Closure of a Vein Graft Aneurysm, Complicated by an Acute Coronary Syndrome and Cardiogenic Shock

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October 25, 2021

Abstract

Saphenous vein graft (SVG) aneurysms are rare complications after coronary artery bypass grafting which may lead to major complications. We report a patient with SVG aneurysm, it's treatment by percutaneous intervention using peripheral vascular plug. Procedure was complicated by an ACS of unclear cause, which was urgently diagnosed and treated.

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Brief title: Vein Graft Aneurysm Closure Complicated by ACS

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All authors do not have any conflicts of interest.

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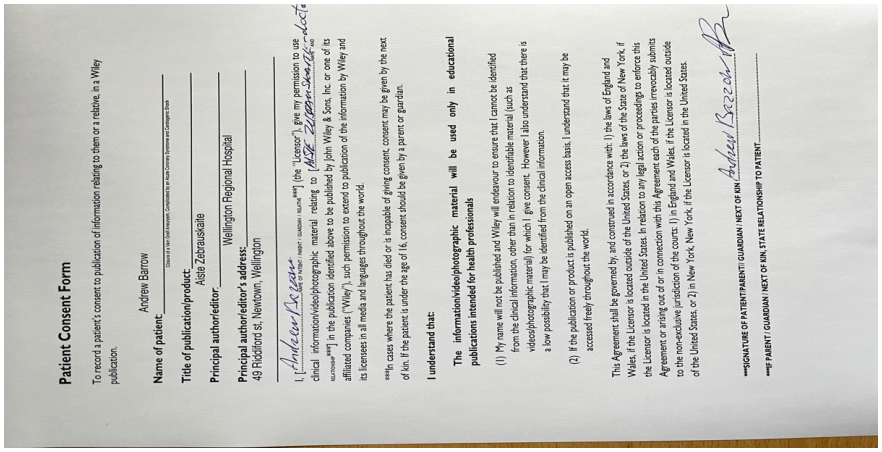

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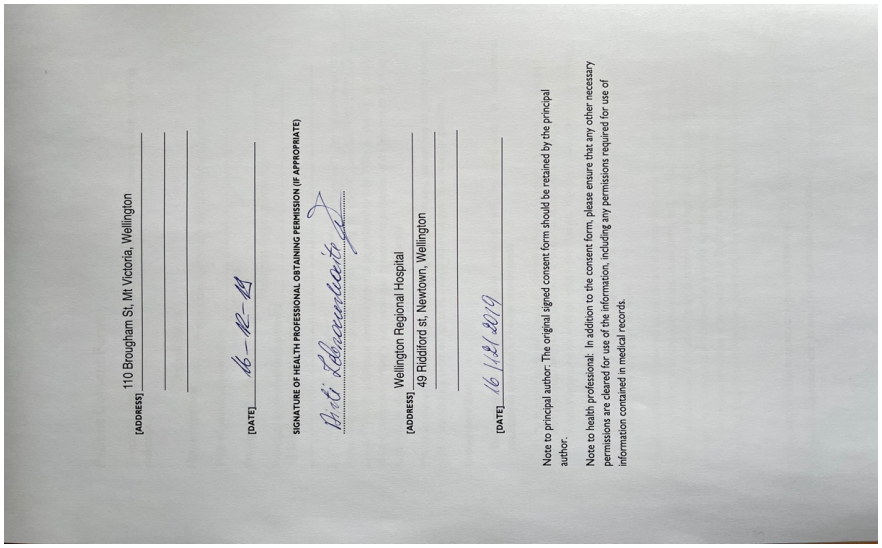

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Abstract

Saphenous vein graft (SVG) aneurysms are rare complications after coronary artery bypass grafting which may lead to major complications.

We report a patient with SVG aneurysm, it's treatment by percutaneous intervention using peripheral vascular plug. Procedure was complicated by an ACS of unclear cause, which was urgently diagnosed and treated.

Case report

A 79 year old male presented to Emergency Department with acute progressing breathlessness and chest pain for the last 3 days.

The patient had coronary artery bypass grafting (CABG) 22 years ago. He has been having stabile angina symptoms after CABG, nor repeated coronary angiograms or percutaneous revascularisation procedures performed.

Patient had diagnosed saphenous vein graft (SVG) aneurysm. Chest roentgenograms performed between 2014 and 2019 revealed an enlarging mass projected over the left hilum. To clarify the enlarging mass, chest Computer Tomography (CT) performed in 2019. It revealed that a heterogeneous mass is a SVG to OM1 aneurysm, 64x49x60mm size with possible thrombus. A mass effect on the Pulmonary Artery (PA) was reported (Figure1). Patient was asymptomatic, conservative management was recommended. Patient was on long term oral anticoagulation due to the permanent atrial fibrillation. Follow up with repeated CT scan recommended.

Initial investigation performed in Emergency Department. Troponin T repeated two times was negative, no new acute changes on ECG. Patient was admitted to Cardiology department for further investigations.

Repeated CT scan showed that SVG aneurysm size increased by 1-2mm, still possible thrombus in-situ. Was not possible to asses if there is any flow to the distal SVG segment.

Coronary angiography demonstrated a 40% mid LAD lesion, Cx occlusion and 70% proximal RCA disease. The LIMA to the LAD and the PDA graft were occluded. The mid Cx graft had a large aneurysm with no flow visible distal to this (Figure2). Percutaneous occlusion of the vein graft and PCI to the RCA was planned.

IVUS was used to size the ectatic proximal SVG (Figure3). A 12mm Amplatzer Vascular Plug II was selected as the closure device (CD). The combination of the acute angulation into the SVG and the short length (90cm) of the CD delivery system created considerable challenges. Eventually, an innovative telescoping system allowed successful delivery of the CD (Figure2).

As the femoral sheath was about to be removed the patient became profoundly hypotensive and bradycardic. Differential diagnosis included: vasovagal episode, bleeding, ischaemia or tamponade. This failed to respond to atropine and fluid. Adrenaline was therefore given with restoration of blood pressure. The patient then developed increasing chest pain and recurrent hypotension. An LVEDP was 12 mmHg. An echocardiogram demonstrated extensive inferior hypokinesis. Angiography demonstrated thrombotic occlusion of the RCA which was treated with PCI (Figure4) with subsequent recovery.

The patient had a follow up visit 3 months after interventional management. He remains asymptomatic.

Learning points include: Differential diagnosis of SVG aneurysm. Percutaneous approach using peripheral vascular plug for SVG aneurysm closure. Use of an innovative system to allow delivery of the CD and the assessment and management of cardiogenic shock.

Discussion

SVG are defined as a permanent localized dilatation of >3 cm in diameter. They are rare complications of CABG, predominantly occur late, 10-20 years after surgery at an estimated rate >1% (1). However the true rate is not known, because majority of patients are asymptomatic and aneurysms are not diagnosed (2). Most aneurysms are usually presenting as mediastinal masses on chest radiography or thoracic CT performed for unrelated causes.

The majority of patients are asymptomatic and does not require any treatment. Symptomatic patients usually present with non-specific symptoms, that makes a differential diagnosis challenging. For the majority of symptomatic patients, the first presentation appears as ACS or congestive heart failure symptoms (1). Myocardial ischemia may occur due to distal embolization, thrombosis, fistula drainage with coronary steal, or mass effect on the native vessel (3). Other uncommon presentations include fistulas into the right atrium, right ventricle, pulmonary artery, or bronchi. The rupture of the aneurysm can be lethal and diagnosed only during autopsy (4). The mass effect always correlates to the size of aneurysm. This case report reflects classical SVG aneurysm presentation. It was an accidental finding, the patient was asymptomatic for a number of years and presented acutely with atypical ACS symptoms.

Diagnostic modalities include chest X-ray, echocardiography, thorax CT (contrast enhanced), magnetic resonance imaging angiography, and coronary angiography. Coronary angiography remains a gold standard to confirm diagnosis before planning a further treatment strategy. In this case we faced the real challenge, due to the size of aneurysm none of diagnostic tests could assess the flow in the distal SVG segment. Selective contrast injections on coronary angiogram showed a slow turbulent flow in the first third of the SVG. It was not clear if there is any flow to the OM branch. We discussed a possibility to perform a CT coronary angiogram, however slow contrast flow is not favorable for distal SVG imaging. The patient was asymptomatic for a long time, there were no new ischaemic changes on echocardiogram imaging, we presumed that there is no significant flow to the distal SVG segment and OM territory. The mass effect to PA was the dominant problem. It was decided that SVG aneurysm closure should be performed at the first instance.

According to the fact that SVG aneurysm is a rare complication, there is no clear consensus on appropriate management. It is suggested that either surgical aneurysm repair or percutaneous management can be considered (1). Percutaneous approaches include covered stent grafting (5,6), coil embolization (7), vascular plug insertion (8), and alcohol injection to the graft (9). Giving into account patient's age, the fact that there were no proved distal flow through the graft, percutaneous closure approach was favorable. IVUS was used to perform accurate measurements of SVG aneurysm before choosing the exact size of vascular plug. Due to the large size of aneurysm, peripheral vascular plug was chosen. The peripheral closure device delivery to the SVG was challenging procedure, requiring to construct an innovative telescopic system which was long

enough for the device delivery.

The patient developed an ACS after the SVG aneurysm closure. It raised the important question, if the SVG was supplying the OM branch, and SVG closure caused acute ischaemia. Finally, using Echocardiography and coronary angiogram technique, we identified the cause of patient's instability. Complication was treated without any residual myocardial damage.

Conclusions

SVG aneurysm is a rare condition, some complications may be lethal. We presented the case which reflects typical presentation and diagnostic pathway. It is important to understand possible percutaneous approaches of aneurysm closure. Intravascular imaging gives valuable information for choosing the CD size and type. Fast differential diagnosing and management of complications in the cath lab critically important. Fast problem resolving affects less residual myocardial damage.

References

1. Ramirez F D, Hibbert B, Simard T, et al. Natural history and management of aortocoronary saphenous vein graft aneurysms: a systematic review of published cases. Circulation. 2012;126(18):2248–2256.
2. Dieter RS, Patel AK, Yandow D, et al. Conservative vs. invasive treatment of aortocoronary saphenous vein graft aneurysms: Treatment algorithm based upon a large series, Cardiovasc Surg, 2003;11:507–13.
3. Schamroth CL, Sacks AD. Aortocoronary saphenous vein bypass aneurysm—an unusual presentation, SAMJ S Afr Med J, 1998;88(Suppl 2):C91–3.
4. Taguchi E, Sawamura T, Kamio T, et al., An autopsy case of the rupture of a giant aneurysm in a saphenous vein graft: 18 years after CABG. J Cardiol Cases. 2010; *2* :e88–e91.
5. Bhindi R, Newton J, Westaby S, Wilson N, Ormerod OJ, Uberoj R. Stent-graft repair of coronary vein graft aneurysm. J Vasc Interv Radiol. 2009;20(5):649–51.
6. Rahim SA, Pitta SR, Rihal CS. Saphenous vein graft pseudoaneurysm. J Am Coll Cardiol. 2009;53(20):1918.
7. Maroo A, Rasmussen PA, Masaryk TJ, Ellis SG, Lincoff AM, Kapadia S. Stent-assisted detachable coil embolization of pseudoaneurysms in the coronary circulation. Catheter Cardiovasc Interv. 2006;68(3):409–15.
8. Mylonas I, Sakata Y, Salinger MH, Feldman T. Successful closure of a giant true saphenous vein graft aneurysm using the Amplatzer vascular plug. Catheter Cardiovasc Interv. 2006;67(4):611–6.
9. Sonnenberg B, Rutledge J, Welsh RC. Occlusion of a large expanding saphenous vein bypass graft aneurysm with percutaneously injected ethylene-vinyl alcohol copolymer. JACC Cardiovasc Interv. 2010;3(10):1089–90.

Figures

Figure1. SVG aneurysm on CT scan (red arrow)

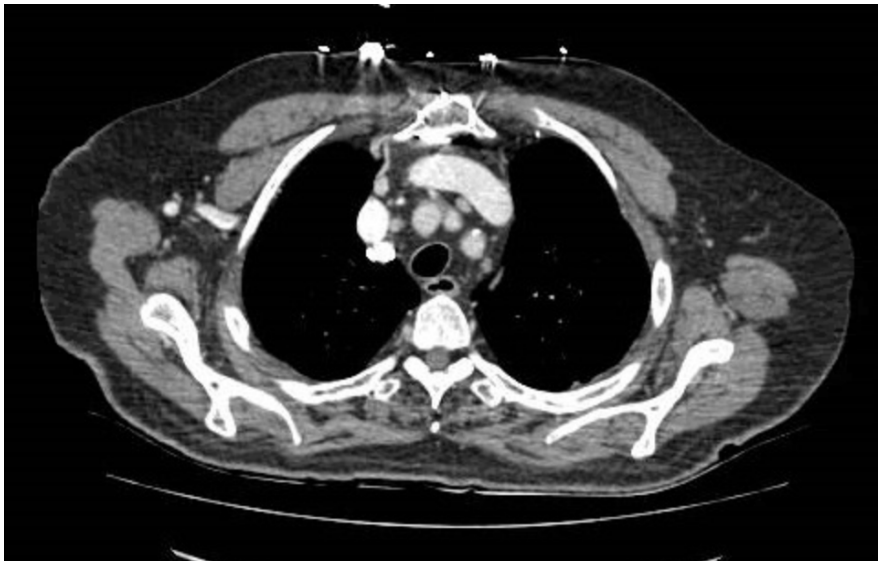
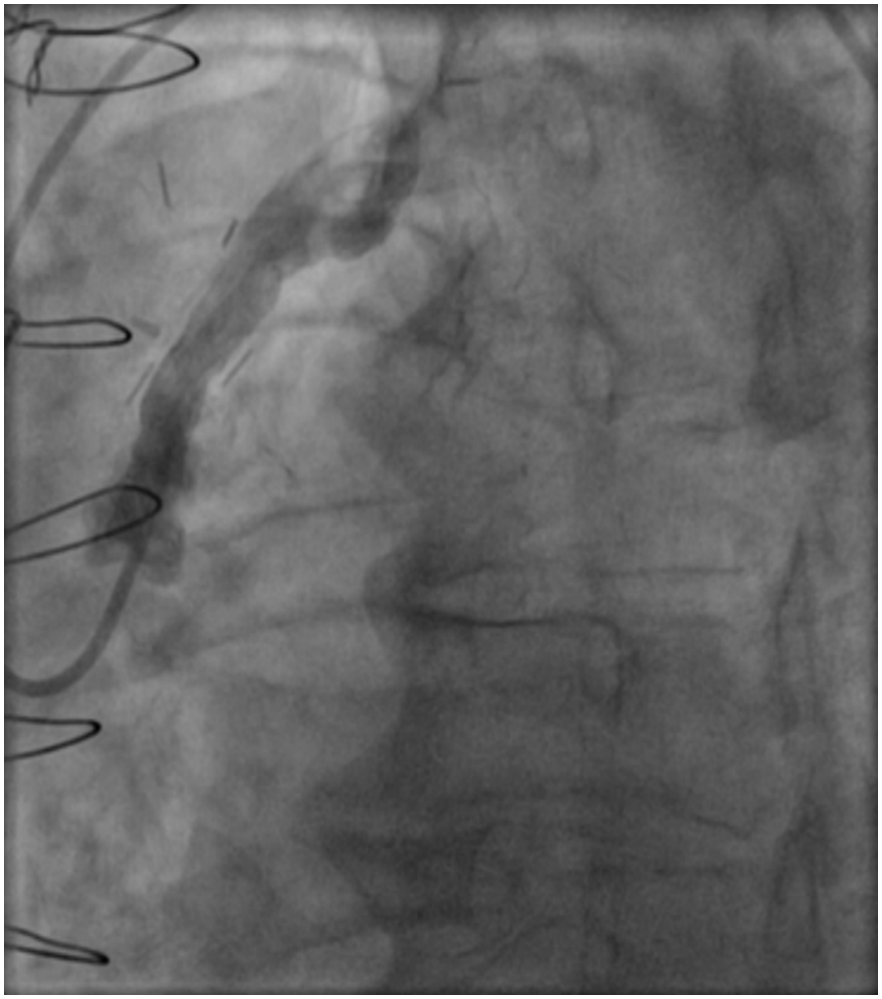


Figure2. SVG aneurysm aneurysm on angiogram. A – SVG aneurysm before closing. B – SVG aneurysm after closing with peripheral closure device.



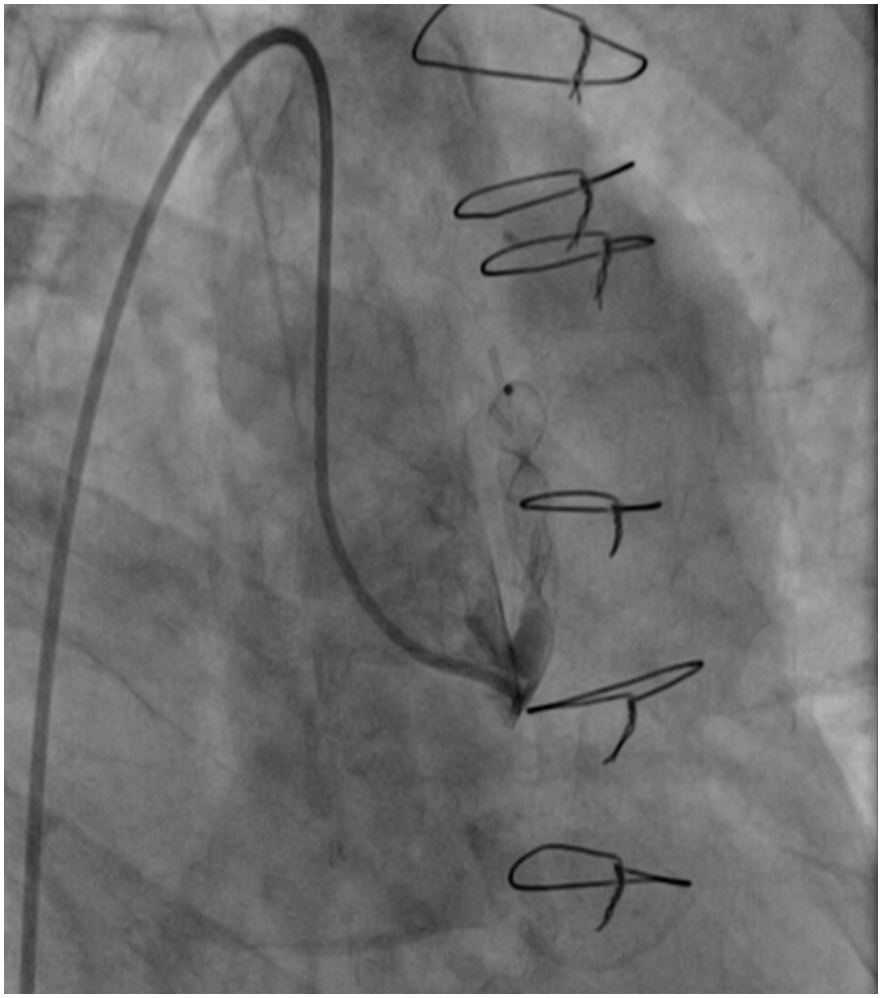


Figure3.

IVUS run for SVG aneurysm sizing.

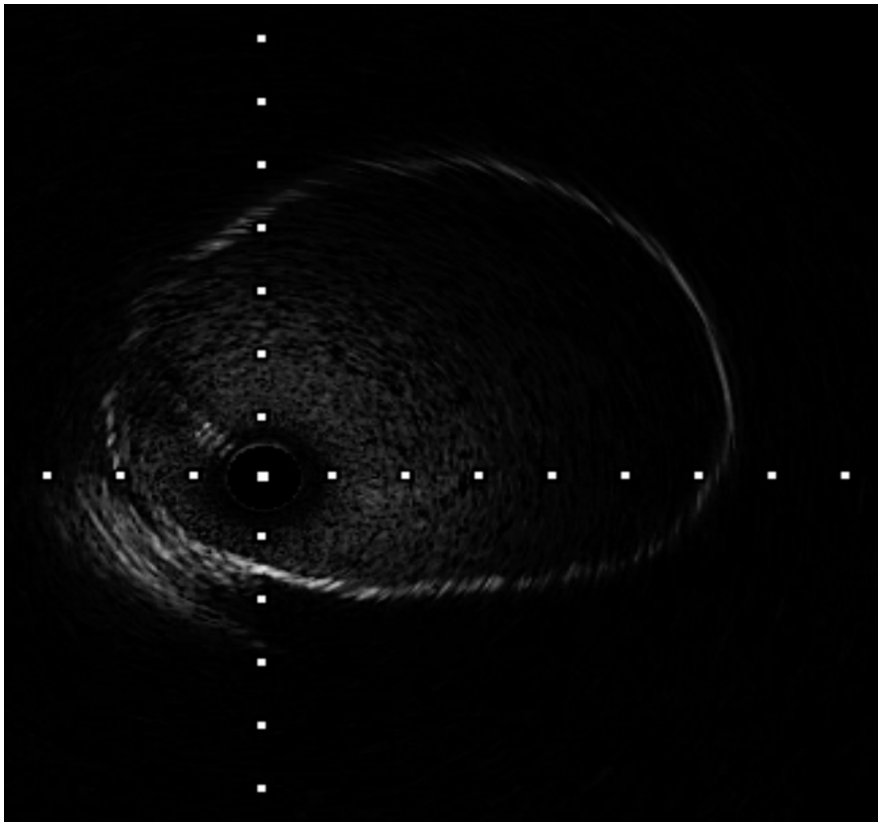


Figure4.

A – Thrombotic subboclusion of proximal RCA. B – RCA after successful PCI.