

Inverted left atrial appendage after left-ventricular-assist device implantation

Roshith Chandran, Vikrant Pathania

Department of Cardiac Anesthesia, Freeman Hospital, Newcastle upon Tyne Hospitals NHS Trust, Newcastle Upon Tyne, United Kingdom

Correspondence to Roshith Chandran, MD, DNB, DM, FIACTA, FTEE, EDIAC, Department of Cardiac Anesthesia, Freeman Hospital, Newcastle upon Tyne Hospitals NHS Trust, Newcastle Upon Tyne, NE7 7DN, United Kingdom. Tel: +44 741 194 6570; e-mail: roshith.chandran@nhs.net

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Left atrial (LA) appendage inversion is a rare event in cardiac surgery and can often be mistaken for a mass, thrombus, or vegetation. This can be a challenge, especially in the case of a left-ventricular-assist device where a correct diagnosis is of crucial significance. Intraoperative transesophageal echocardiography is an invaluable tool to detect an inverted LA appendage and differentiate it from other potentially dangerous diagnosis like LA clot. Knowledge of this entity along with a high index of suspicion can help early diagnosis of this scenario and avoid unnecessary reinstitution of cardiopulmonary bypass and resurgery

Keywords:

left atrial mass, left-ventricular-assist device, transesophageal echocardiography

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Introduction

Postcardiac surgery left atrial (LA) appendage inversion is a rare event and can cause diagnostic dilemma, as it can be mistaken for a mass, thrombus, or vegetation. This can be a challenge in the case of a left-ventricular-assist device (LVAD) where a correct diagnosis is of crucial significance.

Case report

A previously fit and well 29-year-old female presented to our hospital with gradually progressive shortness of breath and pedal edema, after giving birth to a child 2 months ago. Two-dimensional echo revealed an ejection fraction less than 10% with dilated ventricles. A diagnosis of peripartum cardiomyopathy was made and she was commenced on heart failure medications. The patient had poor response to medical management and suffered a cardiac arrest in the hospital. Postsuccessful resuscitation, it was decided to consider her for heart transplant. Considering the COVID epidemic and paucity of available donors, it was decided to support her mechanically with a LVAD. After an uneventful LVAD (HVAD, HeartWare; Medtronic Inc., Minnesota, USA) implantation via midline sternotomy and standard cardiopulmonary bypass (CPB), the device was activated and the revolutions on the pump were steadily increased to 2600 rpm for deairing on CPB. The power on the LVAD device increased to a maximum of 7.5 W and the flows dropped. As the deairing proceeded, a suspicious hyperechoic mass was noted in the LA on transesophageal echocardiography (TEE), leading to

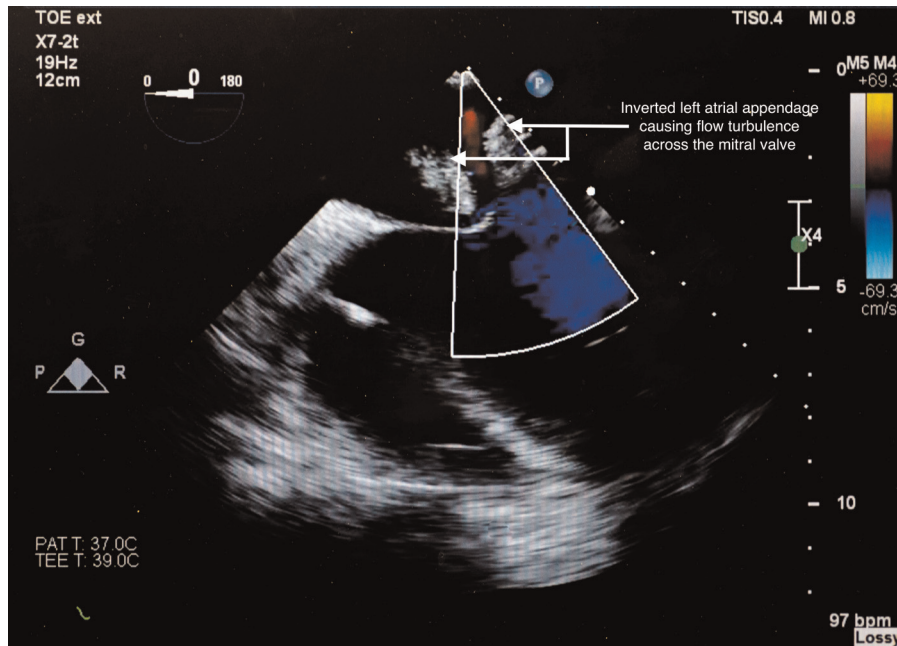
confusion of a LA clot. Inversion of the LA appendage was suspected since the pre-CPB TEE showed no LA clot and it was unlikely that a new clot would form in an anticoagulated patient on CPB. The LVAD flows were reduced and re-examination of the LA by the surgeon revealed an inverted appendage, which was promptly everted with the help of a forceps. LA mass disappeared, LVAD flows stabilized, and the power utilization immediately dropped to 3.2 W. The patient made an uneventful recovery and was discharged from the hospital within 2 weeks of surgery (Figs 1–3).

Discussion

Discovery of a LA mass intraoperatively raises a suspicion of a clot, tumor, or vegetation. Suction force produced by the LVAD can cause deformity of the LA appendage causing inversion. In the case of severe heart failure, LVAD is activated and flows are gradually increased as the CPB flows are reduced, in a bid to transition from full CPB to assisted flows with the LVAD. Increased suction force from the LVAD, especially in the presence of low blood volume in the left ventricular chamber, can pull blood from the LA across the mitral valve and can result in inversion of the LA appendage. It is also possible that the appendage may invert during the deairing maneuvers [1]. On TEE, it may present as a ‘crooked finger’ or with a tongue-like appearance [2]. Apart from causing

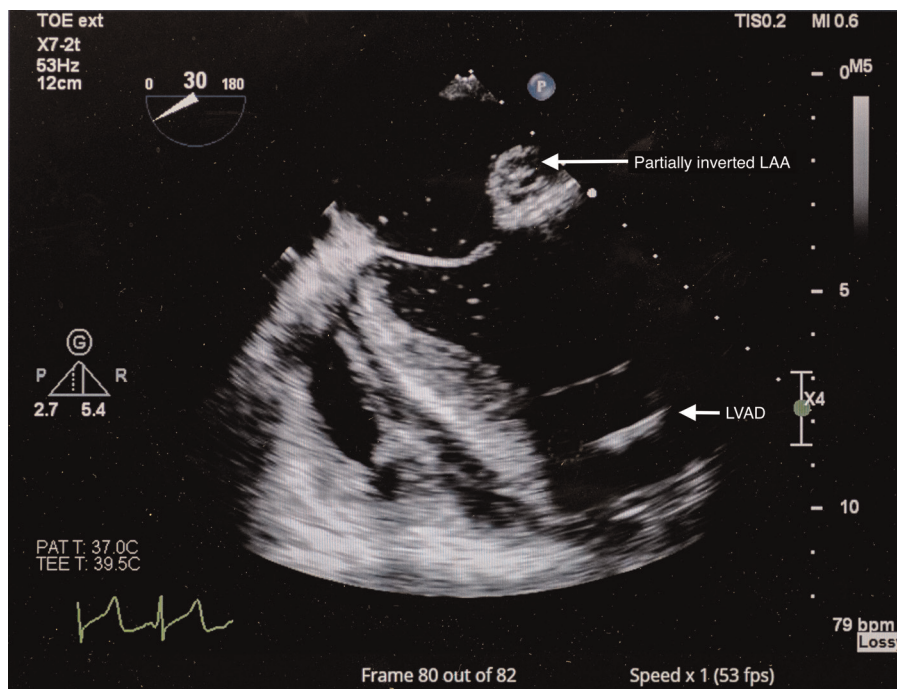
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Figure 1



Mid-esophageal four-chamber view with color Doppler across the mitral valve showing the inverted left atrial appendage causing flow turbulence.

Figure 2

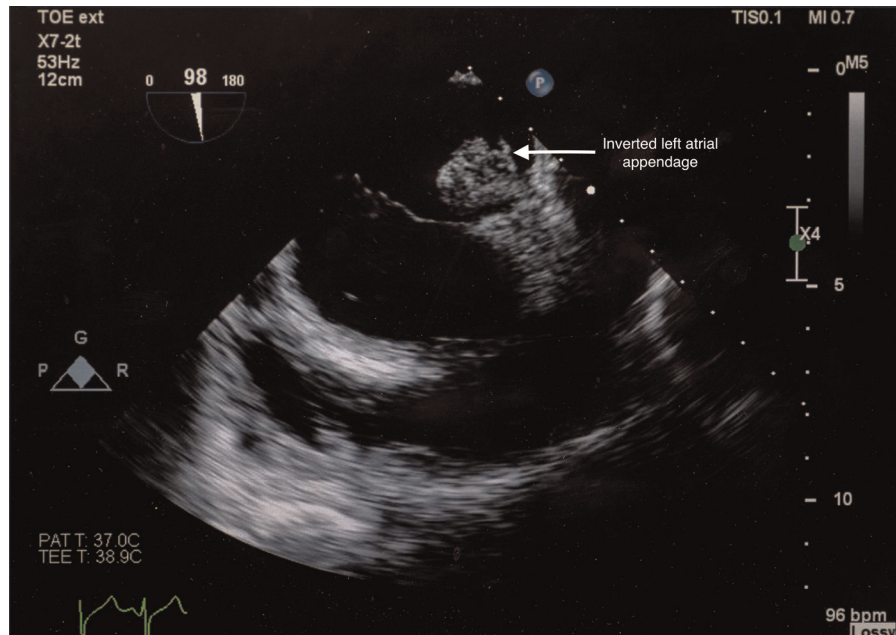


Mid-esophageal four-chamber view showing the mass, with the LVAD. LVAD, left-ventricular-assist device.

confusion in the diagnosis, it can cause mitral valve obstruction and impaired ventricular filling [3] and necrosis and rupture of the LA wall. It can also lead to distortion of the pulmonary veins causing pulmonary congestion and subsequent right-ventricular failure, especially in cases of borderline right-ventricular function [4]. Patients with dilated cardiomyopathy

have functional mitral regurgitation and subsequent LA dilation with an enlarged appendage and thus are susceptible to appendage inversion. The inability to identify the mass as an inverted left atrial appendage can result in unnecessary return to CPB, surgical intervention, and additional ischemia time. Regular preoperative TEE assessment for patients

Figure 3



Mid-esophageal two-chamber view showing the typical appearance of the inverted left atrial appendage.

undergoing LVAD implantation includes assessment of LA appendage for clots, especially in the presence of severe MR and atrial fibrillation [5]. It is essential to have a high index of suspicion for an inverted left atrial appendage, especially when a new mass appears postsurgery. Comparison with preoperative images will help clinch the diagnosis, especially with the knowledge that the mass is homogeneous and arises from the anterolateral wall of the atrium just superior to the mitral valve and inferior to the pulmonary veins. The absence of LA appendage when seen in the mid-esophageal two-chamber view and mid-esophageal LA appendage view along with typical shape of the mass with a broad base and highly mobile tip is highly suspicious of appendage inversion [2]. An inverted appendage generally everts spontaneously with fluid loading of left ventricular (Trendelenberg maneuver or Valsalva maneuver) or by transiently reducing LVAD flows. Other methods to correct it include digital manipulation, or using forceps [6]. Rarely, LA appendage ligation might be required to prevent reinversion. Intraoperative TEE is thus an invaluable tool to detect an inverted left atrial appendage and

differentiate it from other potentially dangerous diagnosis like LA clot, which would have mandated unnecessary reinstatement of CPB and resurgery.

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Conflicts of interest

There are no conflicts of interest.

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