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CASE REPORT
Structural intervention

Left atrial appendage occlusion guided by intracardiac echocardiography in a patient with a 34 mm atrial septal defect occluder: a case report

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Background Intracardiac echocardiography (ICE)–guided left atrial appendage occlusion (LAAO) is increasingly common. Patients with previous atrial septal defect closure constitute a significant challenge for transseptal access.

Case summary A 49-year-old man with persistent atrial fibrillation, hypertension, and reduced left ventricular function was considered for LAAO after a life-threatening intrathoracic bleeding while on oral anticoagulation. Percutaneous atrial septal defect closure was performed 15 years before with a 34 mm Amplatzer Septal Occluder. Preprocedural cardiac computed tomography demonstrated the atrial septal occluder device with a small native interatrial septum at the inferior margin. The left atrial appendage landing zone measured 17 × 22 mm. The LAAO was performed under local analgesia. A steerable sheath was used to guide the transseptal puncture, and the ICE probe was traced along a guidewire across the atrial septum. A 12-F Amulet delivery sheath was advanced through the same transseptal hole. Under ICE and fluoroscopy guidance, a 25 mm Amplatzer Amulet was deployed. Follow-up imaging showed a well-positioned device with a small peridevice leak at the disc.

Discussion This case report illustrates the feasibility of LAAO performed with ICE guidance from the left atrium in a patient with a large Amplatzer Septal Occluder with a small native interatrial septum. It demonstrates that prior atrial septal defect closure should not be considered as a contraindication for LAAO but warrants careful preprocedural planning.

Keywords Left atrial appendage occlusion • Intracardiac echocardiography • Atrial septal defect • Atrial septal occluder • Case report

ESC curriculum 2.1 Imaging modalities • 2.4 Cardiac computed tomography • 5.3 Atrial fibrillation

Learning points

- Intracardiac echocardiography–guided left atrial appendage occlusion is feasible in patients with prior atrial septal defect closure.
- Preprocedural cardiac computed tomography provides valuable information for planning the transseptal puncture and guiding the device implantation.

Introduction

Left atrial appendage occlusion (LAAO) is an alternative to oral anticoagulation in selected patients with atrial fibrillation. Procedural imaging guidance is fundamental in ensuring a successful device implantation. Intracardiac echocardiography (ICE) from the left atrium represents a safe and effective alternative to transoesophageal echocardiography,[1-3] which may improve patient comfort and facilitate logistics in the

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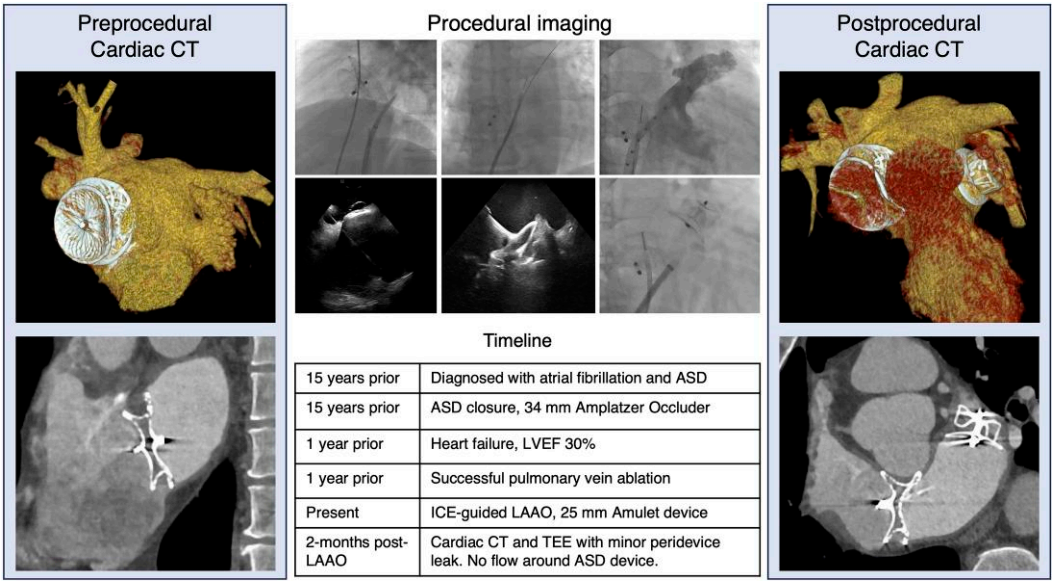
catheterization lab.[1] Prior case reports have demonstrated the feasibility of LAAO in patients with previously implanted atrial septal defect (ASD) occluders but only in patients with smaller ASD devices and with transoesophageal echocardiography or fluoroscopy guidance.[4,5] Herein, we present a case of LAAO with ICE from the left atrium in a patient previously implanted with a 34 mm Amplatzer Septal Occluder (ASO) having a 44 mm right atrial disc.

A 49-year-old male with hypertension, persistent atrial fibrillation, and a secundum ASD closed by percutaneous implantation of a 34 mm ASO device in 2003 was referred for LAAO. In 2016, the patient was admitted with presumed tachycardia-induced cardiomyopathy, and after multiple unsuccessful cardioversions despite amiodarone therapy, he underwent successful pulmonary vein ablation through a double transseptal puncture low antero-septally in relation to the ASO device. Subsequent transthoracic echocardiography while in sinus rhythm consistently demonstrated a mildly reduced left ventricular ejection fraction of 40%. He was prescribed a beta-blocker, angiotensin-converting enzyme inhibitor, and continued warfarin. However, while on warfarin, he experienced a life-threatening bleeding in the thoracic musculature, requiring multiple transfusions and intensive care. Anticoagulation was discontinued, and he was referred for LAAO after multidisciplinary discussion between specialists in thrombocardiology, imaging, congenital, and interventional cardiology, including a shared decision-making with the patient. His CHA_2DS_2-VASc score was 2, while his HAS-BLED score was 3.

According to the institutional standard, LAAO procedures are guided by preprocedural cardiac computed tomography (CT) and intraprocedural ICE from the left atrium.[1] The preprocedural cardiac CT demonstrated a well-positioned ASO device with a small native interatrial septum located inferior to the device. A distance around 7–9 mm was measured from the ASO device edge to the atrial wall (*Figure 1E and F*). The windsock-shaped LAA measured 20 × 32 mm at the orifice and 17 × 22 mm at the intended device landing zone.

Using local analgesia and an ultrasound-guided double right femoral vein access, a 9-F ViewFlex Xtra ICE catheter (Abbott, IL, USA) was introduced into the right atrium. The ICE catheter was placed in the mid-portion of the right atrium with slight retroflexion and clockwise rotation to visualize the ASO device and to guide the transseptal puncture (see Supplementary material online, *Video S1*). Based on the preprocedural planning, a steerable Agilis NxT sheath (Abbott, IL, USA) was utilized to position the transseptal system at the limited area of the native interatrial septum inferior to the large ASO device (*Figures 1B* and *2A and B*; see Supplementary material online, *Video S1*). A BRK-1 needle and dilator were introduced into the left atrium and exchanged for a GW002 wire positioned in the left upper pulmonary vein (*Figure 2C*). The 12-F Amplatzer TorqVue 45/45 Delivery Sheath (Abbott, IL, USA) was advanced over the GW002 wire into the left atrium to dilate the transseptal puncture hole and then retracted into the inferior vena cava. The ICE catheter was aligned with the GW002 wire by careful anterior flexion and clockwise or counterclockwise rotational adjustments under biplane fluoroscopy while carefully advanced into the left atrium using the wire as a roadmap (*Figure 2C*).[6] Once the ICE catheter is inside the left atrium, it is positioned with a slight retroflexion and rotated to centre the view on the left atrial appendage (*Figure 2D*). A contrast angiogram confirmed the left atrial appendage anatomy and sizing (see Supplementary material online, *Video S2*). A 25 mm Amplatzer Amulet was successfully implanted under ICE guidance from a position at the entrance of the left upper pulmonary vein (*Figure 2E–H*; see Supplementary material online, *Video S3*). After device deployment, ICE confirmed a stable position and absence of residual peridevice leak by the three standardized views: the mid left atrial, the left upper pulmonary vein, and the supramitral view,[6] along with a contrast angiogram (see Supplementary material online, *Video S4*). Sheaths were retracted, and the procedure was finalized by closure of the femoral access using a figure-8 suture. Procedure time was 57 min from femoral access to vascular closure, and no periprocedural complications occurred. The patient was discharged on 75 mg acetylsalicylic acid daily for 6 months according to institutional standard.[7] A 2-month follow-up cardiac CT and transesophageal echocardiography confirmed a well-positioned LAAO device with a minimal peridevice leak at the device disc (*Figure 3*). The ASO device was well positioned, and no residual flow around the device could be visualized. No clinical stroke, systemic embolism, or bleedings occurred during follow-up.

Summary figure



Discussion

The feasibility, efficacy, and safety of ICE directly from the left atrium have previously been documented.[1–3] However, to our knowledge, this is the first case that describes the feasibility of ICE from the left atrium in a patient with a large implanted ASO device.

The risk of atrial fibrillation is significantly increased in patients with previous ASD closure.[8] Although anticoagulation is the mainstay therapy for stroke prevention, LAAO represents an effective and safe alternative in select patients, such as those with major adverse bleeding events during anticoagulation therapy.[9,10]

An increasing number of patients are being treated with LAAO, and the demand for a local anaesthetic procedure is rising. Transseptal puncture is usually considered impossible if ASO devices are present. However, this case illustrates that ASO devices should not necessarily be considered as an exclusion criterion for either LAAO or ICE from the left atrium. Although the ASO device represents a challenge, it was considered feasible to continue with our standard approach of ICE-guided LAAO based on the preprocedural cardiac CT. Similar conclusions have been made by Gloekler *et al.*[5] reporting LAAO performed *through* an ASO device. Gafoor *et al.*[4] reported the feasibility of LAAO in three patients with previous persistent foramen ovale

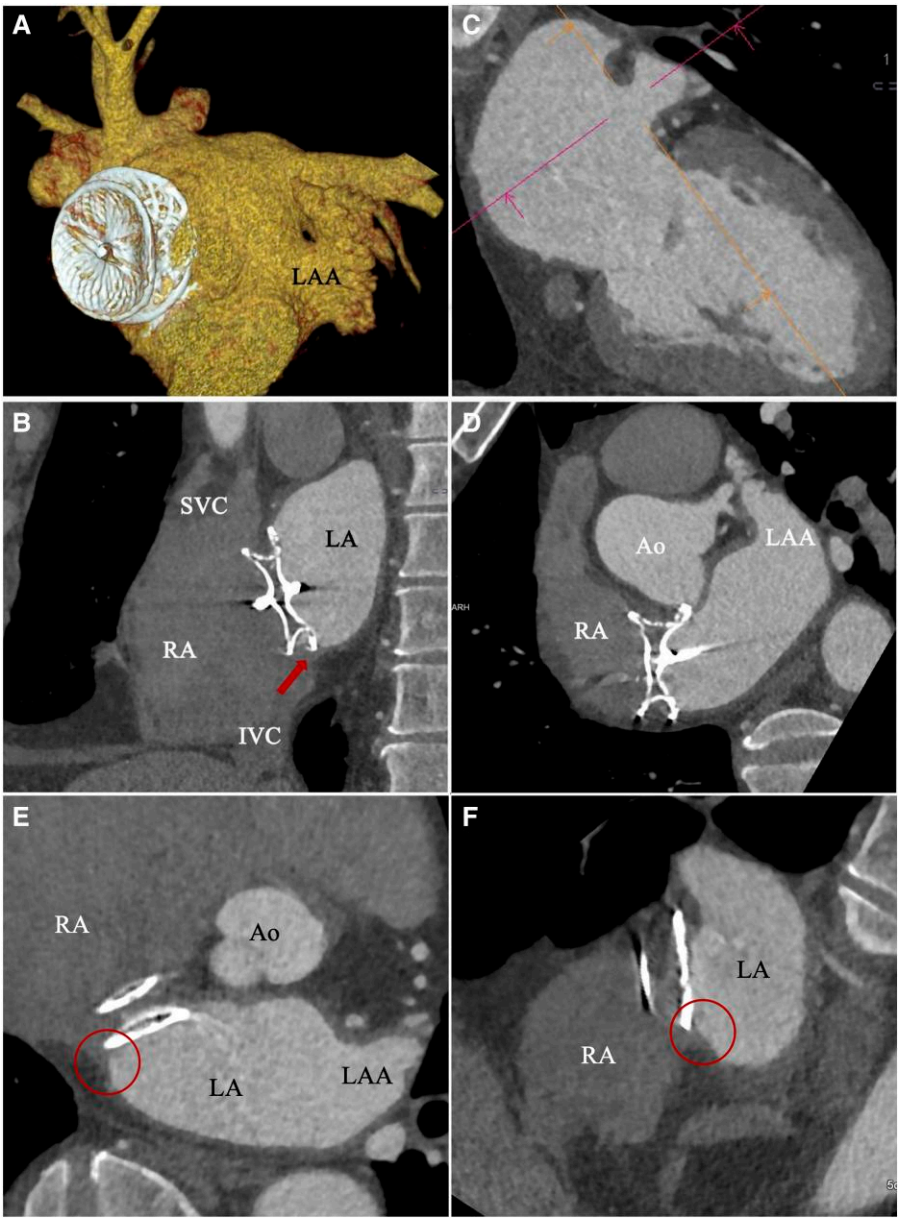


Figure 1 Preprocedural cardiac computed tomography. (*A*) 3D cardiac computed tomography of the left atrium, the Amplatzer Septal Occluder device (34 mm), and the left atrial appendage. (*B*) A small native interatrial septum can be visualized inferior to the Amplatzer Septal Occluder (arrow). (*C*) Cardiac computed tomography view of the left atrial appendage in a view corresponding to right anterior oblique 30° and cranial 10°. (*D*) Relationship between left atrial appendage and septal occluder device. (*E* and *F*) Visualization of the native interatrial septum (circle) at the posterior and inferior edge of the Amplatzer Septal Occluder, which measured 7 × 9 mm from the device edge to the atrial wall. Ao, ascending aorta; LA, left atrium; LAA, left atrial appendage; RA, right atrium; SVC, superior vena cava; IVC, inferior vena cava.

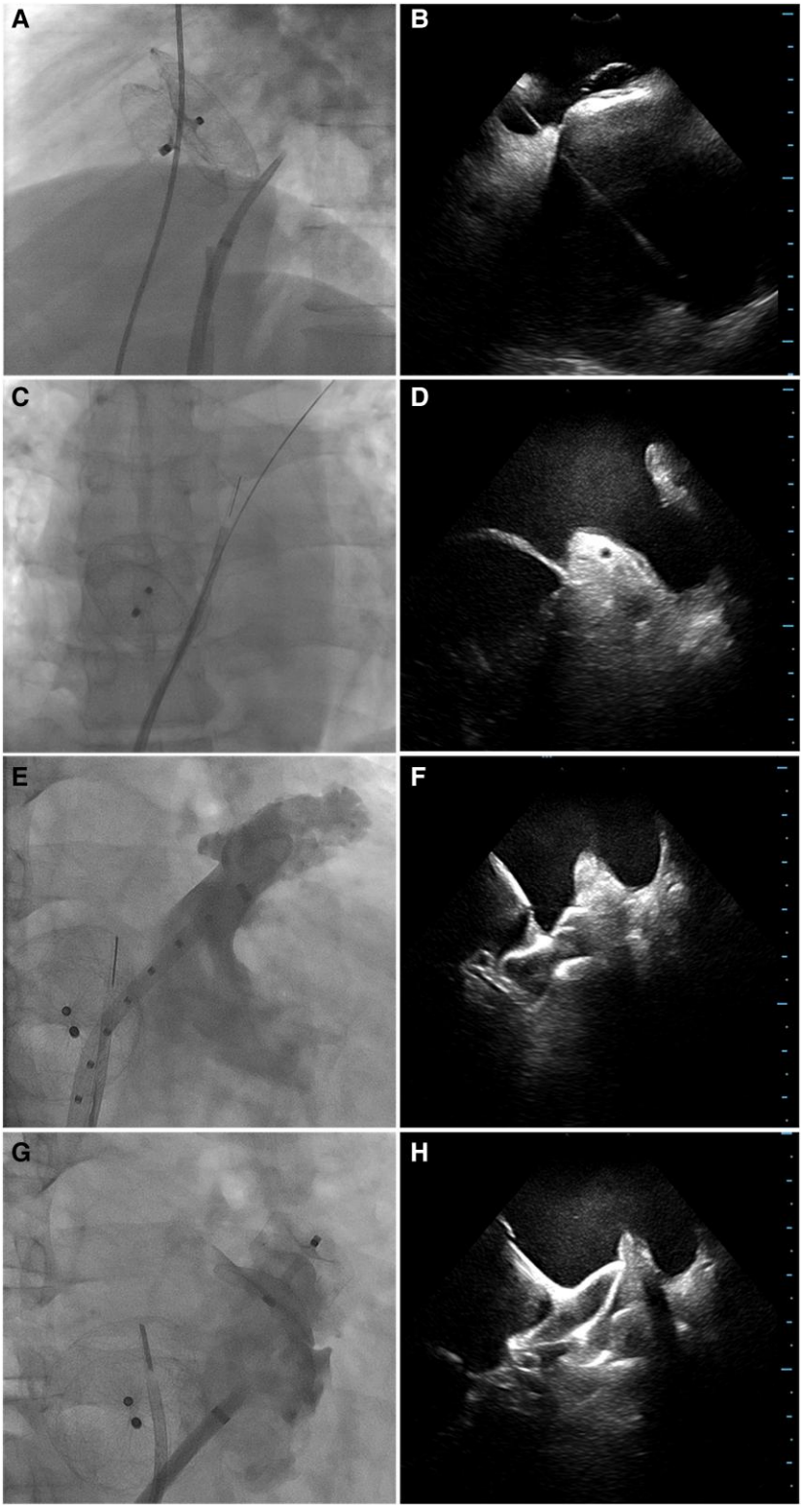


Figure 2 Intraprocedural fluoroscopic and intracardiac echocardiography images. (*A*) Fluoroscopic visualization of the Amplatzer Septal Occluder device and the Agilis NxT sheath with the transseptal system positioned inferiorly to the device. (*B*) The corresponding intracardiac echocardiography image after transseptal puncture with the GW002 wire in the left upper pulmonary vein. (*C*) The intracardiac echocardiography probe is advanced into the left atrium and positioned at the entrance of the left upper pulmonary vein. (*D*) The corresponding intracardiac echocardiography view of the left atrial appendage for procedural guidance. (*E*) Selective left atrial appendage angiogram before device deployment. (*F* and *H*) Intracardiac echocardiography images during device deployment. (*G*) Final angiogram with contrast injection after device release.

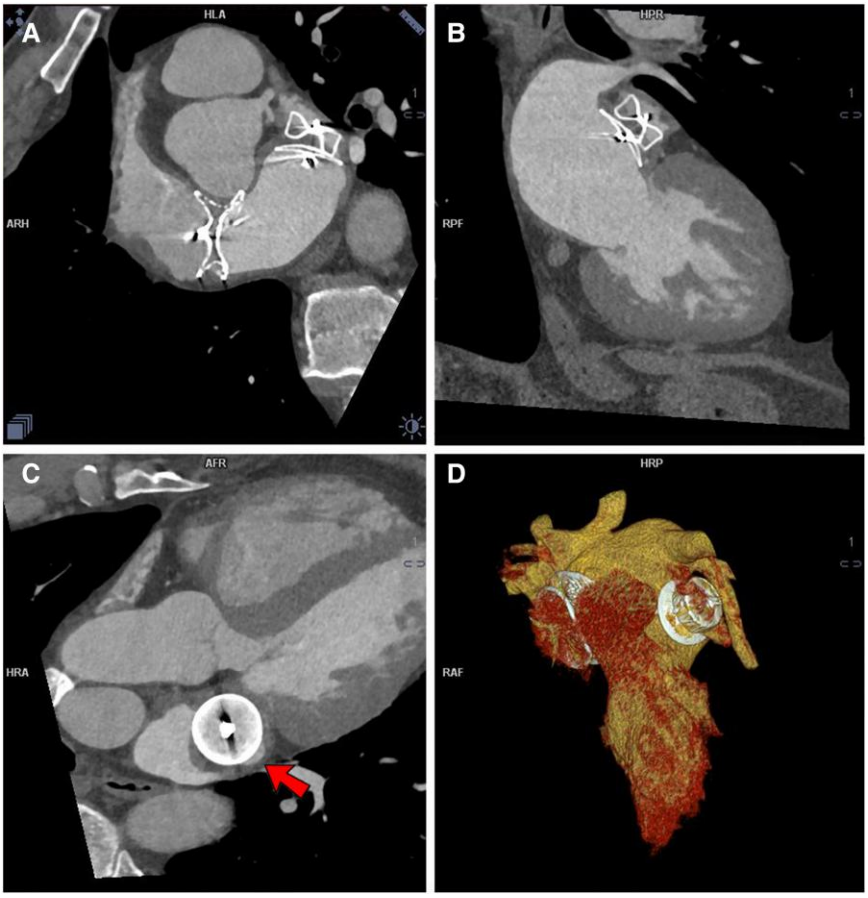


Figure 3 Follow-up cardiac computed tomography images. (*A–C*) show the corresponding orthogonal multiplanar reconstructions of the left atrial appendage, with (*B*) depicting a right anterior oblique 30° and cranial 10° view. (*C*) shows an en face view of the Amulet device disc, revealing a small peridevice gap at 5 o'clock (arrow). Contrast opacification can be visualized in (*A*) and (*B*) distal to the device lobe. (*D*) shows 3D images of the heart, with the Amplatzer Septal Occluder and left atrial appendage occlusion devices *in situ*.

closure. Similarly, case series of atrial fibrillation ablation procedures in patients with ASD closure devices have demonstrated that ICE from the right atrium provides important guidance to appropriate transseptal puncture at the native part of the septum.[11,12] The careful preprocedural imaging with cardiac CT is recommended to appreciate the interatrial anatomy, and a distance exceeding 6 mm from the device edge to the atrial wall has been considered adequate for transseptal puncture.[13] The preprocedural cardiac CT performed in this case clearly illustrated the native atrial septum and relation to the LAA. This facilitated the use of a steerable sheath and aided the guidance of the transseptal puncture to the native interatrial septum. Thus, the combination of preprocedural cardiac CT and intraprocedural ICE guidance may be important for safe transseptal puncture and enable successful LAAO procedures in patients with previously implanted ASO devices.

Conclusion

This case report illustrates the feasibility of LAAO performed with ICE guidance from the left atrium in a patient with a large ASO with a small native interatrial septum. It demonstrates that prior ASD closure should not be considered as a contraindication for LAAO but warrants careful preprocedural planning.

Lead author biography

Dr Kasper Korsholm is an associate professor in cardiology at Aarhus University and a fellow in cardiology at Aarhus University Hospital, Denmark. His research interests are particularly focused on structural heart interventions for stroke prevention.

Supplementary material

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

Consent: In accordance with COPE guidelines, written patient consent has been obtained prior to publication of the images and text of this case report.

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Data availability

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

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