Aortic root spontaneous echocardiographic contrast due to haemodynamic support with a percutaneous left ventricular assist device (TandemHeart)

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Intra-procedural transoesophageal echocardiography (TEE) is useful in guiding device placement and monitoring for procedural complications in the interventional lab. We report a case of spontaneous echo contrast (SEC) formation in the aortic root immediately following initiation of haemodynamic support with a percutaneous left ventricular (LV) assist device for cardiogenic shock. With TEE guidance, assist device flow rates were adjusted, resulting in resolution of SEC. This case illustrates another potential use for intra-procedural TEE during LV assist device placement.

Keywords
Cardiogenic shock • Spontaneous echo contrast • Left ventricular assist device • TEE • Transoesophageal echocardiography • Aortic valve

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Case history

A 51-year-old female with a history of orthotopic heart transplantation in 2005 for dilated cardiomyopathy was transferred from an outside facility for worsening dyspnoea at rest and symptomatic volume overload for several days. She was adherent to her immunosuppressant regimen and was followed regularly by her heart transplant physician prior to presentation.

On arrival, the patient was afebrile, tachycardic with a regular pulse rate of 118 b.p.m., and hypotensive with a blood pressure of 91/58 mmHg. Her physical examination was consistent with a severe volume overload with an elevated jugular venous pressure, audible S3, diffuse bilateral pulmonary rales, distended abdomen, and pitting oedema of the bilateral lower extremities. Electrocardiogram revealed sinus tachycardia with non-specific ST-T-wave changes. Cardiac enzymes were within normal limits. Transthoracic echocardiogram revealed mild concentric LV hypertrophy and a severely depressed LV ejection fraction with global hypokinesis (20–25%). An urgent endomyocardial biopsy showed mild acute cellular rejection (Grade 1R). She was started on high-dose intravenous steroids and pressors and underwent an intra-aortic balloon pump placement at bedside for further haemodynamic support. Due to continued haemodynamic instability and a worsening cardiac index (0.85 L/m²) despite these measures, she was referred to the cardiac catheterization laboratory for TandemHeart placement.

Intra-procedural TEE confirmed severe global LV hypokinesis with no significant valvular abnormalities. The patient was
anticoagulated with unfractionated heparin following a transseptal puncture, and the activated clotting time was therapeutic at 200 s upon successful placement of the TandemHeart left atrial cannula across the inter-atrial septum. Within five minutes of activation of the TandemHeart at 4.5 L/min, minimal aortic cusp excursion was noted and dense SEC consistent had formed within the aortic root distal to the aortic valve (Figure 1, Supplementary data online, Figure S1). Using TEE guidance, the TandemHeart flow rate was reduced until there was resolution of the aortic root SEC and improved aortic valve leaflet excursion (Figure 2, Supplementary data online, Figure S2). Flow rates >2.9 L/min resulted in reformation of SEC distal to the aortic valve.

The patient stabilized haemodynamically on TandemHeart support and had significant improvement in LV systolic function within 4 days of treatment with high-dose steroids, thymoglobulin, and plasmapheresis as seen with bedside TEE at a minimal flow rate of 1.7 L/min (images not shown). The TandemHeart was successfully removed after 7 days without complications, and the patient was discharged on hospital day 24 in stable health with no neurological sequelae.

**Discussion**

SEC forms as a result of red blood cell aggregation due to interactions with plasma proteins including fibrinogen during low-flow states and is considered a precursor to early thrombus formation. To our knowledge, this is the first case documenting dense SEC formation in the aortic root as a result of aggressive haemodynamic support with an LV-assist device, an important echocardiographic finding due to its association with an increased risk for embolic events in other low-flow states.

While thrombus formation is a known complication of TandemHeart use, in previously reported cases, the thrombi were catheter-associated and attributed to inadequate or overly low-flow rates. In the present case, the combination of cardiogenic shock with aggressive LV unloading likely led to low shear rates distal to the aortic valve, resulting in SEC formation despite therapeutic levels of heparin. Although the ascending aorta and root can be seen with surface echocardiography, TEE is the preferred method of imaging in the intra-procedural setting due to its ability to guide inter-atrial septal puncture and assess catheter thrombus. If repeated imaging is desired for assist device weaning purposes, we favours TEE imaging due to its superior image resolution and sensitivity to detect small thrombi. In the light of these findings, intra-procedural TEE during LV-assist device placement may offer an additional advantage in being able to assist with flow rate titration when initiating haemodynamic support.

**Supplementary data**

Supplementary data are available at European Journal of Echocardiography online.

**Conflict of interest:** none declared.

**References**


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**Figure 1** Dense spontaneous echo contrast distal to the aortic valve following activation of the TandemHeart at 4.5 L/min. Aortic valve leaflet movement is severely restricted at mid-systole. LA, left atrium; LV, left ventricle; Ao, aorta.

**Figure 2** Resolution of spontaneous echo contrast after adjusting the TandemHeart flow rate from 4.5 to 2.5 L/min. Aortic leaflet mobility has returned to normal. LA, left atrium; LV, left ventricle; Ao, aorta.