulous planning and technical finesse to avoid complications and rupturing the diseased degenerative aneurysm.

Summary figure

We report a case of a large SVG aneurysm closed percutaneously and identify the key procedural steps taken to minimize risk of complication.

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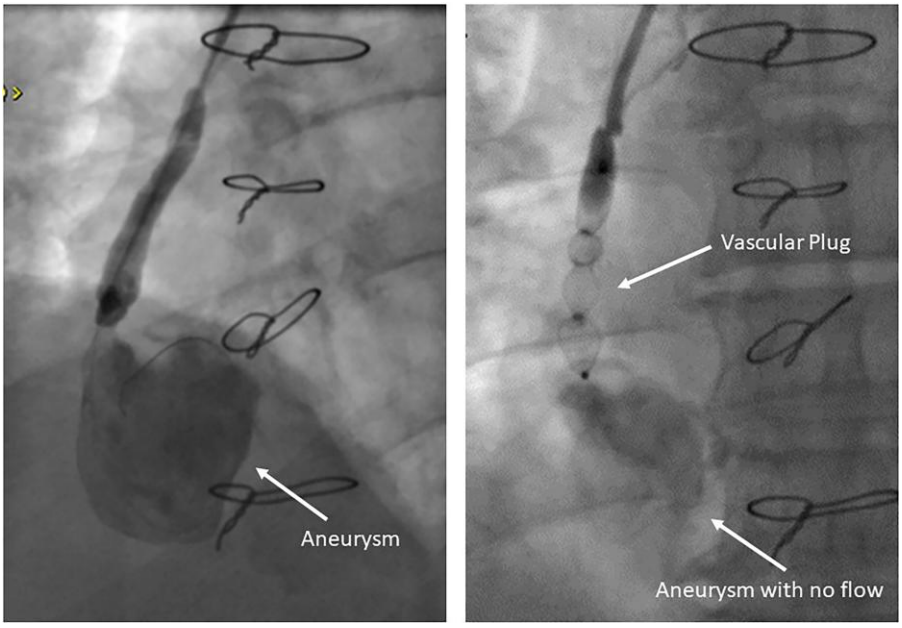


Case presentation

A 74-year-old male with previous CABG, 23 years previously presented to a neighbouring hospital emergency department with chest pain. He had a history of atrial fibrillation, hypertension, anaemia, and chronic kidney disease. Whilst in the emergency department, the patient had a witnessed collapse with pulseless electrical activity arrest with subsequent inferior ST elevation on electrocardiogram. He was taken for emergency primary percutaneous coronary intervention (PPCI).

Coronary angiography demonstrated an occluded and aneurysmal SVG to the right coronary artery (RCA) and a chronically occluded native RCA (see Supplementary material online, *Video 1*). A brief attempt at PCI was unsuccessful in wiring the graft through the aneurysm. He was subsequently treated medically with tirofiban and discharged, with a view to native vessel reconstruction if viable myocardium. The patient represented to the hospital again with increasing shortness of breath and peripheral oedema, which was treated and resolved with diuretics.

A cardiac gated computed tomography (CT) scan was performed and identified the neck and the size of the aneurysm that was 59 × 47.4 mm

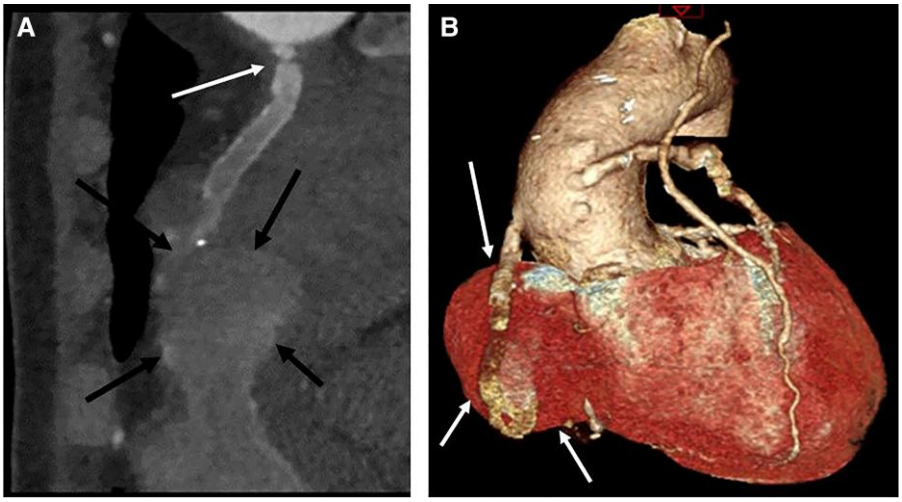


Figure 1 (*A*) Cardiac computed tomography showing calcified, diseased saphenous vein graft with critical proximal stenosis (white arrow). Large calibre distal aneurysm measuring 5.9 cm in maximal diameter (black arrows). Thrombosed with no contrast enhancement of distal right coronary artery. (*B*) 3D reconstruction showing exact size and location of large saphenous vein graft aneurysm.

causing compression of the right atrium and the extensive disease in the proximal graft (*Figure 1*). He was referred to our centre and was discussed at the multi-disciplinary team meeting. Given his high surgical risk (EuroSCORE II mortality of 22.68%), he was accepted for percutaneous closure of the diseased graft and aneurysm and recanalization of the occluded RCA. A decision based on the fact that the MRI demonstrated viable myocardium in the RCA territories and also delineated the large, partially thrombosed SVG aneurysm compressing the right atrium (*Figure 2*).

Figure 2 Cardiac magnetic resonance imaging demonstrating large partially thrombosed saphenous vein graft aneurysm to the right coronary artery (white arrow).

Dual arterial access system was obtained from the right radial artery (7Fr) and right common femoral artery (8Fr) sheaths. The SVG graft had a severe narrowing at its proximal/ostial part and was wired with a Pilot 200 and its ostium pre-dilated with a 4.0 mm non-compliant balloon to facilitate passage of equipment (*Figure 3A*) (see Supplementary material online, *Videos 1,2 and 3*).

A workhorse wire was advanced into the aneurysm and an 8Fr guide catheter extension passed deeply into the SVG just before the mouth of the aneurysm (*Figure 3B*). This was to provide sufficient support to advance the closure device whilst not engaging the friable aneurysm. The wire was removed and an Amplatzer Vascular Plug II® advanced into the SVG (see Supplementary material online, *Video 4*). Contrast was used to confirm the position within the SVG prohibiting any residual flow (see Supplementary material online, *Video 5*). The vascular plug was then disengaged from the delivery system, leaving it behind, occluding the SVG antegrade flow (*Figure 3C*) (see Supplementary material online, *Videos 6 and 7*). The native RCA (see Supplementary material online, *Video 8*) was then reconstructed with rotational atherectomy to modify the calcium and subsequently stented with excellent final results (*Figure 4*) (see Supplementary material online, *Video 9*).

He remained symptom free on follow up, so no repeat imaging was undertaken.

Discussion

Saphenous vein graft aneurysms are a rare complication of CABG. Although aneurysms are technically defined as enlargement of the vessel by 1.5 times its original diameter, SVG aneurysms tend to be much larger.[1,2] The incidence of SVG aneurysms has been reported to be approximately 0.07%; however, the majority of SVG aneurysms are asymptomatic, and thus, the true incidence of them is likely to be underestimated, with many being diagnosed as an incidental finding.[3]

Complications from SVG aneurysms are caused from the compressive effects of the large aneurysm or from perforation which is typically fatal causing catastrophic haemorrhage into the thoracic cavity.[1,4,5] Cardiac CT is the imaging modality of choice to identify, size, and describe the position of the aneurysm although they can be identified less specifically on other imaging modalities including echocardiography and chest radiography where they

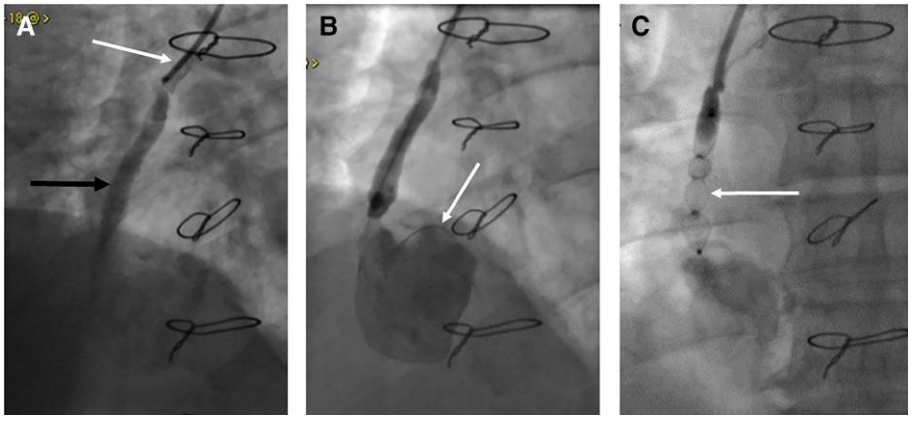


Figure 3 (*A*) Multipurpose guide catheter (white arrow) engaging the degenerative SVG to right coronary artery (black arrow). (*B*) Workhorse wire in saphenous vein graft aneurysm (white arrow) with deeply engaged guide catheter extension. (*C*) Deployed Amplatzer Vascular Plug occluding antegrade flow into saphenous vein graft aneurysm (white arrow).

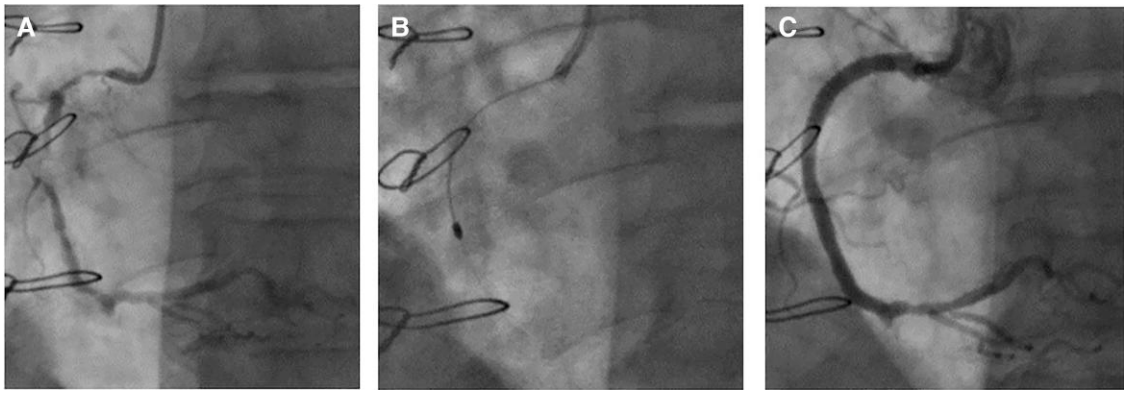


Figure 4 (*A*) Native right coronary artery with severe calcific disease. (*B*) Calcium modification with rotational atherectomy. (*C*) Final result after reconstruction with overlapping drug eluting stents.

present as a mediastinal mass.[6] There are no guidelines or randomized trials to support the closure or method of closure of these aneurysms.

It is widely accepted that giant SVG aneurysms, as in this case, carry a significant risk of rupture and morbidity if left untreated. It is also intuitive that, given the frailty and co-morbid state of many of these patients, the least invasive strategy to treat them may be the preferred one. However, if other concomitant cardiac procedures are required, then the patient may benefit from a redo cardiac surgery.

Coiling, stenting, or plugging such aneurysms percutaneously are preferred over redo surgery to excise the graft.[7–9] If coils are used, then multiple coils have to be used to obliterate the aneurysm cavity completely.[9]

Planning the procedure is important for success and in avoiding complications with multiple points to be considered. We elected to proceed with plugging the vein graft first as opposed to recannalizing the native artery as there was no antegrade flow distal to the aneurysm which meant there would be no acute ischaemia after deploying the plug and occluding the graft. On occasions and when there is a concern of triggering ischaemia, balloon occlusion of the graft may show ischaemia and lead to performing the treatment to the native vessel before occluding the vein graft.

The vascular plug use requires a single plug that is usually sized 1.3–1.5× the diameter of the intended vessel to be occluded. Given the widespread disease in the vein graft as well as the size of the plug, a single plug was used to occlude the graft rather than deploying it in the aneurysm or using coils in the aneurysm itself.

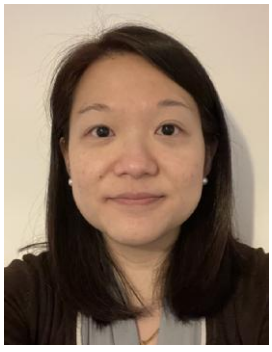
A single plug is adequate as it promotes thrombosis and total occlusion which negates the need for using more than one plug at the inflow and outflow, particularly as in this case, there was no distal flow in the vein graft. The presence of thrombosis in the graft promotes quicker occlusion enhancing the thrombotic occlusion.

No large case series exist on the safety or efficacy of this, but in this case, we describe the technical approach and procedural planning necessary for a successful procedure. Once blood flow into the aneurysm has stopped, the vein graft and the aneurysm thrombose shrink in size and no longer pose a risk of rupture and haemorrhage.

Conclusion

Saphenous vein graft aneurysms are a rare late complication of degenerative vein grafts. In selected patients, percutaneous closure of these aneurysms may be the preferred option using vascular plugs or coils. Proper meticulous planning is important in achieving a good outcome and avoiding unwanted complications.

Lead author biography



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Supplementary material

Supplementary material is available at *European Heart Journal–Case Reports* online.

Consent: Consent had been obtained from the patient to report and publish the images of their coronary anatomy and cardiac scans in this case report in accordance with COPE guidelines.

Conflict of interest: None declared.

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Data availability

No new data were generated or analysed in support of this research.

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