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Dual device intervention for stroke prevention and bradycardia: a case report

Fulvio Cacciapuoti,[1] Salvatore Crispo,[1] Davide D'Andrea,[1] Crescenzo Materazzi,[1] Salvatore Chianese,[1,2] Simona Cotena,[3] Rossella Gottilla,[1] Valentina Capone,[1,2] Ciro Mauro[1]

[1]Department of Cardiology, "Antonio Cardarelli" Hospital, Naples; [2]Department of Advanced Biomedical Sciences, "Federico II" University, Naples; [3]Intensive Care Unit, "Antonio Cardarelli" Hospital, Naples, Italy

Correspondence: Fulvio Cacciapuoti, Division of Cardiology "A. Cardarelli" Hospital, Via A. Cardarelli, 9, 80131 Naples, Italy.
Tel.: +39 081 747 4011. E-mail: fulvio.cacciapuoti@aocardarelli.it

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Abstract

Atrial fibrillation significantly increases the risk of thromboembolic events, necessitating anticoagulation for stroke prevention. However, patients with a history of intracranial hemorrhage pose unique management challenges, particularly regarding the use of anticoagulants and the need for dual antiplatelet therapy following procedures like percutaneous coronary intervention. In addition, the occurrence of bradyarrhythmias often necessitates pacing, underscoring the importance of innovative strategies such as left atrial appendage closure devices and leadless pacemakers to manage atrial fibrillation effectively while minimizing hemorrhagic risks.

A 61-year-old man with permanent atrial fibrillation, recent intracerebral hemorrhage, and bradycardia presented with dizziness and recurrent syncopal episodes. During hospitalization, he underwent coronary angiography and percutaneous coronary intervention with drug-eluting stent placement in the left anterior descending and right coronary arteries. Due to anticoagulation risks, he subsequently underwent left atrial appendage closure with the LAmbre™ device and received an Aveir™ leadless pacemaker. Both procedures were successful, and he was discharged in stable condition.

This case highlights how a combination of left atrial appendage closure, leadless pacing, and coronary intervention provided effective stroke prevention, heart rate control, and ischemic management in a high-risk atrial fibrillation patient. These strategies avoided the prolonged use of anticoagulants while addressing the patient's cardiovascular and hemorrhagic risk.

Key words: atrial fibrillation, left atrial appendage closure, leadless pacemaker, hemorrhagic risk, bradycardia.

Introduction

Atrial fibrillation (AF) is the most common sustained cardiac arrhythmia, affecting millions of individuals worldwide. It is characterized by rapid and irregular heart rhythms, which can lead to significant morbidity and mortality due to an increased risk of thromboembolism and stroke [1]. Patients with AF often require anticoagulation therapy to mitigate this risk, typically managed with direct oral anticoagulants (DOACs) [2]. However, in patients with a history of intracerebral hemorrhage (ICH) or other bleeding disorders, the use of DOACs poses substantial risks, necessitating alternative approaches to stroke prevention that minimize the risk of recurrent bleeding [3,4].

The management of atrial fibrillation becomes particularly complex when patients experience bradyarrhythmias, such as bradycardia or ventricular asystole, often exacerbated by the medications used for rate control, such as beta-blockers [5]. These bradyarrhythmias can lead to debilitating symptoms, including dizziness, syncope, and reduced quality of life. For patients with symptomatic bradycardia who are at high risk for stroke due to AF, a comprehensive and multifaceted treatment strategy is crucial [6].

In this context, left atrial appendage closure (LAAC) has emerged as a valuable alternative to oral anticoagulation. The LAAC procedure effectively reduces the risk of stroke by occluding the left atrial appendage (LAA), where thrombus formation is most likely to occur in patients with AF [7]. Among the devices available for LAAC, the LAmbre™ device has shown promise due to its unique design, allowing for secure closure while minimizing the risk of embolism [8].

Simultaneously, addressing bradycardia in these patients is essential. Traditional pacemaker implantation can be complicated by the increased risk of pocket hematomas, especially in patients already on dual antiplatelet therapy. The advent of leadless pacemakers, such as the Aveir™ system, offers a minimally invasive solution that reduces the risk of infection, pocket-related complications, and lead displacement [9,10]. Moreover, the active fixation mechanism of the Aveir pacemaker enhances its stability and reliability, making it an ideal choice for patients with complex cardiovascular histories [11].

Case Report

A 61-year-old male presented with episodes of dizziness and recurrent syncopal episodes over several weeks. He had a known history of permanent AF and was on rate control due to episodes of AF with a high ventricular response. The patient reported progressively worsening symptoms characterized by lightheadedness and a feeling of impending loss of consciousness. Notably, he had suffered a frontal ICH two months prior, which contraindicated the use of DOACs and placed him at an increased risk of thromboembolic events. Additionally, he

reported episodes of dyspnea during mild exertion, often accompanied by profuse sweating and, occasionally, chest pain. Upon admission, the patient was hemodynamically stable. On auscultation, the cardiac activity was irregular and normal in frequency, with a mean heart rate of 60 bpm. The blood pressure was 130/70 mmHg, and the SpO2 was 97% on room air.

Given his reported symptoms, the patient underwent coronary angiography during hospitalization. This was followed by percutaneous coronary angioplasty for coronary artery disease, which involved the placement of drug-eluting stents in the left anterior descending and right coronary arteries (Figure 1). The recent angioplasty necessitated triple antithrombotic therapy (a combination of anticoagulant and dual antiplatelet therapy) for optimal management. However, this approach was complicated by the patient's history of ICH. The combination of the recent ICH and the need for triple therapy significantly increased his hemorrhagic risk, posing a considerable challenge in developing a safe and effective treatment strategy.

The patient's permanent AF had been diagnosed several years earlier, and he had recently been managed with bisoprolol 1.25 mg daily due to episodes of heart failure caused by high heart rate, to prevent tachycardia-induced cardiomyopathy. The bradyarrhythmias resulting from beta-blocker therapy, combined with the high heart rate from his AF, further complicated his clinical picture. Given his history, bradycardia was identified as a major contributor to his symptoms. Other differential diagnoses included orthostatic hypotension, although the patient denied positional symptoms. Transient ischemic attacks were also considered, but neurological evaluation revealed no focal deficits or signs of recent ischemia. His high stroke risk due to AF, combined with his contraindication to anticoagulants after the cerebral hemorrhage, underscored the need for a definitive treatment plan to prevent future thromboembolic events.

A series of detailed investigations were conducted to assess the patient's cardiac condition. A 48-hour Holter ECG revealed prolonged episodes of ventricular asystole lasting up to 8 seconds, confirming bradycardia as a major contributor to his symptoms.

A transesophageal echocardiogram (TEE) further evaluated the LAA and confirmed the absence of thrombi, supporting the decision to proceed with LAAC.

Considering the patient's significant risk of stroke, bleeding risk, and symptomatic bradycardia, a multidisciplinary team opted for a dual therapeutic strategy: LAAC using the LAmbre™ device (Lifetech Scientific, Shenzhen, China) and implantation of a leadless pacemaker (Aveir™ – Abbott, Chicago, IL, USA). The choice of a leadless pacemaker was further driven by the patient's use of dual antiplatelet therapy, which increased the risk of pocket hematomas associated with traditional pacemaker implantation.

Given the complexity of his case, a contrast-enhanced computed tomography (CT) scan was performed to gather information regarding three key aspects: the condition of his vascular access for device implantation, the dimensions and anatomy of the LAA, and the optimal site for leadless pacemaker implantation. The CT showed adequate vascular access for both procedures, confirmed the absence of thrombus within the LAA, and identified the best location on the interventricular septum for leadless pacemaker fixation (Figure 2). Pre-procedural blood tests revealed a baseline hemoglobin level of 14.3 g/dL, with a slight drop expected due to procedural bleeding risks.

The procedure was performed under general anesthesia, with the patient sedated and intubated. After establishing femoral venous access, the LAAC was performed first. Guided by TEE and fluoroscopy, a transseptal puncture was made to access the left atrium (Figure 3A). A dedicated catheter designed for left atrial appendage access was introduced over the guide wire, facilitating navigation into the LAA. The correct positioning was continuously monitored using TEE to ensure the catheter was optimally placed for the closure procedure (Figure 3B).

The umbrella portion of the LAmbre device was partially deployed at the ostium of the LAA and carefully pushed inward to seal the appendage, ensuring any thrombus was safely displaced into the distal portion of the LAA. The proximal cover was then deployed, effectively closing the LAA. Fluoroscopy and TEE confirmed the correct positioning of the device without residual leaks (Figures 3C, 3D, 4A).

Once the left atrial appendage closure was completed, a 9 French (Fr) introducer was left in the right femoral vein. The Aveir device was connected to its delivery system through the tethers, and four infusion bags (heparinized saline) were connected. A guide wire was advanced into the superior vena cava, and the introducer was replaced with an 18 Fr dilator, subsequently exchanged for a dedicated 25 Fr introducer. Using the 25 Fr introducer, the Aveir pacemaker and its delivery system were advanced to the inferior vena cava.

Prior to fixation, pacing and sensing thresholds were measured to ensure the device's effectiveness. Once optimal thresholds were confirmed, the pacemaker was actively screwed into the septum and detached from the delivery system (Figure 4B). The delivery system and introducer were removed, and manual compression was applied to the right femoral vein for 20 minutes, achieving adequate hemostasis, followed by a compressive bandage for 12 hours.

The procedure was completed without complications. Post-procedural imaging confirmed that both devices were correctly positioned and functioning as intended. The patient was monitored closely for any signs of bleeding or adverse events. His hemoglobin dropped by 1 g/dL (from 14.3 g/dL to 13.2 g/dL), likely due to procedural blood loss; however, this reduction was not clinically significant and did not require intervention.

The patient continued dual antiplatelet therapy with aspirin and clopidogrel, along with bisoprolol 1.25 mg. Anticoagulation was avoided due to his recent frontal cerebral hemorrhage. He was discharged two days after the procedure in stable condition, with follow-up arranged for pacemaker function testing and monitoring for potential thromboembolic events.

Discussion

This case highlights the successful management of a complex patient with permanent atrial fibrillation, contraindications to anticoagulation due to a recent cerebral hemorrhage, and symptomatic bradycardia. LAAC using the LAmbre device was chosen as an effective alternative to oral anticoagulants for stroke prevention. The unique design of the nitinol-based, self-expanding LAmbre device, with its distal umbrella and proximal cover, ensures a secure occlusion of the LAA, shows promising results in terms of efficacy and safety in worldwide different clinical trials offering an alternative to the known Amulet and Watchman closure systems, thereby minimizing the risk of embolism [7]. The partial deployment of the umbrella at the LAA ostium, followed by its inward advancement, helps propel any residual thrombus into the distal portion of the appendage, further reducing stroke risk [8].

Simultaneously, the implantation of the Aveir leadless pacemaker addressed the patient's symptomatic bradycardia, which had resulted from the iatrogenic suppression of heart rate due to bisoprolol [9]. The Aveir leadless pacemaker was selected due to its longer battery life, retrievability, and advantages such as reducing the risk of infection, pocket hematomas, and lead displacement [10]. The Aveir system also features active fixation, allowing the pacemaker to be securely screwed into the interventricular septum, rather than passively anchored. Moreover, Aveir includes a dedicated removal device, enhancing its retrievability if necessary. [11]. The pre-procedural contrast-enhanced CT played a crucial role in planning the intervention, guiding both the LAAC and pacemaker implantation by assessing vascular access, LAA anatomy, and identifying the optimal site for device placement.

The patient's periprocedural haemoglobin drop, although modest, was closely monitored and did not have significant clinical implications. The combination of echo-guided LAAC and leadless pacemaker implantation proved to be an effective strategy for managing this high-risk patient, addressing both stroke prevention and heart rate control in a minimally invasive manner [12,13].

Conclusions

This case exemplifies a successful and innovative approach to managing a patient with permanent atrial fibrillation, who presented with significant clinical challenges due to an

elevated hemorrhagic risk from a prior intracerebral hemorrhage and intolerance to beta blockers. The combination of left atrial appendage closure using the LAmbre device and leadless pacemaker implantation with the Aveir system offered a comprehensive solution to address both stroke prevention and symptomatic bradycardia without resorting to long-term anticoagulation or further beta-blocker therapy.

The strategic use of advanced imaging for pre-procedural planning was crucial in ensuring the safety and efficacy of both interventions, ultimately reducing the patient's risk of thromboembolic events while effectively managing bradyarrhythmia. This case underscores the importance of tailoring treatment strategies to individual patient needs through a multidisciplinary approach, particularly in complex cases involving pharmacological contraindications.

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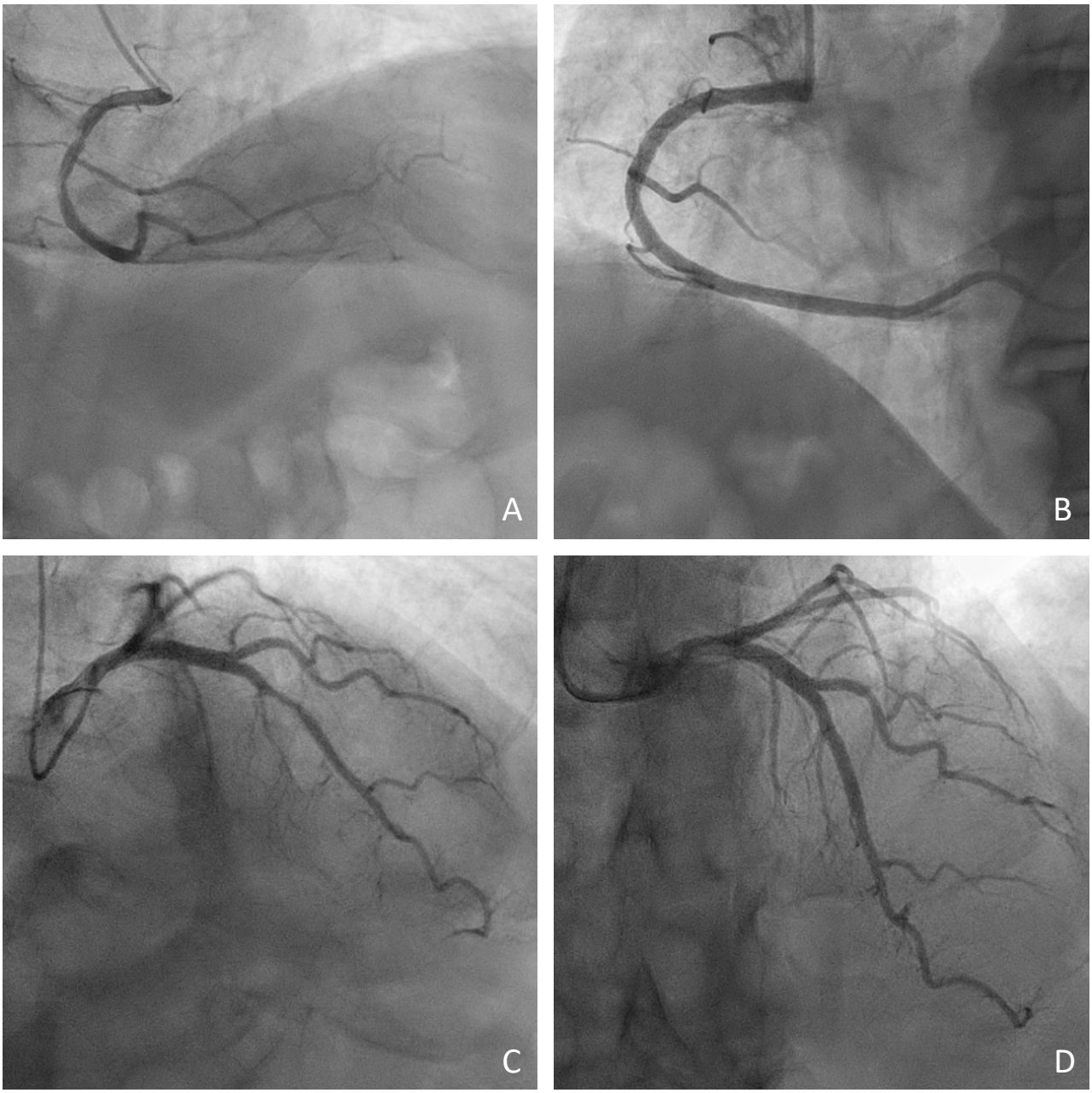

Figure 1. Coronary angiogram showing the stenosis in left anterior descending and right coronary arteries (A and C). Post-procedure results (B and D).

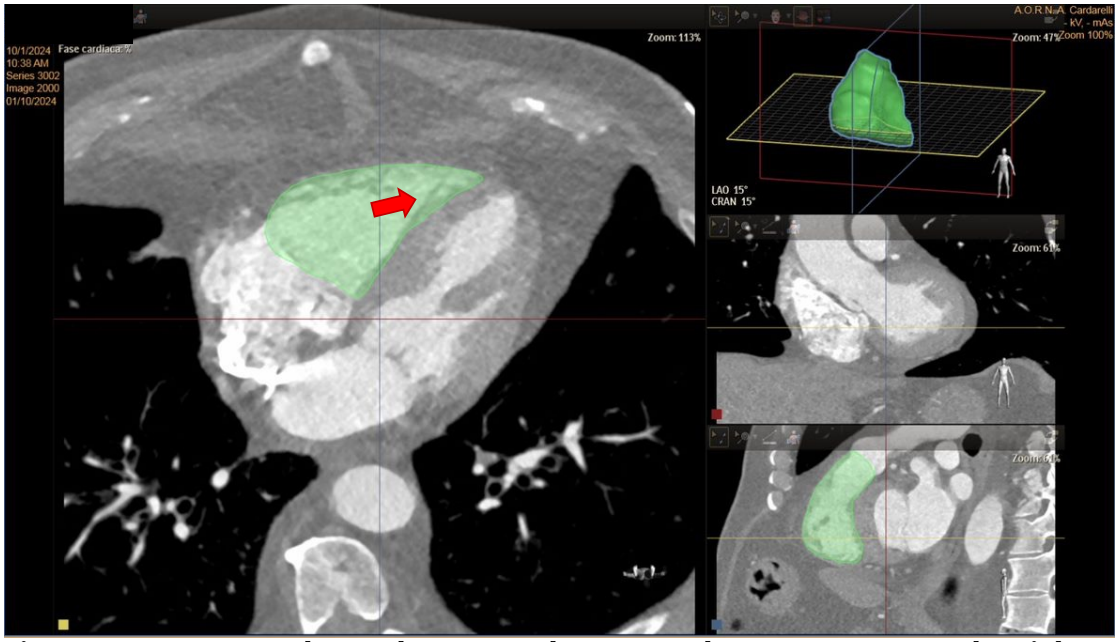

Figure 2. Contrast-enhanced computed tomography scan. In green the right ventricle. The arrow indicates the optimal site on the interventricular septum for the implantation of the Aveir pacemaker.

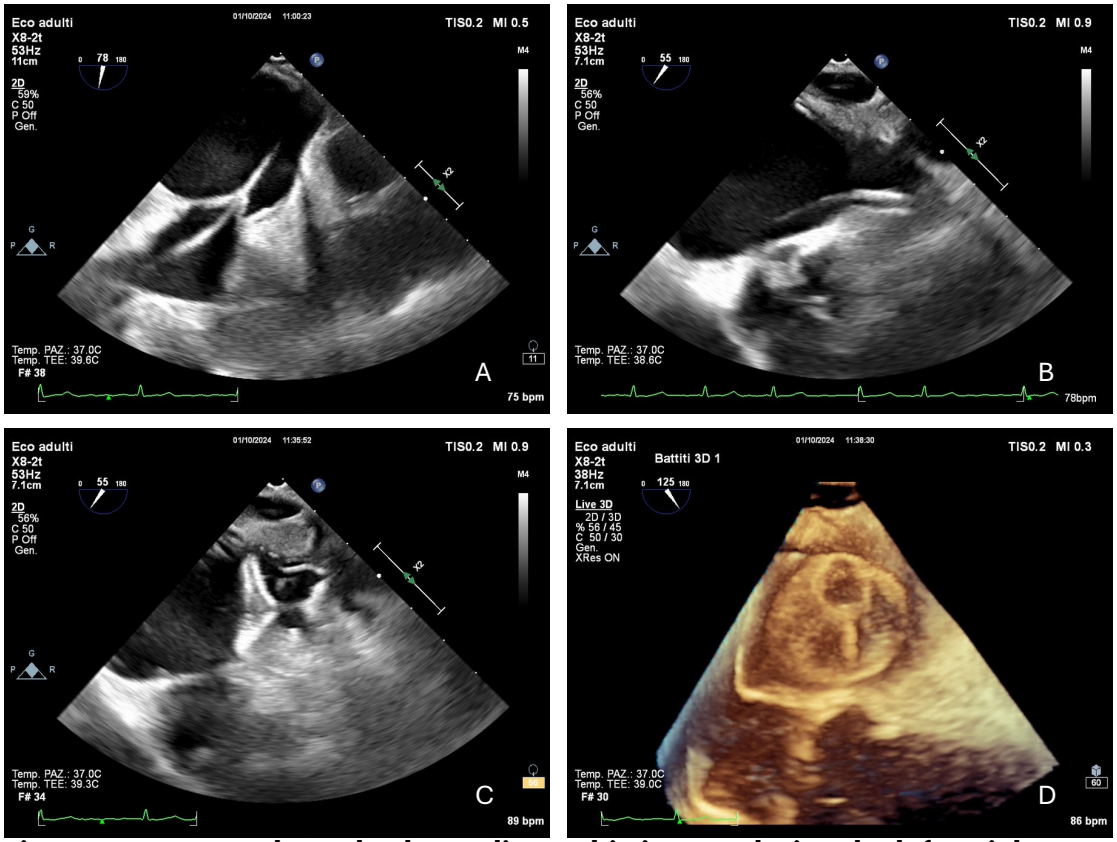

Figure 3. Transesophageal echocardiographic images during the left atrial appendage closure procedure. A) Visualization of the transseptal puncture site at the fossa ovalis, confirming access to the left atrium; B) catheter positioned within the left atrial appendage prior to deployment of the LAmbre device; C) deployment of the distal umbrella of the LAmbre device at the ostium of the LAA; D) complete deployment of the LAmbre device, demonstrating effective occlusion of the LAA (3-D echo).

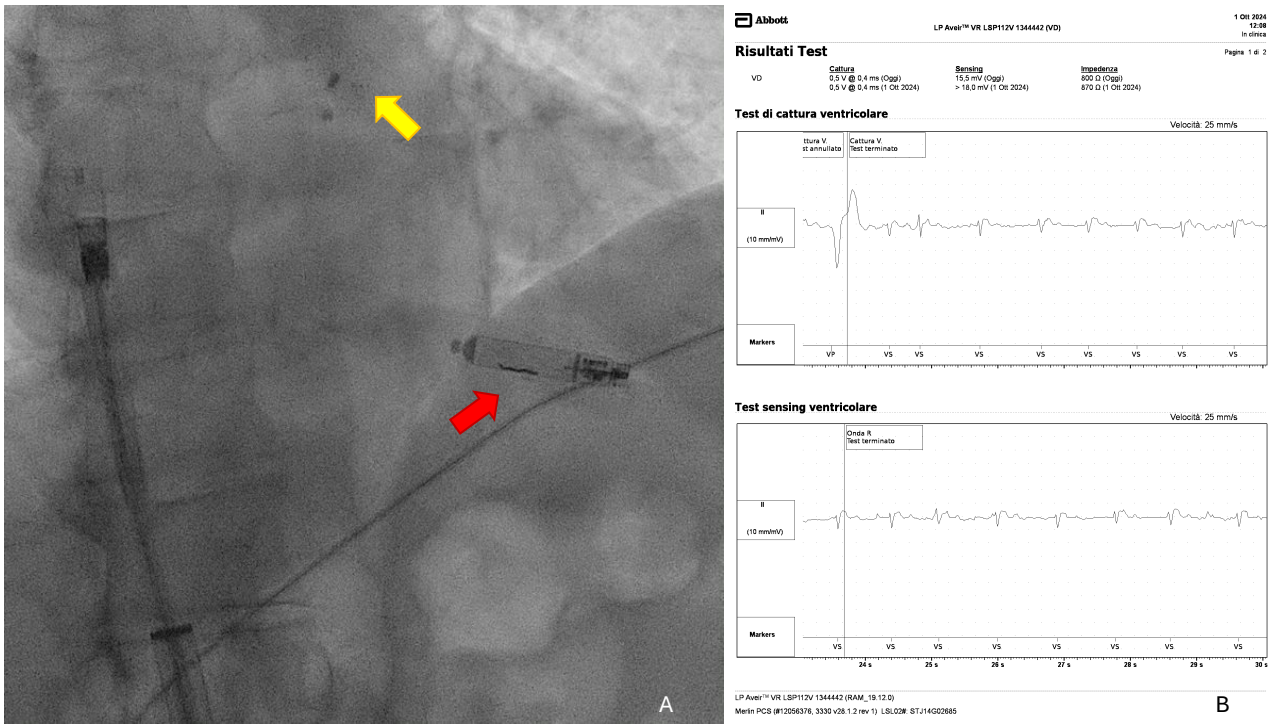

Figure 4. A) Post-procedural imaging confirming the successful placement of both the left atrial appendage closure device (yellow arrow) and the leadless pacemaker (red arrow). The image demonstrates the proper positioning of both devices; B) intraprocedural testing of the leadless pacemaker following implantation. Pacemaker's sensing and pacing thresholds are being evaluated to confirm optimal functionality and effective cardiac stimulation.