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Case report

Ablation of atrial fibrillation in a patient with an interatrial septal occlusion device.

Renee Montesinos-Segura[1,a], **Diego Davila-Flores**[1,a], **Fernando Quevedo-Candela**[1,a], **Mario Cabrera-Saldaña**[2,b], **Pío Zelaya-Castro**[2,b], **Richard Soto-Becerra**[2,b]

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Authors' Affiliation
[1] Instituto Nacional Cardiovascular, INCOR-EsSalud, Lima, Peru.
[2] Arrhythmias Unit, Instituto Nacional Cardiovascular, INCOR-EsSalud, Lima, Peru.
[a] Cardiology resident physician; [b] Electrophysiologist.

Correspondence
Renee Montesinos-Segura
Av. Salaverry 1210, Jesús María, Lima -Perú
mrenee.ms@gmail.com
+51 930437412

E-mail
maria.grande@hospitalitaliano.org.ar

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ABSTRACT

The interatrial septal occluder devices pose challenges for the transeptal approach in atrial fibrillation ablation, making it essential to have image-guided methods for safe transeptal puncture, such as intracardiac echocardiography (ICE). We describe the case of a 49-year-old patient with symptomatic paroxysmal atrial fibrillation, refractory to antiarrhythmic drugs, who had a previously unsuccessful ablation attempt and was carrying an interatrial septal occluder device. Atrial fibrillation ablation was performed using the Carto V7 3D mapping system, and the transseptal puncture was guided by ICE, resulting in a successful procedure. This case report highlights the importance of multimodality imaging to achieve successful and effective transeptal puncture for atrial fibrillation ablation in patients with interatrial septal occluder devices.

Keywords: Heart Septal Defects, Atrial; Septal Occluder Device; Atrial Fibrillation; Catheter Ablation; Echocardiography (source: MeSH-NLM).

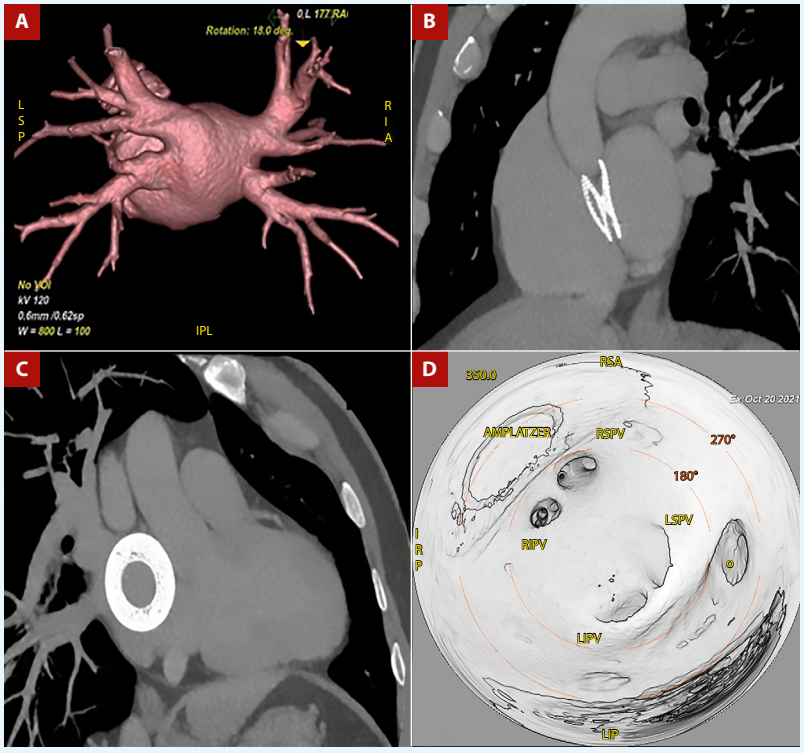
Introduction

The rhythm control strategy is considered ideal for managing symptomatic and recurrent atrial fibrillation (AF) [1]; however, the evidence on the use of antiarrhythmics in patients with congenital heart diseases (CHD), like atrial septal defects, is limited, with low efficacy and adverse effects [2]. Consequently, radiofrequency ablation has emerged as an increasingly used alternative, particularly in patients who do not respond to medical treatment [1]. In patients with CHD and AF, it is common to encounter limitations in venous access and transeptal approaches due to previous surgeries or procedures. Therefore, a profound understanding of cardiac anatomy obtained through echocardiography, magnetic resonance imaging, and/or computed tomography is required [2]. Transeptal puncture in patients with interatrial septal occlusion devices presents technical difficulties; however, it is feasible in most cases [3]. Access is obtained by crossing the native septum or through the device [3]. Due to the challenging nature of this procedure, there have been few reported cases of atrial fibrillation ablation in patients with interatrial septal occluders. We present the report of the first case of atrial fibrillation ablation in a patient with an interatrial septal occluder device at the National Cardiovascular Institute "Carlos Alberto Peschiera Carrillo" (INCOR – acronym in Spanish).

Case report

A 49-year-old male patient with a history of closure of an ostium secundum type interatrial septal defect in 2017, with an Amplatzer interatrial septal occluder device (Nit occlud N° 26). Physical examination showed no relevant findings. The patient experienced tachycardiac palpitations associated with an electrocardiographic record of paroxysmal atrial fibrillation and typical atrial flutter. He was highly symptomatic and refractory to antiarrhythmic therapy, even experiencing adverse effects related to amiodarone use, like hyperthyroidism. Additionally, he had a failed transseptal puncture AF ablation attempt guided by transesophageal echocardiography in 2019. For this reason, anatomical studies were performed prior to the procedure, the findings of which are described in **Figure 1.** We performed atrial fibrillation ablation using radiofrequency with the 3D mapping system Carto V7 (Biosense – Webster, Diamond Bar, California), through a transeptal approach guided by intracardiac echocardiography (ICE). Initially, we positioned the Acunav® ICE catheter in the right atrium to visualize the interatrial septum. Thereafter, we advanced the long SL1 sheath (Swartch Left, Abbott) into the superior vena cava, followed by the transeptal puncture needle (BRK, St. Jude) **(Figure 2).** Initially, the transeptal puncture was guided by fluoroscopy, observing a double bounce, and positioning ourselves at the caudal and anterior part of the Amplatzer device. Subsequently, guided by ICE, we were able to visualize a "tent-like" image over the remaining interatrial septum (IAS). In real-time, we observed the advancement of the needle over the long sheath and the interatrial septum, reaching the left atrium.

Due to the lack of progression of the sheath over the remaining interatrial septum, it was necessary to exchange the transeptal puncture needle with a 0.035" guidewire, passing it towards the left pulmonary veins. With this support, we advanced the long sheath into the left atrium. Due to the difficulty of the approach, we decided to perform the procedure with only one transeptal puncture.



RSPV: right superior pulmonary vein; RIPV: right inferior pulmonary vein; LSPV: left superior pulmonary vein; LIPV: left inferior pulmonary vein.

Figure 1. Cardiac angiotomography. **A.** Presence of four pulmonary veins draining into the left atrium, each with its own ostium. **B-C.** Presence of an occluder device at the interatrial septum level, with a remaining portion in the inferoposterior region where the transeptal puncture was performed. **D.** Endoscopic view of the left atrium showing the interatrial septum with an occluder device and the ostium of the pulmonary veins without anatomical alterations.

We then advanced the high-density mapping catheter PENTARAY (Biosense - Webster, Diamond Bar, California) to perform a three-dimensional anatomical reconstruction of the left atrium and the four pulmonary veins (PVs), followed by the passage of the D-curve ablation catheter with contact force sensor THERMOCOOL SMART TOUCH - SF NAV (Biosense - Webster, Diamond Bar, California). With this catheter, we performed circumferential antral isolation of the four PVs, applying point-to-point radiofrequency ablation using the VISITAG SURPOINT software (Biosense - Webster, Diamond Bar, California). We achieved an ablation index of 400 on the posterior wall and 550 on the anterior wall **(Figure 3).** The electrical activity of both left and right PVs was verified, showing bidirectional block. Additionally, the maneuvers of overstimulation did not induce atrial tachyarrhythmias Finally, we withdrew the ablation catheter towards the right atrium and performed an ablation line along the cavotricuspid isthmus, achieving bidirectional block in this area. The patient was discharged with antiarrhythmic therapy (propafenone 150 mg three times a day and bisoprolol 5 mg once a day) and anticoagulation with warfarin. At the 6-month follow-up, there were no acute complications or recurrences reported.

Discussion

This is the first reported case of AF ablation in Peru in a patient with an interatrial communication occluder device. This procedure is complex because AF ablation requires accessing the left atrium through a transeptal puncture (TSP), which can be single or double, and it is one of the critical steps in this procedure [4]. Usually, the TSP is performed under the guidance of both echocardiography and fluoroscopy [2]. However, TSP in patients with ISA occlusion devices can be challenging due to limited or absent visualization of the interatrial septum,

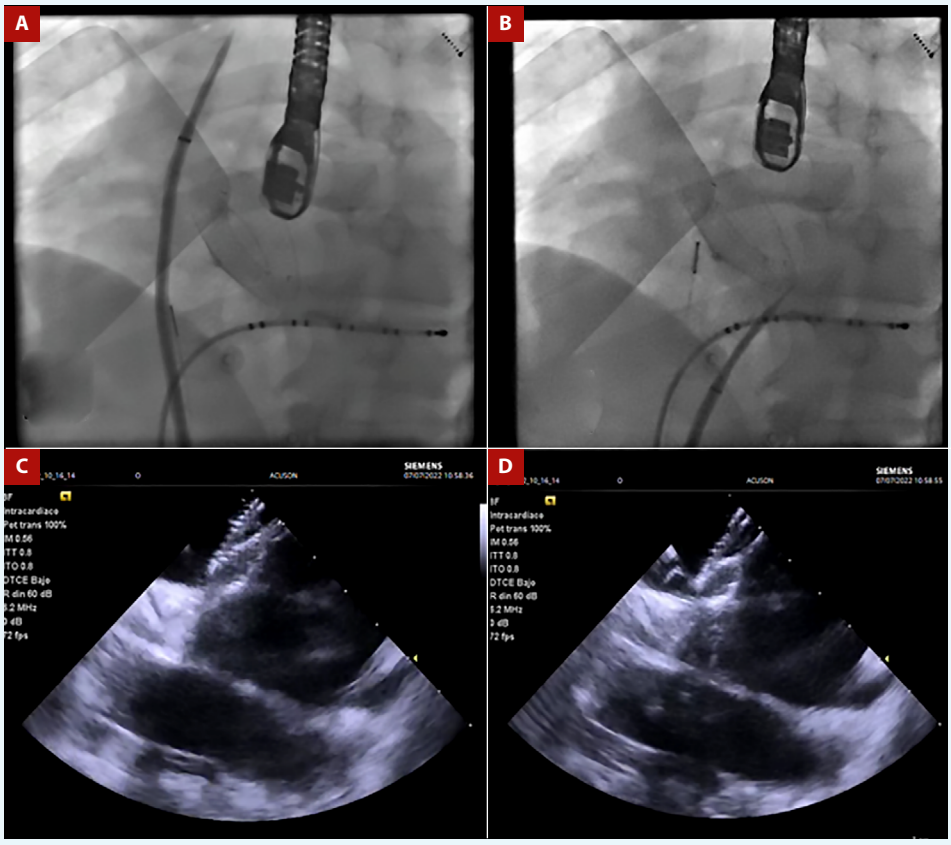


Figure 2. A. Fluoroscopic view in left anterior oblique projection showing the long sheath with the transeptal puncture needle positioned in the superior vena cava. **B.** Presence of the long sheath and the transeptal puncture needle at the posteroinferior edge of the occluder device in the remaining interatrial septum. **C.** Intracardiac echocardiography image showing the remaining interatrial septum in the posteroinferior region and the occluder device. **D.** Presence of a "tent-like" image in the remaining interatrial septum as the needle is about to pass through to the left atrium.

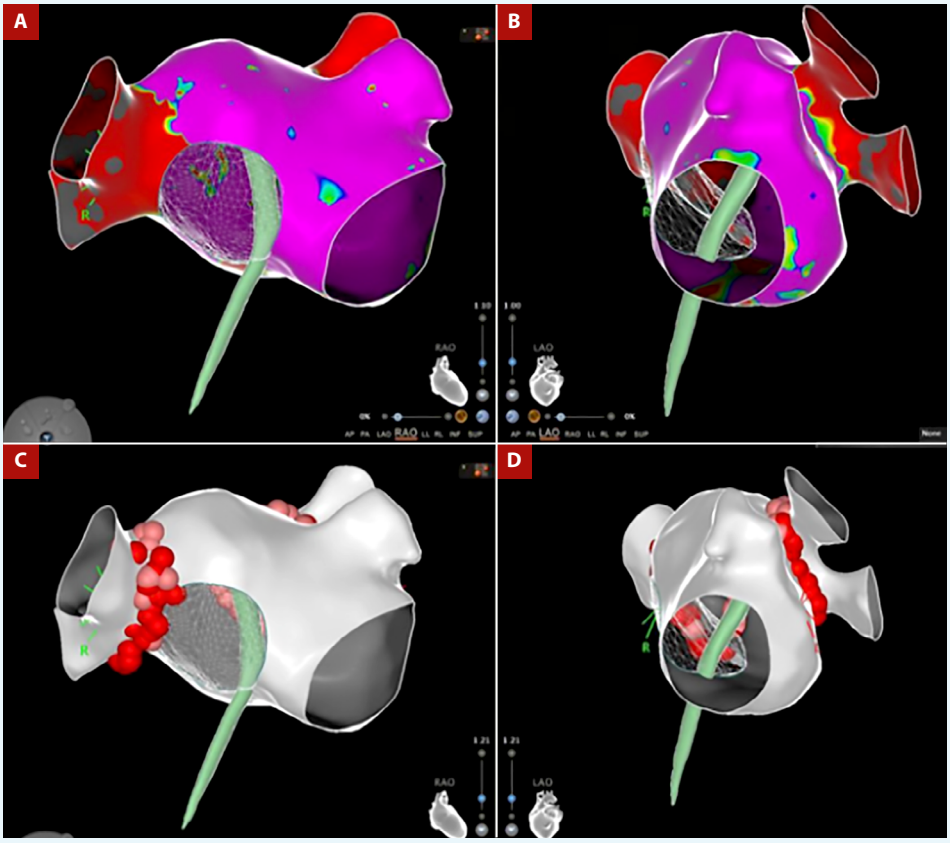


Figure 3. A-B. 3D reconstruction of the left atrium with a voltage map, showing areas of low voltage in the left pulmonary veins indicative of electrical isolation. **C-D.** 3D anatomical reconstruction of the left atrium with an image of the transeptal puncture, where the points of radiofrequency ablation are observed in the circumferential antral region of the four pulmonary veins.

posing a potential risk of complications such as perforation of the posterior wall of the right atrium or the aortic root if the TSP is performed anteriorly or posteriorly, respectively [3,4]. Other complications have also been described, such as device displacement or deformation, inadvertent epicardial puncture, or residual interatrial shunting, which have been reported as infrequent [4,5]. Furthermore, more severe complications such as pericardial effusion and cardiac tamponade have also been reported [6].

The decision regarding the puncture site in the IAS in this patient with an occluder device was based on the findings of the 3D reconstructed tomography performed before the procedure and on ICE guidance during the procedure. If there is sufficient space around the device, it is possible to perform the transeptal puncture (TSP) in the remaining IAS. Otherwise, direct access through the device is necessary, especially in cases with devices ≥32 mm or even ≥26 mm, as per the center's experience [3]. A descriptive study conducted in China found that in most patients, the TSP was performed through the native septum in the posteroinferior region of the device. In patients with no available puncture space, the TSP was performed in the waist of the device [3].

A systematic review on the safety and efficacy of catheter ablation for AF in patients with IAS closure device demonstrated a success rate of 98.4% for TSP guided by ICE and fluoroscopy in the cases reviewed. Additionally, during the follow-up period (6-22 months), there was no recurrence of AF in 77% of the cases [4]. The review also showed that there were no differences in AF recurrence between patients who underwent TSP at the remaining IAS level versus those who had puncture through the device [4]. In our case, a single TSP technique was performed instead of the usual double puncture, reducing the risk of perforation, less device compression, and less catheter interposition, which can complicate 3D reconstruction and PV ablation [4].

The use of ICE is very useful in achieving TSP at specific locations of the IAS [5,7]. In this case, the use of ICE was crucial in guiding the entire TSP through the remaining native septum.

Thus, ICE played a fundamental role in the understanding of the anatomy of the remaining IAS and selecting the puncture site, allowing for a safe procedure and early detection of any potential complications, which fortunately did not occur in this case.

This case report highlights the importance of multi-modality cardiovascular imaging for the planning and execution of AF ablation in patients with IAS occluder devices. Among these modalities, the use of cardiac tomography is crucial in defining the exact anatomical landmarks to consider, enabling successful and efficient transeptal puncture through the guidance of ICE to perform AF ablation.

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