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**CASE REPORT**
*Structural intervention*

# A case report of transcatheter closure of post-Bentall ascending aortic pseudoaneurysm due to coronary button dehiscence

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**Background** Ascending aortic pseudoaneurysm due to coronary button dehiscence is a rare, yet life-threatening complication of reconstructive cardiac surgery. Because of its rare entity, large data are lacking, and therefore, treatment guidelines are missing.

**Case summary** We describe a case of a 53-year-old male with a past medical history of ascending aortic aneurysm and severe aortic regurgitation who underwent Bentall procedure with 26 mm conduit and mechanical aortic valve 1 year before. Follow-up chest computed tomography (CT) revealed coronary button dehiscence with a giant aortic root pseudoaneurysm and mural thrombus inside. Given the risk of rupture, the heart team decided to go for a percutaneous approach. Based on a pre-interventional 3D reconstructed CT scan and guided by transoesophageal echocardiography and intravascular ultrasound, the pseudoaneurysm was successfully occluded with a 6 × 4 mm Amplatzer Duct Occluder II and simultaneous left main coronary artery (LMCA) stenting with a 4.0 × 15 mm drug-eluting stent. Post-procedural chest CT and echocardiography revealed minimal contrast leakage posterior to the aortic root and para LMCA region, confirmed thrombosis formation post occluder and stent deployment, and patent flow of LMCA.

**Discussion** We describe the successful 3D reconstructed CT scan and peri-procedural transoesophageal echocardiography–guided percutaneous treatment of a giant aortic root pseudoaneurysm with an occluder and a drug-eluting stent with excellent results.

**Keywords** Ascending aortic pseudoaneurysm • Coronary button dehiscence • Left main coronary stenting • Transcatheter device closure • Case report

**ESC curriculum** 2.2 Echocardiography • 2.4 Cardiac computed tomography • 3.4 Coronary angiography • 7.5 Cardiac surgery • 9.1 Aortic disease

## Learning points

- Simultaneous occluder deployment and coronary stenting not only stabilize the position of occluder to prevent migration but also securing the patency of left main coronary artery.

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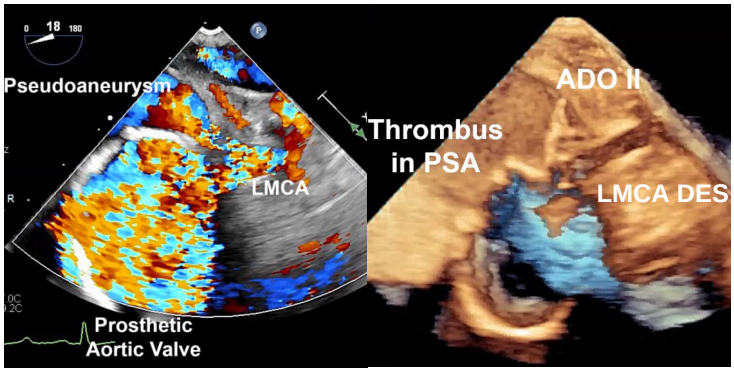
## Introduction

Ascending aortic pseudoaneurysm due to coronary button dehiscence is a rare, yet life-threatening complication of reconstructive aortic surgery, trauma, or infection,[1] potentially leading to reoperation with significantly higher surgical mortality.[2] In appropriately selected patients, transcatheter closure may be an effective alternative treatment.[3] Few isolated reports have described transcatheter closure of distal anastomotic dehiscence after a Bentall operation.[4,5] The anatomical complexity of coronary dehiscence increases the possibility of compromised coronary flow during transcatheter closure. In this report, we describe a case of rapidly enlarged aortic root pseudoaneurysm after a Bentall procedure caused by left coronary anastomotic dehiscence that was successfully occluded with a transcatheter device closure and simultaneous left main stenting in a high-risk patient for reoperation.

## Summary figure

TIMELINE

| Date | Events |
|---|---|
| April, 2021 | Ascending aortic aneurysm and severe aortic regurgitation, underwent a Bentall procedure with a 26 mm conduit and mechanical aortic valve |
| May, 2022 | Chest computed tomography scan revealed an aortic root pseudoaneurysm due to coronary button dehiscence, measuring 8.8 x 6.4 cm, with mural thrombus inside |
| July, 2022 | First assessment of the patient in our Heart Center |
| August, 2022 | Transcatheter device occlusion of the pseudoaneurysm and concomitant coronary stenting |
| February, 2023 | 6-months follow-up |
| August, 2023 | 12-months follow-up |




## Case presentation

A 53-year-old man with a history of hypertension presented with an ascending aortic aneurysm and severe aortic regurgitation and underwent a Bentall procedure with a 26 mm conduit and mechanical aortic valve. One year after the operation, a chest computed tomography revealed an aortic root pseudoaneurysm in the mediastinum, measuring 8.8 × 6.4 cm, with mural thrombus inside. Coronary button dehiscence with the formation of a pseudoaneurysm was diagnosed, where the entry point was right next to the reimplantation site of the left main coronary artery (LMCA) (*Figure 1A*). Although the patient remained asymptomatic, and there was no remarkable finding of physical examination, the rapid progression in the size of the pseudoaneurysm is still worrisome. Upon admission, transoesophageal echocardiography (TEE) showed a huge pseudoaneurysm with the orifice of the LMCA, right next to the aortic valve prosthesis, with systolic pulsatile flow from the aorta into the pseudoaneurysm cavity (*Figure 1B*; Supplementary material online, *Video S1*). Given his high risk of reoperation, he was referred for transcatheter device occlusion of the pseudoaneurysm and concomitant coronary stenting to prevent the impedance of blood flow of the LMCA.

Under TEE and fluoroscopic guidance, the pseudoaneurysm was selectively engaged with a 7F Judkins right coronary guide catheter, followed by passage of two 0.014 in coronary guidewire into the pseudoaneurysm, while a second 6F Judkins right guide catheter was introduced through

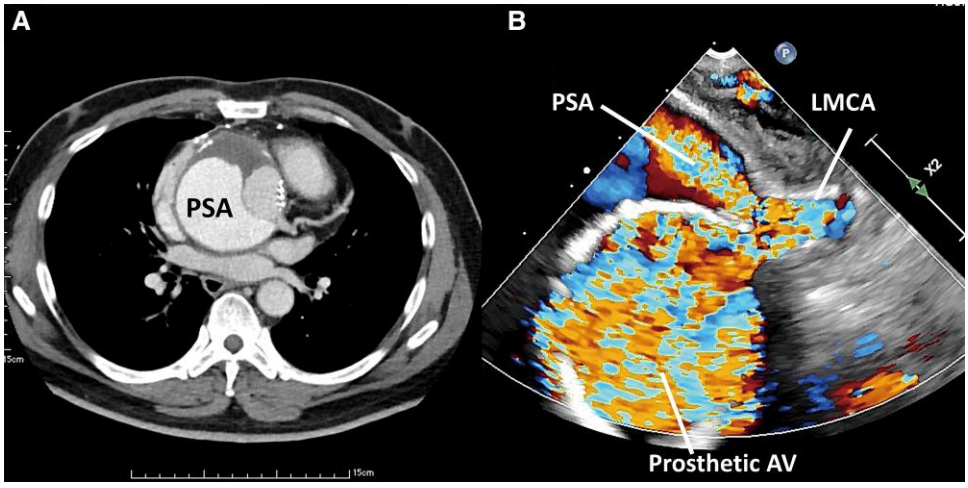



**Figure 1** Pre-procedural multimodal imaging analysis. (*A*) Chest computed tomography revealed an 8. 8 × 6.4 cm aortic root pseudoaneurysm, with partial mural thrombus. (*B*) Transoesophageal echocardiography with colour Doppler confirmed the relationship between the entry point of the pseudoaneurysm and the position of the left main coronary artery. AV, aortic valve; LMCA, left main coronary artery; PSA, pseudoaneurysm.

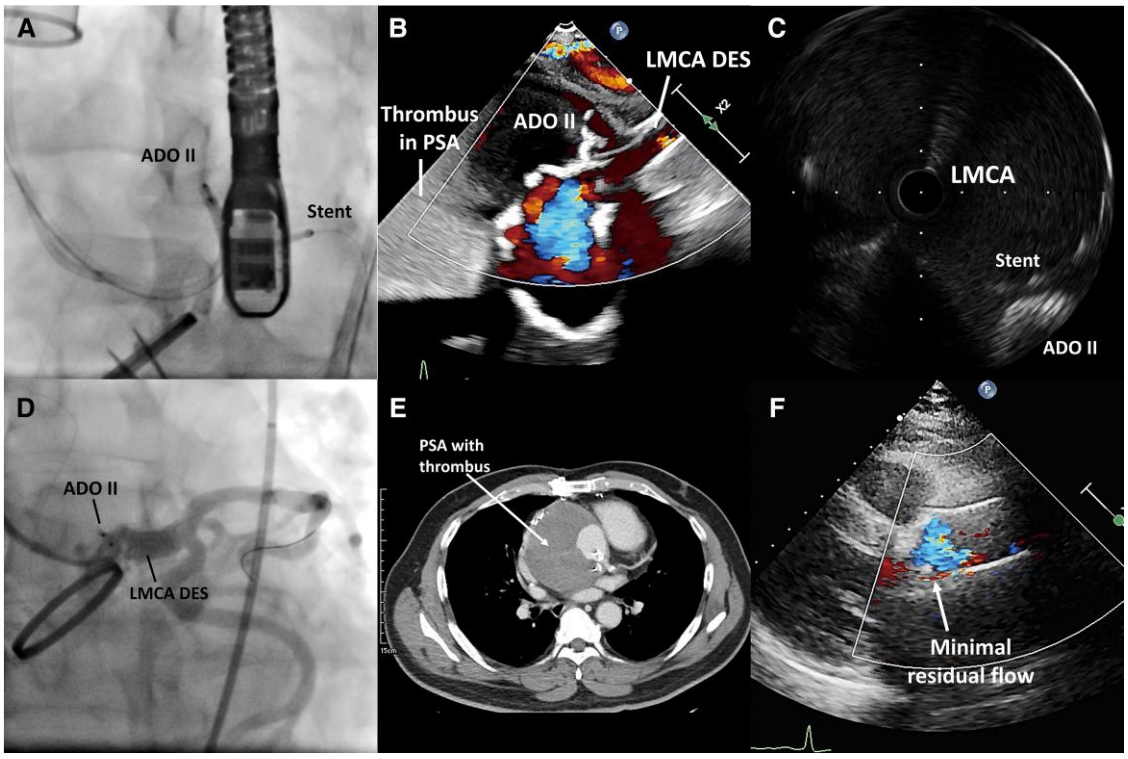



**Figure 2** Peri-operative and post-procedural images. (*A*) Fluoroscopy showed the Amplatzer Duct Occluder II 6 × 4 mm was deploying at the inlet of pseudoaneurysm, and a drug-eluting stent was standing by in the left anterior descending coronary artery. (*B*) Transoesophageal echocardiography with colour Doppler confirmed well-seated occluder with immediate thrombus formation and patent blood flow of the left main coronary artery. (*C*) IVUS after post-dilatation showed the optimization of stent expansion of the left main coronary stent, and the position of the occluder was secured by the coronary stent. (*D*) Final angiogram showed coronary button dehiscence was secured by the occluder and left main coronary stent, and coronary blood flow was TIMI-III flow. (*E*) Post-procedural chest computed tomography revealed thrombosis of aortic root pseudoaneurysm. (*F*) Post-procedural transthoracic echocardiography revealed minimal residual leakage in parasternal long-axis view with colour Doppler. ADO II, Amplatzer duct occluder type two; DES, drug eluting stent; IVUS, intravascular ultrasound; LMCA, left main coronary artery; PSA, pseudoaneurysm; TIMI, thrombolysis in myocardial infarction.

contralateral femoral access that was used to engage LMCA, with a 0.014 in coronary guidewire into the distal left anterior descending coronary artery. Sequentially, we used a guide extension to cross the pseudoaneurysm and then introduced an extra-stiff Confida™ Brecker guidewire (Medtronic Inc, Minneapolis, MN, USA), and finally, a 7F Judkins right coronary guide catheter was passed into the pseudoaneurysm. The Judkins right guide catheter facilitated a 5F shuttle sheath, for placement of a 6 × 4 mm Amplatzer Duct Occluder II (Abbott Vascular, Santa Clara, CA; *Figure 2A*). Meanwhile, a drug-eluting stent was standing by in the left anterior descending coronary artery (*Figure 2A*; Supplementary material online, *Video S2*). Amplatzer Duct Occluder II 6 × 4 mm was deployed at the entry point of coronary button dehiscence under TEE guidance, and immediate thrombus formation was demonstrated (*Figure 2B*; Supplementary material online, *Videos S3 and S4*). Owing to the partial protrusion of the occluder into the LMCA, the drug-eluting stent (Xience Sierra 4.0/15 mm, Abbott, CA, USA) standing by in the left anterior descending artery was pulled back and deployed consecutively (see Supplementary material online, *Video S5*). Transoesophageal echocardiography demonstrated a patent LMCA following occluder deployment and left main coronary stenting (*Figure 2B*; Supplementary material online, *Video S6*). Intravascular ultrasounds confirmed the optimization of the drug-eluting stent, patency of the LMCA, and the secure positioning of the occluder (*Figure 2C*). The final fluoroscopy showed well-seated devices (*Figure 2D*; Supplementary material online, *Video S7*). The patient was discharged after an uneventful hospital course. Post-procedural chest computed tomography and transthoracic echocardiography confirmed thrombosis formation after occluder and stent deployment, with minimal contrast leakage posterior to the aortic root and para-LMCA region (*Figure 2E* and *F*). The patient has remained asymptomatic for 1 year following the procedure. During this time, he underwent chest computed tomography scans every 6 months. The pseudoaneurysm's size has remained stable, with the presence of mural thrombus inside, and there have been no signs of progression.

# Discussion

Pseudoaneurysms in the aortic root following Bentall's procedure are reported in 6–10% of patients. The most common site for these pseudoaneurysms to occur is the graft anastomosis site, followed by the coronary artery anastomosis site, the aortotomy site, the aortic cannulation site, and the needle vent site.[6,7]

The underlying pathology that leads to aortic pseudoaneurysms may vary. The most common cause is infection of various anatomical structures, such as the valve, aortic graft, or mediastinum. Additionally, predisposing factors like rheumatoid arthritis, a history of prolonged corticosteroid use, and connective tissue disorders may complicate the post-operative period following successful aortic root surgeries.

Coronary button dehiscence constitutes a huge challenge due to the high pressures, high flow, and complex anatomy of the surrounding structure in that area. Currently, the gold standard for repairing anastomotic pseudoaneurysms is through open resection and revision of the anastomosis. While surgical repair of pseudoaneurysms following aortic surgery can be safely performed with good long-term outcomes, it carries a high mortality rate and prolongs hospital stays.[8]

Alternative percutaneous management options have been described for patients with aortic anastomotic pseudoaneurysm who are considered to be at prohibitive operative risk. These options include thrombin injection,[9] coil embolization,[10,11] and transcatheter closure with a vascular plug.[4] Thrombin injection is primarily used in the acute phase of the disease to prevent the need for an emergent high-risk operation, but it should not be considered a definite therapy.[9] The proximity of the suture line to the LMCA precludes the use of a short aortic stent graft extension. Although coil embolization has been reported as an alternative therapy, coil migration in the area of the aortic root remains a significant concern that can lead to stroke and myocardial infarction.[11]

The use of a vascular plug has also been described to treat pseudoaneurysms in this location,[4,5] but none of the studies mentioned the potential impediment of coronary blood flow.

In our patient, the pseudoaneurysm leakage originated at the anastomosis of the aortic root graft involving the left coronary button. To the best of our knowledge, no prior reports have addressed simultaneous occluder deployment and coronary stenting. Our procedure demonstrated that a transcatheter approach can offer a promising alternative for select patients, potentially reducing surgical morbidity and mortality. Specifically, simultaneous left main stenting not only stabilizes the position of the occluder to prevent migration but also ensures patency of the LMCA. Although the long-term efficacy of this approach has not been well established, our case suggests it may be a viable option for certain patients.

Considering the complexity of the procedures, precise measurements of anatomical relationships are based on 3D imaging from computed tomography and peri-procedural TEE.[7,12,13] These imaging modalities provide precise information in determining the exact size and length of the neck of the pseudoaneurysm for appropriate device selection and for facilitating the procedure and ensuring procedural success in this particular case of closure of a coronary button dehiscence after the Bentall procedure.

## Patient perspective

All the risks, benefits, and alternatives were discussed with the patient before the intervention. Considering high risk of reoperation, the patient asks for transcatheter closure.

# Lead author biography

Huan Chiu Lin is a doctor of Heart Center, Cheng Hsin General Hospital, Taipei, Taiwan. His work focuses specifically on echocardiography and image analysis in the field of structural heart diseases.

# Supplementary material

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

**Consent:** The authors confirm that written informed consent for the publication of this case report was obtained from the patient in line with the Committee on Publication Ethics (COPE) guidelines.

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## Data availability

The data underlying this article are available in the article and in its online supplementary material.

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