

Initial Experience of Intracardiac Echocardiography-Guided Left Atrial Appendage Occlusion: Report of Six Cases

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Introduction

In recent decades, the incidence of atrial fibrillation (AF) has increased exponentially worldwide.^{1,2} This comorbidity is directly related to cardioembolic events, and oral anticoagulation is considered the gold standard treatment for its prevention. Although oral anticoagulation is effective in preventing ischemic stroke, warfarin is contraindicated in 14% to 44% of patients at risk for cardioembolic stroke; nevertheless, even in eligible patients, only 54% are anticoagulated. Currently, direct-acting oral anticoagulants (DOAC) are preferable as preventive therapy for ischemic stroke; however, the discontinuation rates of these drugs reported in clinical trials, mainly due to intolerance or side effects, vary from 23% to 35%. In patients with a history of hemorrhagic stroke, uncontrolled non-intracranial bleeding, and end-stage chronic kidney disease or dialysis, the use of DOAC is relatively or absolutely contraindicated.

In cases of non-valvular AF, when the aforementioned contraindications to DOAC use are present, left atrial appendage occlusion (LAAO) has shown to be effective as a therapeutic alternative.³ This procedure has been guided and performed using transesophageal echocardiography, which is considered the gold standard. However, services that have incorporated intracardiac echocardiography as an auxiliary tool during catheter ablation for the treatment of AF went on to use this method as a safe and effective alternative to transesophageal echocardiography in LAAO procedures.³⁻⁵

Case reports

Between July 2022 and March 2023, 6 patients underwent intracardiac echocardiography-guided LAAO therapy along with catheter ablation for AF. The mean

age of patients was 74 ± 8 years, and 4 (66.7%) were male. The mean CHA₂DS₂VASC score was 5.2 ± 1.4 , and the mean HASBLED score was 3.2 ± 1.8 . The individual demographic data of the patients as well as the indications for LAAO are displayed in Table 1. The ablation procedures were conducted with electroanatomical mapping and a ViewflexTM intracardiac echocardiography catheter (Abbott, USA), as shown in Figure 1A. We performed measurements of the left atrial appendage (LAA) with intracardiac echocardiography in the left atrium after transseptal puncture with pre- and post-ablation measurements, which showed no differences. Measurements were taken in the left interatrial septum, the left superior pulmonary vein, in the ostium of the left inferior pulmonary vein, and in the mitral annulus inferior to the LAA. The mean procedure times for ablation and LAAO were 72.8 ± 13.7 minutes and 24.7 ± 13.8 minutes, respectively. The contrast volume used was 39.2 ± 24.6 ml. Data from the echocardiography and procedures are displayed in Tables 2 and 3. The procedures were considered successful, and 1 patient had a right femoral artery pseudoaneurysm with conservative treatment.

Discussion

In patients with non-valvular AF, ischemic stroke, in addition to being a feared complication with catastrophic consequences, can be prevented with the use of DOAC. Nonetheless, there are patients who have limitations to the DOAC, as well as patients who, even when using them, have cardioembolic events. For these reasons, LAAO has become an efficient mechanical alternative for preventing ischemic stroke.

Currently, transesophageal echocardiography and fluoroscopy are frequently used to guide LAAO. The main advantage of intracardiac echocardiography-guided LAAO would be avoiding general anesthesia in cases where this procedure is performed alone, in addition to being performed by the interventionist, keeping in mind that it is widely used in AF ablations. Even though the images produced by intracardiac echocardiography have excellent quality and clarity, in some cases, the evaluation of some structures may be limited, especially in enlarged left atria, as in patients with AF. This imaging limitation can generally be overcome by placing the intracardiac echocardiography catheter directly into the left atrium, which is not a limitation, considering that transseptal puncture is a step in this procedure.

Keywords

Atrial Fibrillation; Atrial Appendage; Embolic Stroke; Anticoagulants.

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Table 1 – Demographic data of study patients. CKF: chronic kidney failure; DM: diabetes mellitus; LAA: left atrial appendage; SAH: systemic arterial hypertension; AF: atrial fibrillation; DOAC: direct-acting oral anticoagulants.

Demographic data	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6
Age (years)	79	82	76	80	73	55
Sex	M	F	M	M	M	F
Indication for occlusion	Major bleeding	CKF + major bleeding	Major bleeding	Ischemic stroke with DOAC use	Major bleeding	Cardioembolic event + LAA thrombus
SAH	Yes	Yes	Yes	Yes	Yes	Yes
DM	No	Yes	Yes	Yes	No	No
Vascular disease	Yes	Yes	Yes	Yes	Yes	Yes
Type of AF	Persistent	Persistent	Paroxysmal	Persistent	Persistent	Paroxysmal

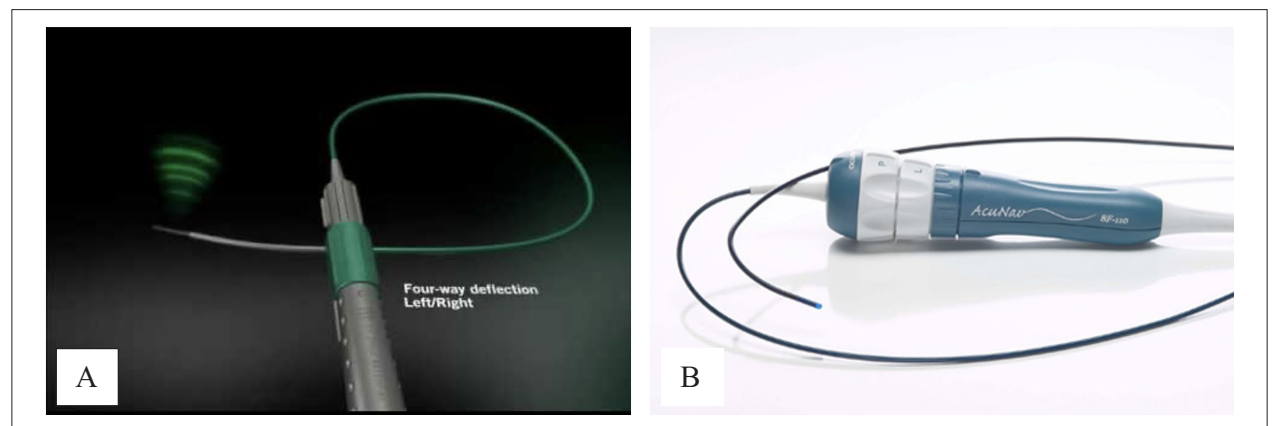


Figure 1 – Models of intracardiac echocardiography catheters. A) Viewflex catheter (ABBOTT™); B) Acunav catheter (Biosense Webster™).

Table 2 – Pre-procedure echocardiographic data of study patients. LA: left atrial; LVEF: left ventricular ejection fraction.

Pre-procedure echocardiographic data	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6
LA diameter (mm)	39	54	39	41.7	42	42
LVEF (%)	59	55	71	67	66	62

The intracardiac echocardiography probe in the left superior pulmonary vein provides a long-axis view of the LAA that is similar to the 0° view on transesophageal echocardiography. With the probe 1 cm proximal to the ostium of the left pulmonary veins, tilted posteriorly (also called retroflexion), a view similar to 45° on transesophageal echocardiography can be obtained, showing the left superior pulmonary vein, the ostium of the LAA, the circumflex artery, and the mitral valve. This view, known as “home view,” is preferred during the procedure (Figures 2 and 3). Another important projection is known as “supramitral” (or inferior) view of the LAA similar to the 135° view on transesophageal echocardiography.⁶

Available clinical studies have shown that intracardiac echocardiography-guided LAAO appears to be non-inferior to transesophageal echocardiography in terms of procedural success, periprocedural complications, and embolic events.^{6,7} A recent meta-analysis, which did not include any prospective randomized studies, with more than 1000 patients analyzed, confirmed that the success rates of the procedures are similar, with a tendency toward a lower rate of procedure-related complications and a lower contrast volume used in patients who received intracardiac echocardiography-guided LAAO compared to transesophageal echocardiography.⁷ Given that intracardiac echocardiography is a monoplanar imaging technique, we recommend that, prior to the procedure, transesophageal echocardiography or computed tomography angiography of the left atrium and LAA should be

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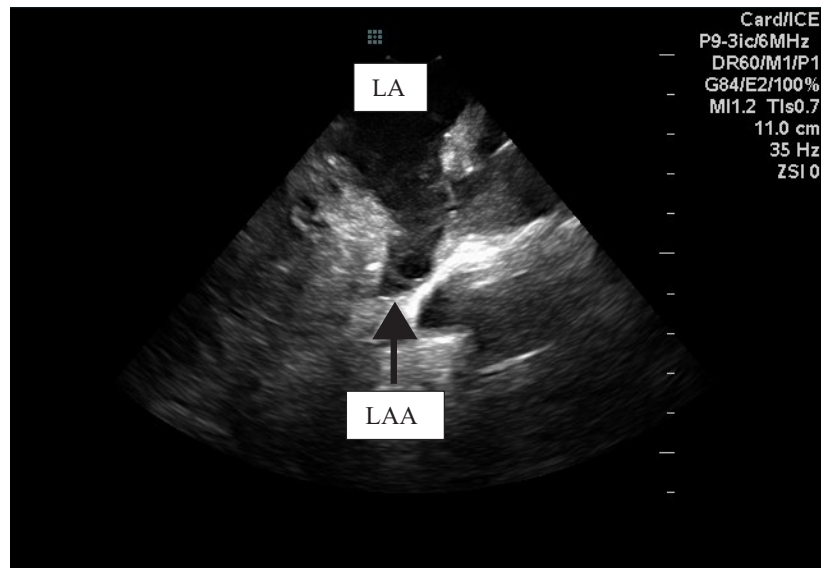


Figure 2 – LAA visualized with an intracardiac echocardiogram probe in the “home view” position, which is positioned on the left side of the interatrial septum (LA). LAA: left atrial appendage; LA: left atrium.

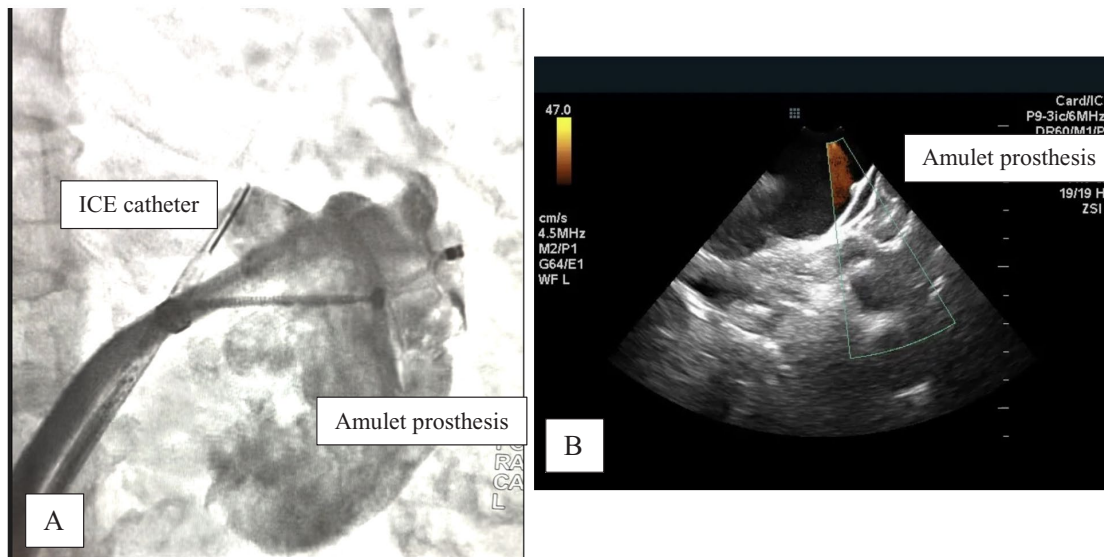


Figure 3 – A: ICE catheter viewed under fluoroscopy in the left “home view” position for final assessment of the LAAO prosthesis before release. B: Final position of the AmuletTM prosthesis after release and Doppler analysis to evaluate periprosthetic leakage. ICE: intracardiac echocardiogram.

performed to rule out the presence of thrombi and to obtain adequate measurement of these structures that will be used to guide the intervention.

In summary, intracardiac echocardiography-guided LAAO shows results and follow-up similar to transesophageal echocardiography. Due to the large volume of LAAO procedures worldwide, new techniques to better integrate this procedure into the standard laboratory routine are important. Intracardiac

echocardiography guidance simplifies the procedure in many cases, avoiding general anesthesia, reducing patient discomfort, and improving and optimizing room usage time. Taken together, the results of several observational studies support the adoption of intracardiac echocardiography-guided LAAO; nonetheless, operators need to master the technique by going through the learning curve necessary to improve and use this complex technique. Our initial experience with use of intracardiac echocardiography as a guide in this procedure was positive,

Table 3 – Procedure data of study patients.

Procedure data	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6
Prosthesis used	Amulet	Amulet	Watchman	Amulet	Amulet	Amulet
Prosthesis diameter	28	28	27	28	25	31
X-ray time (min)	2.4	4.5	4.1	4.4	2.9	5.9
Occlusion time	22	28	23	23	25	27
Contrast volume ml	60	0	35	40	60	40
Hospitalization time	1	3	1	1	1	2
Major complication	Femoral artery pseudoaneurysm	No	No	No	No	No
Minor complication	No	Hematoma	No	No	Hematoma	No

obtaining initial success in all cases, without major acute complications during the procedure or subsequent months. We believe that this is a technique that can be adopted as an option for transesophageal echocardiography in centers with experienced operators.

Author Contributions

Conception and design of the research: Vassallo FS, Serpa HTG, Serpa E; acquisition of data: Vassallo FS, Serpa HTG, Santos LC, Serpa E, Walker BR, Silva E; analysis and interpretation of the data: Vassallo FS, Simões A, Mauro VF; statistical analysis: Vassallo FS; Writing of the manuscript: Vassallo FS, Serpa HTG; critical revision of the manuscript for intellectual content: Vassallo FS, Santos LC, Lovatto CV, Serpa E, Walker BR, Simões A, Carloni H, Mauro VF, Barros G, Silva E, Serpa RG.

Potential Conflict of Interest

Receipt of fees for the left current appendage occlusion procedure by the companies Abbott and Boston.

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Study Association

This study is not associated with any thesis or dissertation work.

Ethics Approval and Consent to Participate

This article does not contain any studies with human participants or animals performed by any of the authors.

References

1. Lippi G, Sanchis-Gomar F, Cervellin G. Global Epidemiology of Atrial Fibrillation: An Increasing Epidemic and Public Health Challenge. *Int J Stroke*. 2021;16(2):217-21. doi: 10.1177/1747493019897870.
2. Wang L, Ze F, Li J, Mi L, Han B, Niu H, et al. Trends of Global Burden of Atrial Fibrillation/Flutter from Global Burden of Disease Study 2017. *Heart*. 2021;107(11):881-7. doi: 10.1136/heartjnl-2020-317656.
3. Holmes DR Jr, Alkhouli M, Reddy V. Left Atrial Appendage Occlusion for The Unmet Clinical Needs of Stroke Prevention in Nonvalvular Atrial Fibrillation. *Mayo Clin Proc*. 2019;94(5):864-74. doi: 10.1016/j.mayocp.2018.09.025.
4. Berti S, Pastormerlo LE, Korsholm K, Saw J, Alkhouli M, Costa MP, et al. Intracardiac Echocardiography for Guidance of Transcatheter Left Atrial Appendage Occlusion: An Expert Consensus Document. *Catheter Cardiovasc Interv*. 2021;98(4):815-25. doi: 10.1002/ccd.29791.
5. Korsholm K, Jensen JM, Nielsen-Kudsk JE. Intracardiac Echocardiography from the Left Atrium for Procedural Guidance of Transcatheter Left Atrial Appendage Occlusion. *JACC Cardiovasc Interv*. 2017;10(21):2198-206. doi: 10.1016/j.jcin.2017.06.057.
6. Berti S, Pastormerlo LE, Santoro G, Brscic E, Montorfano M, Vignali L, et al. Intracardiac versus Transesophageal Echocardiographic Guidance for Left Atrial Appendage Occlusion: The LAAO Italian Multicenter Registry. *JACC Cardiovasc Interv*. 2018;11(11):1086-92. doi: 10.1016/j.jcin.2018.05.008.
7. Ribeiro JM, Teixeira R, Puga L, Costa M, Gonçalves L. Comparison of Intracardiac and Transesophageal Echocardiography for Guidance of Percutaneous Left Atrial Appendage Occlusion: A Meta-Analysis. *Echocardiography*. 2019;36(7):1330-7. doi: 10.1111/echo.14415.



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