

Case report: asymptomatic pseudoaneurysm of the native coronary soon after the graft anastomosis treated with off-pump repair

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Background	Pseudoaneurysms (PSAs) of native coronary arteries are rare but potentially lethal complications occurring after coronary artery graft anastomosis mainly secondary to median sternotomy.
Case summary	A 61-year-old man underwent coronary artery bypass grafting because of stable angina. After the surgery, the patient was asymptomatic. A routine pre-discharge transthoracic echocardiogram was performed showing a haematoma of the apex partially involving the right ventricle with systolic colour Doppler flow going from the left ventricle to the pericardium. A coronary computed tomography scan was ordered and it revealed the presence of a PSA of the left anterior descending (LAD) artery distal to the graft anastomosis with the left internal mammary artery. An off-pump direct suture of the LAD injury through a redo sternotomy was successfully performed.
Discussion	The development of a PSA of a native coronary artery after bypass grafting is a very rare and potentially fatal condition. A correct and prompt diagnosis is crucial to avoid lethal complication.
Keywords	Pseudoaneurysm • Coronary native artery • Bypass grafting • Post-sternotomy • Case report
ESC Curriculum	2.2 Echocardiography • 2.4 Cardiac computed tomography

Learning points

- In the setting of coronary artery bypass grafting, a pseudoaneurysm (PSA) of the anastomotic site is a rare complication that could remain undetected.
- The use of multimodality imaging [echocardiography, computed tomography (CT) scan, coronary CT] is of paramount importance to obtain a correct diagnosis and to plan the prompt intervention for the PSA, depending on its positioning and vessel diameter.
- An off-pump repair is a possible option if a percutaneous approach is excluded.
- When choosing the best location for anastomosis at visual inspection, small, calcified and tortuous vessels should be avoided to reduce the risk of PSA formation.

Introduction

Pseudoaneurysms (PSAs) of the anastomotic site of the native coronary arteries close to the distal part of the anastomosis of the bypass

grafting are an unusual event after cardiac surgery. The natural course and optimal management of coronary PSAs is unknown.¹ If not diagnosed PSAs might be lethal, progressively increasing in size. Although no standard treatment recommendations exist,² treatment options

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include percutaneous coronary intervention (PCI) with a covered stent, drug-eluting stent, coil embolization, coronary artery bypass grafting (CABG) with isolation of the PSA, or medical management with vigilant clinical follow-up.³ In this case, a surgical approach with off-pump repair represented the only option of treatment.

Timeline

- 22 April 2021: a 61 years old gentleman symptomatic for angina had multivessel coronary artery disease at the coronary angiography.
- 3 May 2021: coronary artery bypass graft was performed including *in situ* skeletonized left internal mammary artery (LIMA) to the left anterior descending (LAD) coronary, saphenous vein graft to-obtuse marginal coronary, and sequential to posterior interventricular artery, saphenous vein separate graft to second diagonal was performed.
- 12 May 2021: a routine pre-discharge transthoracic echocardiogram showed a haematoma partially organized at the level of the apex partially extended to right ventricle.
- 17 May 2021: computed tomography (CT) confirmed the presence of a haematoma.
- 19 May 2021: coronary CT showed the presence of a pseudoaneurysm of the LAD soon after the distal anastomotic site of the LIMA.
- 24 May 2021: percutaneous coronary intervention approach failed.
- 31 May 2021: successful off-pump 7-0 monophylic direct suture of the LAD injury through redo sternotomy approach
- 15 June 2021: the patient was discharged home asymptomatic

Case presentation

A 61-year-old male developed stable angina in the last 6 months. He had history of coronary artery disease treated with multiple PCIs in triple vessel coronary artery disease, hypertension, and dyslipidaemia. He was treated with antiplatelet therapy (aspirin 100 mg), bisoprolol 2.5 mg b.i.d., ramipril 5 mg b.i.d., and atorvastatin 80 mg/die. A coronary angiography revealed multivessel disease with critical stenosis of proximal left anterior descending (LAD) artery and right coronary artery. Due to a SYNTAX score of 22, after multidisciplinary team discussion, the patient was addressed to surgical revascularization with *in situ* skeletonized left internal mammary artery (LIMA) graft to LAD, saphenous vein graft (SVG) to posterior descending artery, and sequential to first obtuse marginal coronary (OM1), SVG separated to second diagonal branch (D2). The post-operative was uneventful and the patient remained asymptomatic. A routine pre-discharge echocardiogram was performed 10 days after CABG. It showed the presence of a haematoma of the apex measuring up to 2 cm in diameter and partially extended to the right ventricle with no signs of tamponade (Figure 1, Video 1). On colour Doppler, a systolic flow from the lateral wall into a hypoechoic area next to a pericardial effusion was seen. Physical examination was normal (Figure 1, Video 1). Firstly, a computed tomography (CT) scan was performed confirming the presence of a haematoma of the left ventricle then, a coronary CT confirmed the

presence of a PSA of the LAD close to the distal part of the anastomosis with LIMA due to a laceration of the native coronary (Figure 2). After consultation between cardiologists and cardiac surgery, a first approach with PCI with a covered stent was chosen (Video 2).

However, the intervention failed because of the small size of the LAD at the level of the PSA, not suitable for covered-stent treatment. Therefore, the patient underwent an off-pump repair through redo sternotomy approach. At the inspection in the operating room, the PSA of LAD was seen close to the distal part of the graft anastomosis. There was a laceration of the vessel but the adventitia appeared intact, no blood was found in the pericardium, excluding the large haematoma probably formed at the level of the anastomosis (Figure 3). A direct suture of the laceration of LAD was performed. The post-operative course was uneventful and the patient was extubated at Day 0. After 2 weeks, the patient was discharged still asymptomatic, the pre-discharge echocardiography was negative.

Discussion

Coronary PSA is considered a false aneurysm because of the lack at least one of the three layers (intima, media, and adventitia) of the arterial wall with the disruption of the external elastic membrane.²

They usually occur after traumatic coronary dissection or perforation after PCI.^{4,5} Their occurrence after cardiac surgery is unknown because they often are incidental findings and their natural history is not well described. At the state of the art, there are only few reports about the development of PSA after coronary artery bypass and usually, they are described as affecting the SVG.^{6,7} The novelty of this case report is related to the unusual position for a PSA formation, involving the anastomosis between LAD and LIMA. Usually, this complication is asymptomatic as in our case report.

A coronary PSA is defined as a focal dilation of more than 1.5 time of the proximal vessel diameter. The diagnosis generally involves different imaging modalities. Coronary angiography can detect PSAs by visualizing an outward bulging of the lumen of the vessel. The presence of a narrow neck which communicates with the true lumen is a typical finding in PSAs.⁸ While the coronary angiography shows the lumen only, coronary CT detects a clear definition of the wall of the PSAs giving the confirmation of the diagnosis.⁹

Factors claimed to be related to PSA formation are related to hypertension, trauma to the graft, weakness of a branch, atherosclerotic changes, or calcification of the vessel, mycotic vasculitis, dissection of the graft,¹⁰ or infection. Moreover, proximal site anastomosis are under higher pressure than the distal site and are therefore predisposed to a higher incidence of PSA formation.⁶ Distal site PSA are mainly due to operative factors such as suture line breakdown secondary to tension on the anastomosis.⁶ In case of the development of PSAs after cardiac surgery, usually the presence of pericardial adherence represents a sort of protective factor from cardiac tamponade.¹¹ In this case report, the supposed mechanism for the occurrence of the laceration of the LAD during surgery might be related to the small vessel size in distal LAD, as well as related to the intrinsic characteristics of the arterial external tunica¹² and the presence of the haematoma in pericardium might be indicative of tension on the anastomosis. These two characteristics could represent the promoting factors of iatrogenic injuries during vessel preparation for



Figure 1 Pseudoaneurysm at the transthoracic echocardiography. Apical view showing a hypoechoic sac indicated with a yellow arrow, the pseudoaneurysm, and an isoechoic area around the pseudoaneurysm indicated by a yellow asterisk, the haematoma surrounded by pericardial effusion.

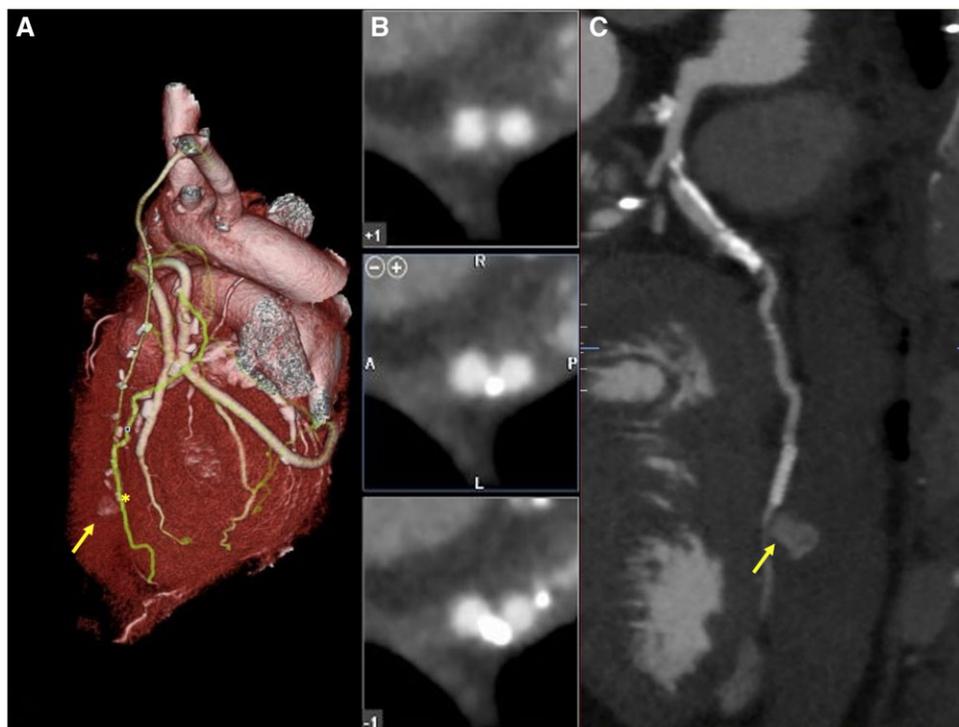


Figure 2 Coronary computed tomography with three-dimensional reconstruction. In Panel A, the yellow arrow marks the pseudoaneurysm. In Panel B, the central bi-dimensional cut-plane is at the level of the yellow asterisk, the other two panes of cut-plane are 1 cm above and 1 cm below the asterisks. In Panel C, it is showed the bidimensional reconstruction of the bypass graft with pseudoaneurysm of the left anterior descending artery close to the distal part of arterial graft anastomosis (yellow arrow).

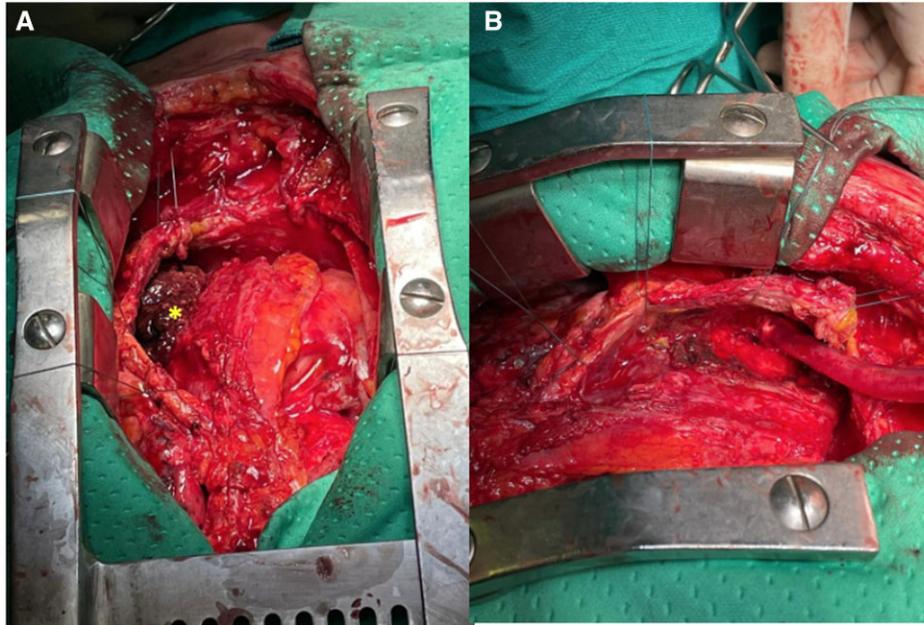
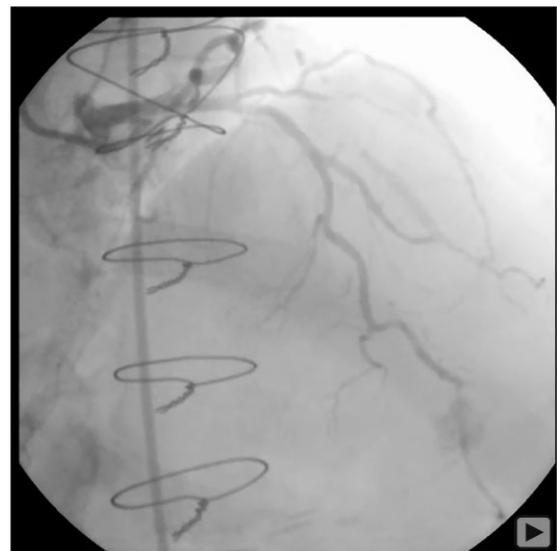


Figure 3 Intraoperative images. The intraoperative view at the pericardium opening, no blood is present in pericardium. *Haematoma.



Video 1 Zoomed four-chamber view showing the haematoma of the apex partially involving the right ventricle with a systolic colour Doppler flow going from the left ventricle to the pericardium.



Video 2 Left coronary injection showing a significant pseudoaneurysm close to the left anterior descending coronary artery anastomosis.

the anastomosis.¹³ Of course, the right choice of the best point for the anastomosis depend on visual inspection of the vessel, trying to avoid the exposition of too many sites of the coronary artery not used for the anastomosis.

In the case described the laceration remained undetected for more than 1 week and it was suspected only after pre-discharge transthoracic echocardiogram. Although the patient remained asymptomatic without haemodynamic instability treatment was recommended because of the potential risk of late rupture.¹⁴ Certainly, drawing up protocols with standard timing for post-surgery echocardiographic control, not only before discharge, could allow an earlier

diagnosis of any complications even in the asymptomatic patient. Treatment options include PCI with coil embolization,¹⁵ covered stent,¹⁶ and medical management with close observation and possible treatment with beta-blockers, calcium channel blockers, long acting nitrates, and antiplatelet or anticoagulants.³ In case of failure of the percutaneous approach cardiac surgery might be chosen. An off-

pump repair strategy was chosen, avoiding the repetition of another extracorporeal circulation. The post-operative period was completely uneventful. In conclusion, the case reveals the importance of being aware of PSA of native coronary after cardiac surgery that could be undetected, and that in such event a multimodality imaging approach is recommended to plan the correct strategy of treatment.

Lead author biography



Sara Ruggerini is consultant cardiologist at Salus Hospital of Reggio Emilia. Her field of interest is valvular heart diseases; she mainly works in the echocardiographic laboratory and in peri-operative transoesophageal echocardiography. She is a member of several scientific societies Italian Society of Cardiology (SIC); European Society of Cardiology (ESC).

Supplementary material

[Supplementary material](#) is available at *European Heart Journal - Case Reports* online.

Slide sets: A fully edited slide set detailing this case and suitable for local presentation is available online as [Supplementary data](#).

Consent: The authors confirm that written consent for submission and publication of this case report including images and associated text has been obtained from the patient in line with COPE guidance.

Conflict of interest: None declared.

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