CASE REPORT

Leadless pacemaker dislodgment: Difficulty in release as a predictor for dislodgment and tools for successful retrieval

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Introduction

Leadless pacemakers (LPs) are an attractive option in many cases because of the elimination of several complications associated with transvenous pacemakers and leads. The LEADLESS II–phase 2 trial[1] demonstrated the safety and efficacy of the AVEIR VR (Abbott, Chicago, IL) helix-fixation LP system. We present a case of a 76-year-old man who developed complete heart block after transcatheter aortic valve replacement (TAVR). After shared decision making, the patient underwent AVEIR VR LP placement. Immediately after implantation, the device had dislodged. We detail a stepwise approach for retrieval, highlighting potential reasons for premature device migration and key points for successful implantation.

Case report

A 76-year-old man with history of systemic hypertension, diabetes mellitus, atrial fibrillation, and symptomatic severe aortic stenosis with preserved left ventricular function. His baseline electrocardiogram showed atrial fibrillation with controlled rate, right bundle branch block, and left anterior fascicular block. He was admitted electively for TAVR and counselled regarding the high risk of conduction system involvement during the procedure and need for permanent pacemaker implantation. He underwent TAVR with Edwards SAPIEN 3 (size 23 mm) valve. The procedure was complicated by complete heart block, and the patient was dependent on the temporary pacemaker. A shared decision making with the patient led to the choice of LP implantation over a transvenous system. The patient was taken for AVEIR VR LP right ventricular endocardial pacemaker implantation in the electrophysiology laboratory.

KEYWORDS Leadless pacemaker; AVEIR; Dislodgment; Retrieval; Snaring

(Heart Rhythm O^2 2024;5:739–740)

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KEY FINDINGS

- Leadless pacemaker device dislodgment is considered a rare but well-recognized complication, with growing experience in real life being reported, including different potential predictors and tools for retrieval.
- In our reported case, the risk of dislodgment potentially increased by difficulty in device release, requiring multiple maneuvers including redocking of the device.
- Simple snaring tools can be used to capture and retrieve the AVEIR leadless pacemaker.

The device was meticulously advanced into the right ventricle using standard techniques, employing a stiff wire, sequential groin dilatation, a 27-F sheath, and the standard VR delivery system. Iodine contrast dye facilitated the identification of the interventricular septum. Predeployment, R-wave sensing measured 5.5 mV, with evidence of adequate injury. Deployment followed the standard helix fixation technique, placing the device in a mid-interventricular septal position under fluoroscopy guidance. The device was securely fixed with 1.5 turns, achieving appropriate injury current, R-wave sensing measured 9.0 mV, and a pacing threshold of 1.7 V at 0.5 ms. Fixation validation involved deflecting of the delivery catheter 30°–45° while observing device movement, and impedance increased from 300 to 360 Ω after a suitable waiting period. After confirming that position, stability, and electrical characteristics were favorable, we proceeded with device release. The tether cables in AVEIR are released from the docking button by rotating a small knob on the back end of the handle, which misaligns the cables sufficient for their release from the anchoring points. Upon the initial attempt for device release, the tether did not immediately detach, requiring use of several maneuvers such as "jiggle" maneuver, minor deflection/change in delivery cable orientation, and advancement of protective sleeve, which all failed to detach the LP. The LP was docked again into the delivery cable and undocked. After confirming no change in LP

https://doi.org/10.1016/j.hroo.2024.08.010

position and pacing parameters, the tether detached easily and device was released.

After several minutes, loss of capture prompted fluoroscopy, revealing device dislodgment into the left pulmonary artery (PA), with docking knob being distal in orientation.

The sheath-and-snare technique was used for device extraction, as the AVEIR extraction tool would not reach to the dislodged device in the left PA. This involved introducing a medium curve 8.5-F steerable sheath (Agilis NxT, St Jude Medical, St Paul, MN) through the 27-F AVEIR introducer sheath and advancing it into the right atrium using a 0.032-mm wire. The sheath was deflected into the right ventricle, and the Radiofocus guidewire M (angled 0.018 mm, Terumo, Tokyo, Japan) was advanced into the left PA (Online Supplemental Video 1). The Terumo wire was exchanged with the 0.032-mm wire and placed distal to the dislodged LP. The EN Snare Endovascular Snare (7 F, 120 cm, 18–30 mm, Merit Medical, South Jordan, UT) was used to capture the LP from the helix and pulled into the deflectable sheath (Online Supplemental Video 2). This was favored over the gooseneck snare, targeting the distally oriented docking button of the device to minimize the risk of injury by the free helix. Subsequently, the device was safely retrieved into the outer sheath and exteriorized from the femoral vein, and hemostasis was maintained by a figure-of-eight suture (Online Supplemental Video 3). A bedside echocardiogram excluded any pericardial effusion. After retrieval, the AVEIR LP delivery system and tether function were examined, and we consulted the manufacturer support; no obvious defect or malfunction was identified. The patient underwent new device implantation using the standard technique, with no complications. A transthoracic echocardiogram on the next day ruled out pericardial effusion, and device interrogation yielded normal results. In outpatient follow-up, the patient reported feeling well, with no device-related complaints.

Discussion

AVEIR is the second actively implanted LPs system since it gained Food and Drug Administration approval in April 2022. There are several reports of dislodged LP retrieval, but most are related to the Micra Medtronic device.[2,3] There have been few reports of AVEIR retrieval using gooseneck snare and double snares.[4–6] Predictors of dislodgment in reported cases included low current of injury at the implant site and low postdeployment impedance. In our case, there was significant difficulty in releasing the device, requiring use of multiple maneuvers and ultimately necessitating docking of the LP before reattempting release. Although fluoroscopic markers and device parameters were unchanged from the status before the initial release attempt, the force exerted on the myocardial fixation site with all the repeated maneuvers, specifically redocking, could have resulted in compromising the fixation by the wiggling effect. When facing a similar degree of difficulty in releasing the LP, reaching all the way to redocking, it would be prudent to consider unscrewing the LP from that site and deploying at a different site to minimize the risk of dislodgment.

Conclusion

This case underscores the significance of difficulty in release and redocking as predictors for LP dislodgment. When faced with such a scenario, unscrewing and deploying at a different site would be prudent. We also describe the method and tools to capture and retrieve the AVEIR LP when the docking button is wedged distally in the PA.

Funding Sources: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Disclosures: All authors have no conflicts of interest to disclose.

Authorship: All authors attest they meet the current ICMJE criteria for authorship.

Patient Consent: The authors confirm that written consent for submission and publication of this case report, including image and associated text, has been obtained from the patient in line with COPE guidance.

Ethics Statement: The research reported in this article adhered to CARE case report guidelines.

Appendix

Supplementary data

Supplementary data associated with this article can be found in the online version at https://doi.org/10.1016/j.hroo.2024.08.010.

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