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CASE REPORT
Coronary heart disease

Late spontaneous internal thoracic artery graft dissection after coronary bypass grafting: a case report

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Background Internal thoracic artery (ITA) grafts are commonly used for coronary artery bypass grafting, with dissection to the graft being a rare occurrence. Herein, we describe a case of spontaneous ITA graft dissection occurring 11 years after grafting, with no clear precipitating incidence.

Case summary The patient was a 61-year-old man who presented with a 3-month history of chest pain and dyspnoea. Dissection of the left internal thoracic artery (LITA) graft was observed on angiography, with a thrombolysis in the myocardial infarction (TIMI) grade 2 blood flow. Intravascular ultrasound confirmed an intimal tear in the proximal graft, with an intramural haematoma. In the absence of atherosclerotic changes, the dissection was treated directly using multiple drug-eluting stents to prevent further extension of the intramural haematoma proximally into the subclavian artery and distally to the anastomosis site. Post-procedural angiography revealed an enlarged true lumen of the LITA, shrinking of the intramural haematoma, and improvement in blood flow to a TIMI grade 3. Chest symptoms resolved immediately after the procedure, with the patient remaining asymptomatic over the 6-month period following the procedure.

Discussion Dissection of the ITA graft can occur spontaneously long after the initial grafting. Intravascular ultrasound is useful for diagnosis. Ensuring adequate coverage of the edges of the dissection with stenting could prevent further extension of the intramural haematoma.

Keywords Coronary artery bypass grafting • Coronary graft dissection • Internal thoracic artery • Intravascular ultrasound • Case report

ESC Curriculum 3.3 Chronic coronary syndrome • 3.1 Coronary artery disease • 3.2 Acute coronary syndrome • 3.4 Coronary angiography • 2.1 Imaging modalities • 2.4 Cardiac computed tomography • 7.5 Cardiac surgery

Learning points

- Chronic spontaneous dissection of an internal thoracic artery is a rare occurrence.
- Intravascular ultrasound is useful to differentiate the dissection, haematoma, and true lumen of the vessel and to guide treatment.
- Adequate coverage of the edges of the dissection during stenting was effective to prevent progression of the dissection and resolution of symptoms.

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Introduction

The internal thoracic artery (ITA) is resistant to accelerated atherosclerotic changes due to endothelial vasodilators like nitrous oxide.[1] However, the ITA can be ruptured by physical force due to the scant presence of smooth muscle cells in the thin-walled media. Although dissection of an ITA graft used for coronary artery bypass grafting (CABG) is rare, it may occur due to iatrogenic injury or spontaneously. Spontaneous dissection can occur with a sudden increase in blood pressure during intense exercise, as well as a complication of collagen diseases, such as Marfan's or Ehlers Danlos syndrome, or increased secretions of stress catecholamines.[2] Herein, we present a 61-year-old man who developed a spontaneous ITA dissection 11 years after CABG, with successful treatment using percutaneous intervention with multiple drug-eluting stents (DES).

Timeline

Time	Events
28 September 2010	Coronary artery bypass grafting consisted of anastomosis of the left internal thoracic artery (LITA) to the left anterior descending artery and an I-shaped graft, composed of the right internal thoracic artery and the radial artery, anastomosed to the diagonal branch, posterolateral, and posterior descending arteries, sequentially.
16 September 2017	Good patency of both bypass grafts in computed tomographic angiography (CTA).
16 March 2021	Chest pain and repeat CTA revealed diffuse stenosis in the proximal half of the LITA. Angiography revealed an extensive dissection of the LITA, with impaired blood flow, assessed as a thrombolysis in the myocardial infarction (TIMI) grade 2.
2 April 2021	Percutaneous coronary intervention of the LITA with multiple drug-eluting stents were performed.
7 September 2021	No recurrence of chest pain.

Case presentation

The patient provided informed consent for publication of this case. The patient was a 61-year-old man who had undergone CABG 11 years prior, in 2010. Coronary artery bypass grafting consisted of anastomosis of the left internal thoracic artery (LITA) to the left anterior descending artery (LAD) and an I-shaped graft, composed of the right internal thoracic artery and the radial artery, anastomosed to the diagonal branch, posterolateral, and posterior descending arteries, sequentially. Health comorbidities included diabetes mellitus (DM), hypertension, and ischaemic cardiomyopathy, with a left ventricular ejection fraction of 33%. In 2017, he underwent computed tomographic angiography (CTA) to verify graft patency before his referral to our hospital upon his relocation (*Figure 1A*). In 2021, the patient presented with a 3-month history of chest pain and dyspnoea, suggesting chronic coronary syndrome because his laboratory tests showed no elevation of myocardial enzyme. An electrocardiogram identified new ischaemic changes with T-wave inversion in V3–V6. On admission, physical examination revealed no abnormalities. As repeat CTA revealed diffuse stenosis in the proximal half of the LITA (*Figure 1B*), we performed coronary angiography. His native coronary angiogram showed severe narrowing in the left main artery, severe proximal stenosis in both LAD and a dominant circumflex, and a non-dominant right coronary artery with a proximal chronic total occlusion. Angiography also revealed an extensive dissection of the LITA with impaired blood flow, assessed as a thrombolysis in the myocardial infarction (TIMI) grade 2 (*Figure 2*). On intravascular ultrasound (IVUS, OptiCross^{TM} HD. Boston Scientific, Natick, MA, USA), an intimal tear was observed in the proximal LITA, with an associated intramural haematoma extending proximally to just before the origin of the LITA and distally to the mid-portion of the LITA. The LITA origin and bypass anastomosis site were intact (see Figure 3, *Video 1*). Although the minimum lumen area was 9.3 mm^2 at the distal end of the LITA, the area of the lumen at the site of dissection was reduced to 3.9 mm^2. As there was no evidence of atherosclerotic changes, the dissection was directly stented using multiple DES (Synergy-DES of 4.0 × 24 mm, 3.5 × 48 mm and 3.0 × 48 mm; Boston Scientific, Natick, MA, USA) from distal to proximal to prevent extension of the intramural haematoma proximally into the subclavian artery and distally into the site of anastomosis. On IVUS analysis, there was no malapposition of the implanted DES. Post-procedural angiography revealed an enlarged true lumen of the LITA, shrinkage of the intramural haematoma, and improved blood flow distally (TIMI grade 3 flow; *Figure 4*). The patient's symptoms resolved and the patient was discharged on postoperative day 2 with prescriptions for 75 mg/day

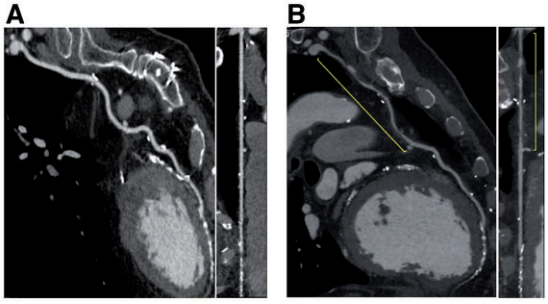


Figure 1 (*A*) Computed tomographic angiography assessed at 7 years after coronary artery bypass grafting, showing good graft patency without any abnormal findings. (*B*) Computed tomographic angiography assessed at 11 years after coronary artery bypass grafting, showing diffuse stenosis in the proximal half of the left internal thoracic artery (yellow line).

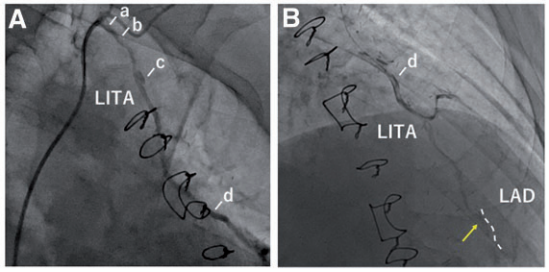
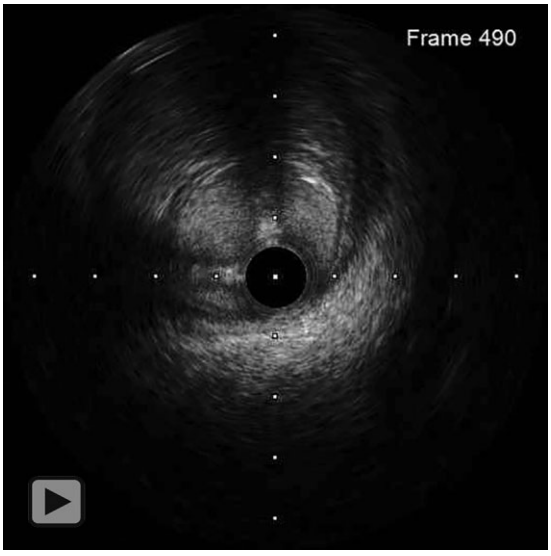


Figure 2 (*A*) Angiography, showing an extensive dissection of the left internal thoracic artery and associated impairment in blood flow through the graft. (*B*) Tip injection by microcatheter from the middle portion of the left internal thoracic artery confirmed a comprised blood flow in the left anterior descending artery. The white dotted line identifies the native left anterior descending artery and the yellow arrow shows the anastomosis site of the left internal thoracic artery with the left anterior descending artery. (a) origin, (b) long smooth narrowing of the vessel leading to the dissection, (c) ulcer-like appearance, and (d) healthy area in the middle portion of the left internal thoracic artery. LAD, left anterior descending artery; LITA, left internal thoracic artery.



Video 1 Intravascular ultrasonography imaging of the left internal thoracic artery from its origin to the bypass the anastomosis site.

clopidogrel and 100 mg/day aspirin. There was no symptom recurrence over the following 6 months.

Discussion

This report presents several unique features. First, the spontaneous dissection of the LITA graft occurred 11 years after CABG. Internal thoracic artery dissections that occur at a short latency after CABG

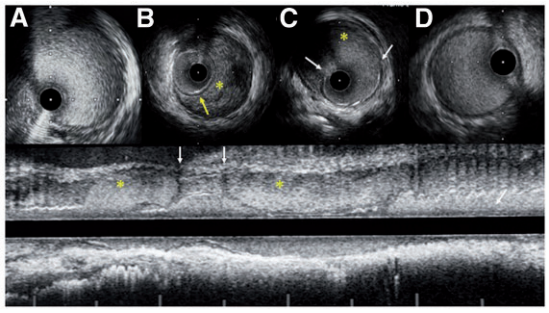


Figure 3 Longitudinal intravascular ultrasonography images showing (*A*) absence of dissection at the origin of the left internal thoracic artery and (*B*) intramural haematoma (*), confirmed by the white–black–white appearance of the intimal-medial membrane (yellow arrow). (*C*) The intramural haematoma (*), extending proximally and distally from the site of dissection (white arrows). (*D*) Intact middle portion of the left internal thoracic artery.

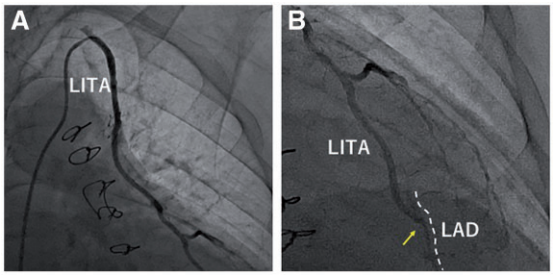
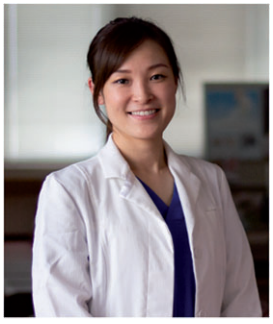


Figure 4 Angiography images after implantation of multiple stents, showing (*A*) the area of the repaired dissection with no evidence of blood flow restriction in the left internal thoracic artery and (*B*) recovery of the left anterior descending artery patency. The white dotted line shows the native left anterior descending artery and the yellow arrows shows the anastomosis site of the left internal thoracic artery with the left anterior descending artery. LAD, the left anterior descending artery; LITA, left internal thoracic artery.

or selective ITA angiography are suggestive of an iatrogenic injury, particularly when involving the proximal ITA.[3] Only four previous cases of chronic phase ITA dissection (occurring 18 months and 2, 3, and 8 years after CABG) have been reported.[4–7] In a case reported by Suresh and Evans,[7] Internal thoracic artery dissection occurred eight years after CABG as the patient lifted a heavy bookcase; in the other three reports, dissection cause was not specified. Here, the reason for ITA dissection was unclear; he had no history of connective tissue diseases or fibromuscular dysplasia, and iatrogenic insult was unlikely as there was no intervention since the CABG. The chronicity of the dissection of the ITA, 11 years after CABG, is the longest duration reported to date. Second, our case demonstrates the usefulness of IVUS for diagnosis and treatment. Although optical coherence tomography may be superior to IVUS for identification of

disrupted flaps, it might not be effective to visualize the full extent of the damage to the vessel wall in the presence of a large intimal haematoma. Use of contrast media or low-molecular-weight dextran to remove residual blood could increase the risk of dissection due to the pressure load on the vessel wall. By comparison, IVUS clearly shows the whole vessel wall, differentiating the dissection, haematoma, and true lumen. IVUS could also help with decisions on stent positioning, early after assessment of the site of lesion. As such, IVUS is useful for both assessment and treatment. Third, the optimal treatment for ITA graft dissection remains unclear. Akita *et al.*[6] indicated that observation is an option for asymptomatic patients with good distal blood flow. Absorbable stents or bioresorbable vascular scaffold implantation may be options for temporary scaffolds, because most patients with spontaneous coronary artery dissection have little or no atherosclerosis and may heal spontaneously. In our case, there were several reasons for performing revascularization for the dissected ITA rather than the native coronary artery. Revascularization for the native coronary artery was challenging because he had triple-vessel coronary disease including the left main artery, one vessel occlusion with DM, and severely impaired left ventricular function. In contrast, revascularization for LITA was easier than for the native coronary artery because the dissected ITA had no atherosclerosis. Moreover, a report by Michael *et al.*[8] demonstrated coronary revascularization with CABG leads to lower all-cause mortality than other interventions in patients with multivessel disease and DM. Gruberg *et al.*[9] reported that revascularization of the ITA graft can be performed safely with low target lesion revascularization rates in long-term follow-up. These reports indicate that treatment strategies should be decided on a case-by-case basis, depending on symptoms, location and length of the haematoma, degree of compromise of the vessel lumen, and extent of blood flow restriction distal to the dissection. As shown here, stenting multiple DES from distal to proximal was our strategy to avoiding the so-called 'tooth-pasting' effect and propagation of the dissection. The risk for acute and late stent thrombosis or in-stent restenosis with the use of longer stents needs to be considered. An individualized approach based on ischaemic vs. bleeding risk assessment is warranted. Particularly in patients with longer or complex treated segments, ischaemic risk prevails over bleeding risk. Late stent malposition is also concerning for an increased very late stent thrombosis risk, following the resorption and healing of intramural haematoma. In this case, a follow-up CTA before cessation of dual antiplatelet treatment may be useful, and after dual antiplatelet treatment for 12 months, termination of this case's second antiplatelet will be based on a follow-up CTA of stent patency.

Lead author biography



Dr Kasumi Ishibuchi studied medicine at Kagawa Medical University in Kagawa, Japan, where she graduated in 2003. She completed her training in internal medicine and cardiology at the University of Kagawa. She became chief of the Department of Cardiology at Higashi-Takarazuka Sato Hospital, Japan.

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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References

1. Yang Z, Oemar BS, Carrel T, Kipfer B, Julmy F, Lüscher TF. Different proliferative properties of smooth muscle cells of human arterial and venous bypass vessels: role of PDGF receptors, mitogen activated protein kinase and cyclin-dependent kinase inhibitors. *Circulation* 1998;**97**:181–187.
2. Sawami K, Natsuaki M, Hongo H, Kajiwara M, Kaneko T, Inoue Y. Spontaneous internal mammary artery graft dissection triggered by emotional stress. *JACC Case Rep* 2019;**1**:732–736.
3. Khan Z, Latif F, Dasari TW. Internal mammary artery graft dissection: a case-based retrospective study and brief review. *Tex Heart Inst J* 2014;**41**:653–656.
4. Ali Z, Sanjeev P, Morton JK. Stenting for spontaneous left internal mammary artery dissection: a case report. *Catheter Cardiovasc Interv* 2003;**60**:389–391.
5. Saito T, Saito N, Komatsu Y, Sekiguchi Y, Asajima H. Chromic dissection of internal mammary artery graft. *Int J Cardiol* 2008;**127**:e124–e125.
6. Akita K, Ohtani H, Sakamoto A, Maekawa Y. Observational treatment of internal thoracic artery graft dissection. *Circ Rep* 2019;**1**:462–463.
7. Suresh V, Evans S. Successful stenting of stenotic lesion and spontaneous dissection of left internal mammary artery graft. *Case Rep* 2009;**2009**:bcr2006087551.
8. Michael EF, Michael D, George DD, Lucas CG, Michael JM, Flora SS *et al.* Long-term survival following mutivessel revascularization in patients with diabetes: the FREEDOM Follow-On Study. *J Am Coll Cardiol* 2019;**73**:629–638.
9. Gruberg L, Dangas G, Mehran R, Hong ML, Waksman R, Mintz GS *et al.* Percutaneous revascularizttion of the internal mammary artery graft: short- and long-term outcomes. *J Am Coll Cardiol* 2000;**35**:944–948.