

CASE REPORT

Open Access



Left atrial appendage closure in a patient previously implanted with an interatrial shunt device: a case report

Dawei Lin^{1,2†}, Mingfei Li^{1,2†}, Zilong Weng^{1,2}, Wenzhi Pan^{1,2,3*}, Daxin Zhou^{1,2,3*} and Junbo Ge^{1,2}

Abstract

Patients with previous interatrial shunt device (IASD) implantation may face greater challenges during future left atrial interventional procedures. Herein, we report the first case of left atrial appendage closure (LAAC) in a patient with previous IASD implantation. The patient successfully underwent LAAC using the LAmBRE device without complications.

Keywords Left atrial appendage closure (LAAC), Interatrial shunt device (IASD), FreeFlow®, LAmBRE device

Introduction

In recent years, left atrial appendage closure (LAAC) has emerged as an effective operation strategy for patients with atrial fibrillation (AF) who are unsuitable for continuous oral anticoagulants [1–4]. Most of the formation of thrombosis occurs in left atrial appendages, especially in patients with AF [5–8]. Therefore, enclosing the left atrial appendage through a minimally invasive method with occluding device would thereby significantly reduce the risk of thromboembolism. To attenuate and delay the progression of symptoms in people with heart failure (HF), a device-based therapy, interatrial shunt device (IASD) implantation has been developed these years

[9–13]. The rationale for the IASD is to percutaneously create an iatrogenic shunt, which then reduces the pressure of the atrial and alleviates heart failure. However, the previous implantation of an IASD will also bring challenges for future LAAC. Here we reported a case of LAAC in a patient carrying a previously implanted IASD for the first time.

Case present

A 71-year-old man diagnosed with paroxysmal AF and HF with a New York Heart Association (NYHA) class of II was admitted to our hospital. He presented a history of hypertension for about 10 years and coronary heart disease for about 5 years (coronary computerized tomography [CT] angiography can be found in supplement Fig. 1). He also reported experiencing renal dysfunction and having undergone stent implantation for aortic dissections (CT examination can be found in supplement Fig. 2). As his CHA₂DS₂-VASc score was 3 (hypertension, vascular disease, and age between 65 and 74), he had a strong indication for anticoagulation. However, the patient has experienced nose bleeding and gastrointestinal bleeding using warfarin or rivaroxaban with a HAS-BLED score of 4 (hypertension, abnormal function of the kidney,

[†]Dawei Lin and Mingfei Li contribute equally to this work.

*Correspondence:

Wenzhi Pan

peden@sina.com

Daxin Zhou

Daxin_Zhou@163.com

¹Department of Cardiology, Zhongshan Hospital, Fudan University, Shanghai, China

²National Clinical Research Center for Interventional Medicine, Shanghai, China

³Shanghai Institute of Cardiovascular Disease, Shanghai, China



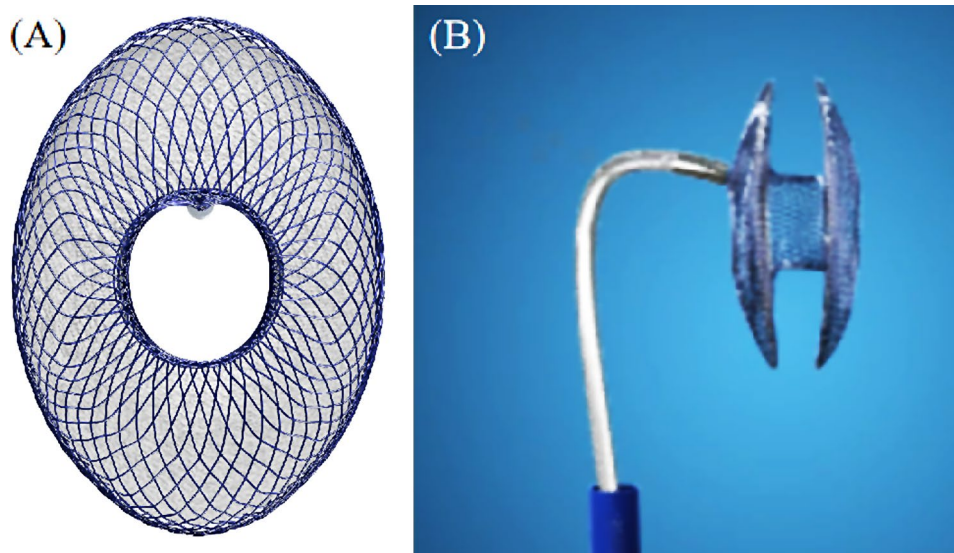


Fig. 1 The FreeFlow® device has a “double elliptical discs, one hole” structure weaved by Nickel-titanium alloy wires, and a 5 mm diameter iatrogenic shunt. (A) Front view. (B) Side view

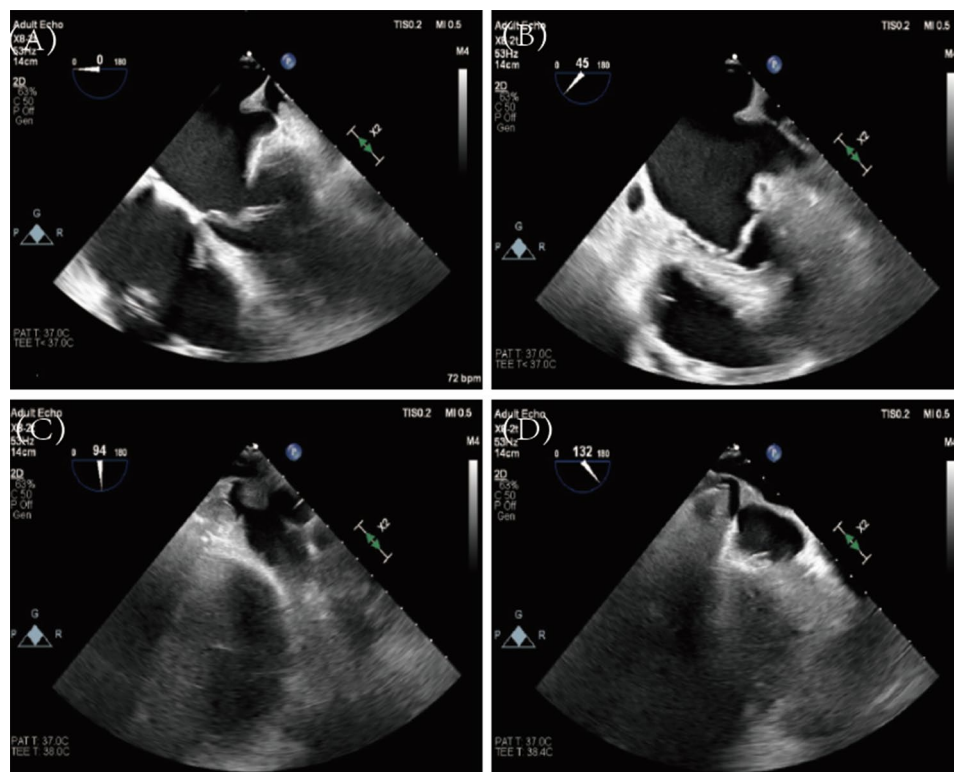


Fig. 2 TEE examination showed a “Cauliflower” kind LAA morphology (A, B, C, and D)

bleeding history or tendency, and age > 65 years). Therefore, LAAC was considered for him because he could not tolerate long-term anticoagulation. Three months ago, the patient was admitted to our hospital complaining about chest tightness and palpitations for two years. He was diagnosed with HF with a NYHA class of III and left ventricular ejection fraction of 55%, pulmonary

hypertension with a pulmonary artery systolic pressure of 53 mmHg, and AF. A successful IASD FreeFlow® (Con Flow MedTec, Shanghai, China) implantation then was performed followed by the usage of spironolactone (20 mg, qd), torasemide (10 mg, qd), and sacubitril/valsartan (50 mg, bid). However, the previous IASD implantation led to more difficulties for LAAC. After obtaining

informed consent for the procedure, LAAC was planned to be performed using transesophageal echocardiography (TEE) guidance under local anesthesia. The FreeFlow[®] percutaneous atrial septal shunt system is a novel ISAD device which has a “double elliptical discs and one hole” structure weaved by Nickel-Titanium alloy wires (Fig. 1). We have performed 20 successful implantations of this device at our hospital. In this case, a 5 mm diameter iatrogenic shunt of the atrial interatrial septum was made after the implantation of FreeFlow[®].

During the TTE examination, a “Cauliflower” kind left atrial appendage (LAA) morphology with a large interior space was observed. The opening of LAA was oval with a slightly longer upper margin, and a shorter lower margin which almost coincided with the left atrial wall. The internal comb-like muscle was well developed inside LAA. Thematic stasis was observed with a slow emptying rate of 15 cm/s in LAA. Width and depth of LAA were measured under TEE (Fig. 2). Besides, the IASD was regularly in site, and an atrial shunt was observed.

The procedure was performed under X-ray fluoroscopy and local anesthesia. Right femoral venous access was used and we delivered a multipurpose angiography

(MPA) catheter to pass the atrial septum through the iatrogenic shunt (center hole) of IASD (Fig. 3A). And then we advanced the delivery sheath into the left atrium through the IASD. After that, we used a pigtail catheter to engage the LAA through the delivery sheath. Under the fluoroscopy projection of RAO 30°, CAU 20°, the operation of LAAC was performed. A 30–36 mm LAmbré occluder was then selected according to the measurement of LAA and it was delivered to LAA, contrast was injected into LAA (Fig. 3B). The anchor plate was opened in a proper position (Fig. 3C). After we found it anchoring appropriately, the external disc of the occluder was then opened (Fig. 3D). Then the upper edge of the occluder was pulled out from LAA and we could find that the LAmbré device was deployed correctly under angiograms (Fig. 3E). Position and compression of the LAmbré device were accessed. No peri-device leak was observed under post-operative TEE examination.

Discussion

Herein, for the first time, we report the technical feasibility of LAAC operation in patients who previously underwent IASD implantation, which hasn't been

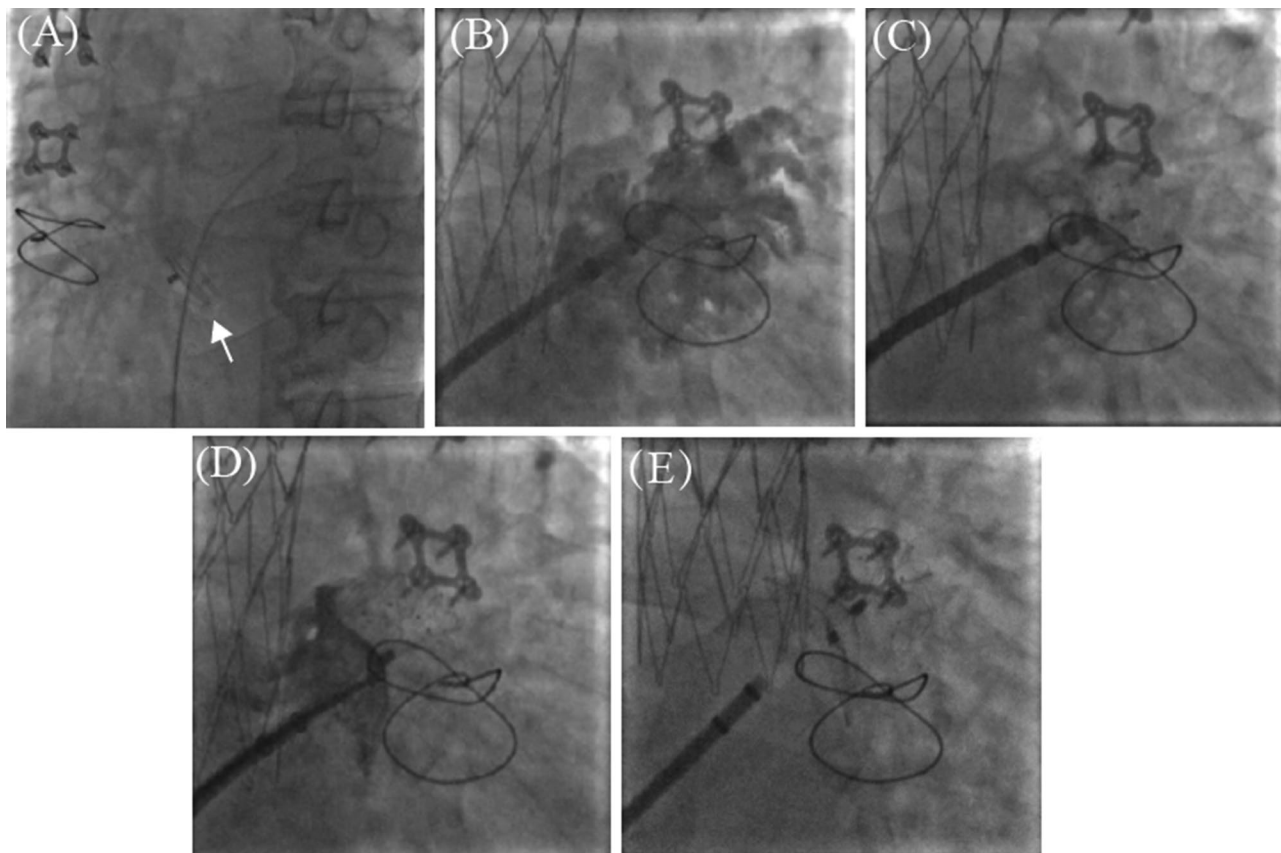


Fig. 3 Fluoroscopy images showed the procedure of LAAC. (A) MPA catheter passed atrial septal through the ISAD. (B) Contrast was injected into LAA. (C) A 30–36 mm LAmbré occluder anchored appropriately. (D) The external disc of the occluder was opened. (E) Occluder was released after confirmation of proper positioning

reported before. For some patients carrying a previously implanted IASD, percutaneous LAAC may be warranted in the future. Patients who undergo the IASD implantation to attenuate HF are usually elderly patients, and they suffer from other cardiovascular complications, including arrhythmia, hypertension, and coronary heart disease, contributing to high CHA₂DS₂-VASc and HAS-BLED score. Therefore, with the increasing cases of IASD implantation, LAAC therapy should be considered for some of these patients.

The structural changes of atrial septal induced by IASD implantation can result in various challenges during future LAAC. Firstly, it was difficult to choose the proper puncture position because the area of the atrial septum was partially occupied by the IASD device. However, according to the IASD (FreeFlow®) implantation, a 5 mm iatrogenic shunt of atrial interatrial septum was made, it provided a channel for left atrial access operations. FreeFlow® is characterized by rapid endothelialization, so it fixed firmly to the atrial septal three months after implantation. Therefore, we decided to perform LAAC through ISAD access. Owing to this approach, unnecessary punctures were avoided resulting in less damage. Besides, for LAA occlusion, the transseptal puncture should be low, in the mid to anterior septum to facilitate engagement of the LAA. Most of the IASDs are implanted in the mid of atrial septum, the subsequent poor coaxiality of delivery sheath would affect the process of closure. In this case, the position of IASD was not high, and the coaxiality was not bad. Additionally, the LAMBRE device would also obtain satisfactory results for cases with poor coaxiality [14–16]. Accordingly, in cases of percutaneous LAAC in patients with previous IASD implantation, an adjustable delivery sheath will facilitate the operation and become a better option. Moreover, patient with IASD implantation always have expansion left atrium and LAA. These enlarged chambers have deeper internal spaces, making it hard for axial localization. Consequently, overly deep placement of the device can lead to incomplete occlusion and must be avoided. Inohara et al. [17]. reported first LAMBRE Closure system implantation experience in North America and also suggested that it could be considered for very large LAAs. In addition, several left atrial accesses operative strategies have been performed in different kind of interatrial devices. For example, with the guidance of intracardiac echocardiography, transseptal puncture catheterization for AF ablation is reported to be a safe and feasible procedure when performed through the native septum adjacent to the amplatzer septal occluder device [18]. Therefore, intracardiac echocardiography may also reduce the difficulty of intervention through the ISAD. Taken together, due to the implantation of IASD, the subsequent change of interatrial septum would affect the operation of LAAC. However, it

can be performed safely and conveniently using the IASD access with a LAMBRE Closure system.

Conclusion

To the best of our knowledge, this is the first reported case of LAAC in patient who previously underwent IASD implantation and from this case, we confirm its technical feasibility. Therefore, for those who develop AF after receiving IVSD implantation and cannot tolerate continuous oral anticoagulants, LAAC can be considered.

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12872-024-03904-0>.

Supplementary Material 1
Supplementary Material 2
Supplementary Material 3
Supplementary Material 4
Supplementary Material 5
Supplementary Material 6
Supplementary Material 7

Acknowledgements

Not applicable.

Author contributions

All authors contributed to the study conception and design. This study was designed by WZP, DXZ and JBG. Material preparation, data collection and analysis were performed by DWL, MFL and ZLW. The first draft of the manuscript was written by DWL and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Funding

National Key R&D Program of China, Grant/Award Number: 2020YFC2008100; Funding Program: Shanghai Clinical Research Center for Interventional Medicine, Grant/Award Number: 19MC1910300.

Data availability

Data sharing not applicable to this article as no datasets were generated or analyzed during the current study.

ETHICS DECLARATIONS.

Declarations

Ethics approval and consent to participate

The study was approved by the Ethics committee of Zhongshan hospital, Fudan University.

Consent for publication

A written informed consent has been obtained from the patient for publication.

Competing interests

The authors declare no competing interests.

Received: 7 October 2023 / Accepted: 25 April 2024

Published online: 06 June 2024

References

1. Osmancik P, Herman D, Neuzil P, Hala P, Taborsky M, Kala P, et al. Left atrial appendage Closure Versus Direct oral anticoagulants in high-risk patients with Atrial Fibrillation. *J Am Coll Cardiol*. 2020;75(25):3122–35.
2. Al-Abcha A, Saleh Y, Elsayed M, Elshafie A, Herzallah K, Baloch ZQ, et al. Left atrial appendage Closure Versus oral anticoagulation in Non-valvular Atrial Fibrillation: a systematic review and Meta-analysis. *Cardiovasc Revasc Med*. 2022;36:18–24.
3. Xipell M, Flores-Umanzor E, Ojeda R, Arias M, Cepas-Guillen PL, Regueiro A, et al. Percutaneous left atrial appendage closure, a safe alternative to anticoagulation for patients with nonvalvular atrial fibrillation and end-stage renal disease on hemodialysis: a single center experience. *Artif Organs*. 2020;44(5):513–21.
4. Kar S, Doshi SK, Sadhu A, Horton R, Osorio J, Ellis C, et al. Primary outcome evaluation of a Next-Generation Left Atrial Appendage Closure device: results from the PINNACLE FLX Trial. *Circulation*. 2021;143(18):1754–62.
5. Du H, Bi K, Xu L, Chen F, Xiong W, Wang Y. Analysis of risk factors for thrombosis of the left atrium/left atrial appendage in patients with non-valvular atrial fibrillation. *Cardiovasc J Afr*. 2021;32(3):116–22.
6. Ntaios G, Perlepe K, Lambrou D, Sirimarco G, Strambo D, Eskandari A, et al. Identification of patients with embolic stroke of undetermined source and low risk of new incident atrial fibrillation: the AF-ESUS score. *Int J Stroke*. 2021;16(1):29–38.
7. van de Vegte YJ, Siland JE, Rienstra M, van der Harst P. Atrial fibrillation and left atrial size and function: a mendelian randomization study. *Sci Rep*. 2021;11(1):8431.
8. Delgado V, Di Biase L, Leung M, Romero J, Tops LF, Casadei B, et al. Structure and function of the Left Atrium and Left Atrial Appendage: AF and Stroke implications. *J Am Coll Cardiol*. 2017;70(25):3157–72.
9. De Rosa R, Schranz D. Creation of a restrictive atrial left-to-right shunt: a novel treatment for heart failure. *Heart Fail Rev*. 2018;23(6):841–7.
10. Kaye DM, Petrie MC, McKenzie S, Hasenfubeta G, Malek F, Post M, et al. Impact of an interatrial shunt device on survival and heart failure hospitalization in patients with preserved ejection fraction. *ESC Heart Fail*. 2019;6(1):62–9.
11. Amat-Santos IJ, Del Trigo M, Bergeron S, Pibarot P, Altisent O, Campelo-Parada F, et al. Left atrial decompression using unidirectional left-to-right interatrial shunt: initial experience in treating symptomatic heart failure with preserved ejection Fraction with the W-Wave device. *JACC Cardiovasc Interv*. 2015;8(6):870–2.
12. Wessler J, Kaye D, Gustafsson F, Petrie MC, Hasenfubeta G, Lam CSP, et al. Impact of Baseline Hemodynamics on the effects of a transcatheter interatrial shunt device in heart failure with preserved ejection fraction. *Circ Heart Fail*. 2018;11(8):e004540.
13. Dujka L, Neuzil P, Reddy V, Mates M, Mraz T, Weichet J, et al. Long-term follow-up of a patient undergoing interatrial shunt device implantation for treatment of heart failure with a preserved ejection fraction. *J Int Med Res*. 2022;50(5):3000605221098178.
14. Gianni C, Anannab A, Sahore Salwan A, Della Rocca DG, Natale A, Horton RP. Closure of the left atrial appendage using percutaneous transcatheter occlusion devices. *J Cardiovasc Electrophysiol*. 2020;31(8):2179–86.
15. So CY, Leung KF, Lam YY, Yan BP. Occlusion of an extremely large left atrial appendage using the Double-LAMBRE technique. *JACC Cardiovasc Interv*. 2019;12(11):1085–7.
16. Huang H, Liu Y, Xu Y, Wang Z, Li Y, Cao K, et al. Percutaneous Left Atrial Appendage Closure with the LAMBRE device for Stroke Prevention in Atrial Fibrillation: a prospective, Multicenter Clinical Study. *JACC Cardiovasc Interv*. 2017;10(21):2188–94.
17. Inohara T, Tsang MY, Lee C, Saw J. Closing gigantic left atrial appendage using a LAMBRE Closure System: first implant experience in North America. *J Cardiovasc Electrophysiol*. 2021;32(1):158–61.
18. Mitacchione G, Curnis A, Forleo GB. Transseptal catheterization of the native septum for atrial fibrillation ablation in presence of septal occluder device: a novel approach with real-time 3D transesophageal echocardiographic guidance. *J Interv Card Electrophysiol*. 2020;59(1):79–80.

Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.