THE TEXAS HEART INSTITUTE® JOURNAL

Case Reports

Accidental Left Ventricular Placement of a Leadless Micra Pacemaker Through a Patent Foramen Ovale

Hamza Alkowatli, MD[1]; Mahmoud Kutmah, BA[2]; Adnan Shaik, BA[2]; Osama Hallak, MD[3]

[1]Department of Internal Medicine, HCA Florida Blake Hospital, Bradenton, Florida
[2]University of Missouri-Kansas City School of Medicine, Kansas City, Missouri
[3]Department of Cardiovascular Medicine, Kettering Health, Kettering, Ohio

Abstract

The Micra device is a leadless pacemaker implanted in the right ventricle via a femoral vein transcatheter approach. There are several indications for and advantages to using a leadless pacemaker, and the device's role in the field of cardiology will probably continue to increase. This article presents the case of a rare complication probably due to inadvertent placement of the device in the left ventricle across an undiagnosed patent foramen ovale.

Keywords: Pacemaker, artificial; heart septal defects; foramen ovale, patent

Case Report

Presentation and Physical Examination

A 92-year-old man presented with an acute-onset right-sided facial droop, expressive aphasia, and right upper extremity weakness. At the time of arrival, his blood pressure was found to be clinically significantly elevated at 210/82 mm Hg. The patient was also found to be in atrial fibrillation (AF) with rapid ventricular response, with a heart rate in the 150s/min. On examination, he was found to have right-sided neglect, left gaze deviation, right-sided weakness, severe aphasia (expressive and receptive), clinically significant dysarthria, and confusion. His initial National Institutes of Health Stroke Scale score was 24, and his Alberta Stroke Program Early CT Score was 10/10.

Medical History

The patient had a history of sick sinus syndrome status post Medtronic Micra leadless pacemaker placement 1 year before admission. The patient also had a history of paroxysmal AF, hypertension, and normal pressure hydrocephalus status post ventriculoperitoneal shunt placement. The patient was not on anticoagulation therapy because of his inability to tolerate it in the past, despite his elevated congestive heart failure, hypertension, age ≥75 years, diabetes, stroke or transient ischemic attack, vascular disease, age 65-74 years, and sex category score.

Differential Diagnosis

Computed tomography scanning of the head and neck was notable for occlusion of the posterior division of the M2 division of the left middle cerebral artery. A 2-dimensional transthoracic echocardiogram demonstrated an ejection fraction of 55% to 60%, a moderately dilated left atrium, a negative agitated bubble study, and a hyperechoic

Citation: Alkowatli H, Kutmah M, Shaik A, Hallak O. Accidental left ventricular placement of a leadless Micra pacemaker through a patent foramen ovale. *Tex Heart Inst J*. 2025;52(1):e238303. doi:10.14503/THIJ-23-8303
Corresponding author: Osama Hallak, MD, Department of Cardiovascular Medicine, Kettering Health, Main Campus, 3535 Southern Blvd, Kettering, OH 45429 (osamaohallak@gmail.com)

object of unclear etiology in the left ventricular (LV) apex (Fig. 1). Upon review of a prior chest computed tomography scan, a metallic object was identified in the LV apex (Fig. 2). A follow-up transesophageal echocardiogram was performed that confirmed these findings (Fig. 3) and also revealed a trivial patent foramen ovale (PFO) (Fig. 4). No evidence of thrombus was noted in the left atrial cavity or appendage.

Technique

When the patient was determined to be in the appropriate time window and have no contraindications, he received intravenous alteplase. He was subsequently taken for an angiogram with thrombectomy and transferred to the intensive care unit for postprocedural care. The patient was placed on aspirin and atorvastatin, with diltiazem

Key Points

- This case highlights the importance of evaluating preprocedural cardiac anatomy to ensure successful implantation, keeping in mind the high prevalence of patent foramen ovale in the general population.
- This case illustrates the need for multiple modalities, including orthogonal fluoroscopic views, to ensure the correct placement of intracardiac devices.
- This report acknowledges that a leadless pacemaker is an unlikely source of increased thrombogenicity based on current data.

Abbreviations

AF, atrial fibrillation
LV, left ventricular
PFO, patent foramen ovale

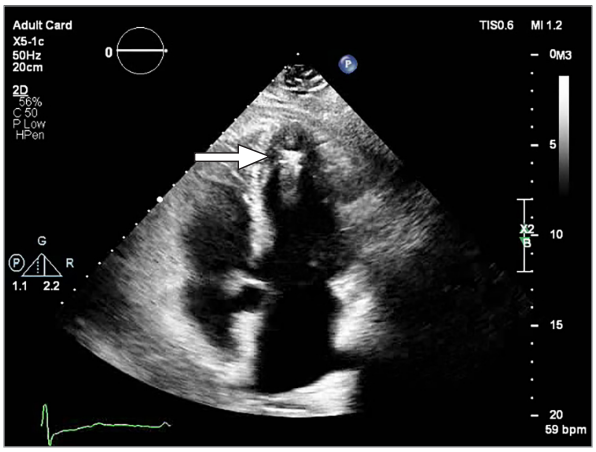

Fig. 1 Transesophageal echocardiogram in an apical 4-chamber view demonstrates a hyperechoic object suspected to be the leadless pacemaker (arrow) in the left ventricular apex.

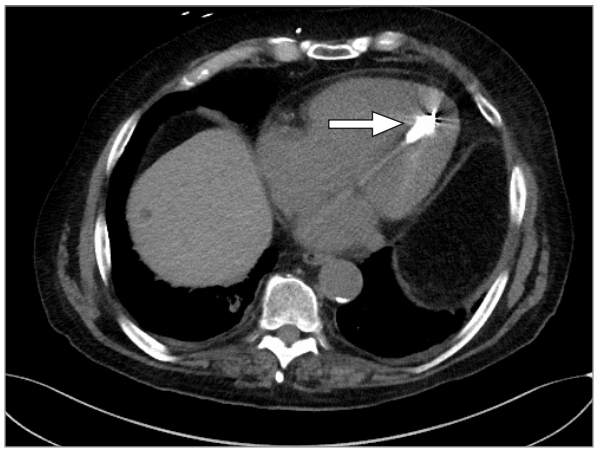

Fig. 2 Chest computed tomography scan reveals a hyperdensity in the left ventricular apex (arrow).

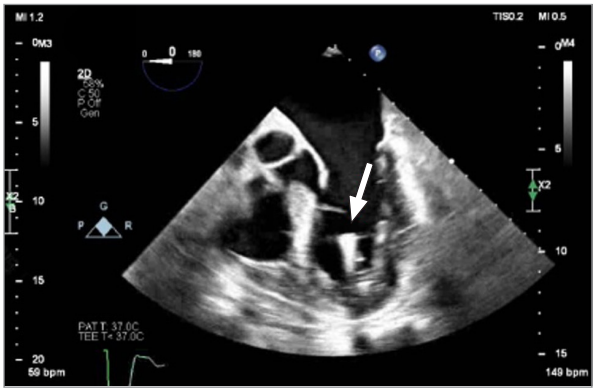

Fig. 3 Transesophageal echocardiogram confirms a hyperechoic object, correlating with computed tomography images, in a focused left ventricle apical view. The object was suspected to be the leadless pacemaker in the apex of the left ventricle (arrow).

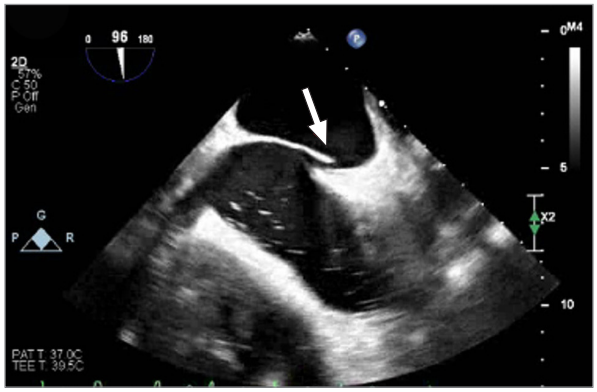

Fig. 4 Transesophageal echocardiogram in the bicaval view demonstrates a patent foramen ovale with a minimal small shunt, consistent with a trivial defect (arrow).

and a nicardipine infusion for the management of his AF and hypertension. Five days after alteplase administration, apixaban was initiated for lifelong anticoagulation because the patient was deemed to be too high risk for removal of the leadless pacemaker and preferred a conservative approach. Of note, during this admission the patient went in and out of AF with rapid ventricular response and normal sinus rhythm. He was given a loading dose of intravenous amiodarone, then switched to an oral form before discharge.

Outcome

By the end of hospitalization, the patient had shown marked improvement in his neurologic status, with almost full recovery of his aphasia and near normalization of his motor and cranial nerve deficits.

Latest Follow-Up

The patient subsequently underwent placement of a dual-chamber pacemaker because of symptomatic atrioventricular dyssynchrony related to the leadless pacemaker. He continues to have mild aphasia but is otherwise doing well.

Discussion

The Micra device is a single-chamber leadless pacemaker designed to be implanted through a minimally invasive approach, commonly via the femoral vein. Leadless pacemakers provide several advantages over transvenous pacemakers with leads, such as the elimination of complications such as pocket hematomas, pocket infections, and lead fractures.[1] In rare instances, their use may be complicated by myocardial and vascular perforations; however, a 2016 study showed no reported dislodgements in a cohort of 725 patients.[2] Left ventricular misplacement is a rare complication that can theoretically occur through iatrogenic perforation or a congenital septal defect. Given this unique case of LV placement of a Micra device, this article describes the diagnosis and management of this novel situation.

There have been 4 documented instances of LV placement of a Micra device, 2 of which were intentional LV placement due to congenital heart disease, including transposition of the great arteries and a single-ventricle heart.[3,4] Another case was due to interatrial septal perforation during device implantation.[5] The final case was due to inadvertent crossing of a PFO.[6] Given the rarity of device dislodgement,[2] misplacement of the device through an undiagnosed PFO probably led to the current findings, similar to those of Martinez et al.[6] Given the high prevalence of undiagnosed PFOs in the general population, it may be prudent to evaluate preprocedural anatomy because indications for the leadless pacemaker increase with its use.[6] Device interrogation may reveal elevated thresholds, which should prompt further investigation into positioning and fixation of the device, especially in patients with known scar tissue in the left ventricle from prior ischemic events. This complication can also be avoided by using multiple imaging modalities, including fluoroscopy and ultrasound, both of which are noninvasive and readily available, to confirm device position. In the 2 previously reported cases of inadvertent placement in the left ventricle, both patients underwent sternotomies and surgical removal of the leadless pacemakers to prevent injury to the mitral valve during attempted percutaneous extraction in 1 case[6] and to prevent systemic embolic events in the other.[5] The patient described in this case report was much older and opted for conservative management, given his need for long-term anticoagulation for AF. Given the rarity of this occurrence, there is no official guidance, and these decisions should be made using a heart team approach.

Because evidence about the thrombogenicity of leadless pacemakers is lacking and this patient had received alteplase before undergoing transesophageal echocardiography, which excluded any source of intracardiac thrombus in this case, it would be difficult to claim with certainty that the patient's condition was related to the misplaced device or his underlying AF. The patient had a normally functioning left ventricle with no apical aneurysm or other cause for sluggish flow, and the device, which had been placed more than a year before, had probably endothelialized,[7] lowering its thrombogenicity. After a thorough discussion among the heart team, the decision was made to restart anticoagulation based on the patient's preference and his high risk for surgical extraction. Because of symptomatic atrioventricular dyssynchrony months later, the patient ultimately underwent dual-chamber pacemaker implantation.

This case highlights the importance of evaluating cardiac anatomy with the use of saline contrast studies, color Doppler ultrasonography, and orthogonal fluoroscopic views to ensure successful implantation and prevent such complications, especially in complex patients with septal defects.

Article Information

Published: 24 June 2025

Author Contributions: : H. Alkowatli and O. Hallak contributed to the conception and design of the case report. H. Alkowatli, M. Kutmah, and A. Shaik were involved in data collection and drafting the manuscript. O. Hallak and H. Alkowatli critically revised the manuscript for important intellectual content and supervised the project. All authors reviewed and approved the final manuscript.

Conflict of Interest Disclosures: The authors have no conflicts of interest to disclose.

Funding/Support: No external funding or financial support was received for this study.

References

1. Groner A, Grippe K. The leadless pacemaker: an innovative design to enhance pacemaking capabilities. *JAAPA*. 2019;32(6):48-50. doi:10.1097/01.JAA.0000554750.85170.d4
2. Reynolds DW, Ritter P. A leadless intracardiac transcatheter pacing system. *N Engl J Med*. 2016;374(26):2604-2605. doi:10.1056/NEJMc1604852
3. Dunne L, Breatnach C, Walsh KP. Systemic ventricular implantation of a leadless pacemaker in a patient with a univentricular heart and atrioventricular node calcification. *HeartRhythm Case Rep*. 2020;6(5):265-267. doi:10.1016/j.hrcr.2020.01.008
4. Shah RS, Davidson WR Jr, Samii SM. Leadless pacemaker implantation in a subpulmonic left ventricle in a patient with congenitally corrected transposition of the great arteries. *HeartRhythm Case Rep*. 2022;8(7):471-474. doi:10.1016/j.hrcr.2022.03.012
5. Ranka S, Sheldon SH, Downey PS, Noheria A. A case of leadless pacemaker in the left ventricle with cardioembolic stroke. *JACC Clin Electrophysiol*. 2021;7(4):563-564. doi:10.1016/j.jacep.2021.01.002
6. Martinez L, Wu A, Salehi A. Unintentional placement of a leadless pacemaker in the left ventricle. anesthesiologynews.com. 2023. Accessed January 23, 2024. https://www.anesthesiologynews.com/PrintArticle/69858
7. Borgquist R, Ljungström E, Koul B, Höijer C. Leadless Medtronic Micra pacemaker almost completely endothelialized already after 4 months: first clinical experience from an explanted heart. *Eur Heart J*. 2016;37(31):2503. doi:10.1093/eurheartj/ehw137