

Implantation of a leadless pacemaker via left subclavian vein following transvenous pacemaker extraction



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Introduction

The Micra leadless pacemaker (Medtronic, Minneapolis, MN) is a ventricular pacing system that is deployed via the femoral vein in standard practice. There have been instances of device deployment via the right internal jugular vein when femoral vein access is unavailable. We present the feasibility of implantation via a left subclavian vein approach, in a patient with occluded/atretic lower limb veins who required dual-chamber pacemaker extraction.

Case report

A 25-year-old man with Down syndrome, congenital aortic stenosis, aortic coarctation, atrial septal defect, and history of a Ross procedure with atrial septal defect and coarctation repair presented to an outside facility with a pocket infection. At the age of 5, the patient received an epicardial pacemaker for complete heart block. The patient later received a dual-chamber transvenous pacemaker in 2009 (age 15), followed by a generator change in 2018, which was complicated by local pocket infection but showed no evidence of systemic infection. Blood cultures were negative at initial presentation and throughout his course. The patient had sinus rhythm with complete heart block and no underlying escape rhythm.

Electrophysiology consultation at the outside facility recommended extraction of the transvenous system and implantation of a leadless pacemaker. However, a venogram revealed occlusion of the left and right external iliac veins, and the lower half of the inferior vena cava (IVC) could not be visualized (Figure 1).

Further delineation at the outside facility with computed tomography angiography revealed chronic occlusion or

KEY TEACHING POINTS

- Leadless pacemaker implantation can be done safely via a left subclavian vein approach when traditional femoral vein access is unavailable.
- Leadless pacemakers may be a reasonable alternative to the traditional semi-permanent pacing approach in cardiac implantable electronic device infection cases.
- Leadless pacemakers can be delivered via the same access site, post transvenous system extraction, precluding the need for extra access sites.

atresia of the left and right external iliac veins with extensive collateral circulation in the pelvis and inguinal regions, and chronic occlusion of the infrarenal IVC. The patient was subsequently referred to our facility for a higher level of care and consideration of implantation from a superior approach.

At our facility, the patient underwent device extraction and leadless pacemaker implant under general anesthesia. First, access was obtained via the right internal jugular vein and 2 sheaths were placed. Through a 6F sheath, a temporary pacing wire was advanced to the right ventricular apex. Next, a stiff 0.035 inch guidewire was passed down to the IVC as far as possible via an 8F sheath to maintain access for an endovascular occlusion balloon in the event of a superior vena cava tear during extraction.

Attention was next focused on the device pocket. Incision immediately produced purulent drainage. The generator and leads were freed from the pocket and extensive debridement performed. With excimer laser sheath (Spectranetics, Colorado Springs, CO) assistance, both atrial and ventricular leads were extracted. Intraprocedure transesophageal echocardiogram confirmed absence of pericardial effusion. Left subclavian vein access was maintained with a stiff 0.035 inch guidewire, which was advanced down to the level of IVC occlusion. After progressive serial dilation with vascular dilators, the 27F Micra (Medtronic, Minneapolis, MN)

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Disclosures: Drs Kita and Le have nothing to disclose. Dr Doshi discloses roles as a consultant for Abbott Medical, Boston Scientific, and Spectranetics (now Phillips). **Address reprint requests and correspondence:** Dr Rahul N. Doshi, Chief, Complex Arrhythmia Management, Honor Health Medical Group, 10200 N 92nd St, Ste 150, Scottsdale, AZ 85258. E-mail address: rahuldoshimd@mac.com.

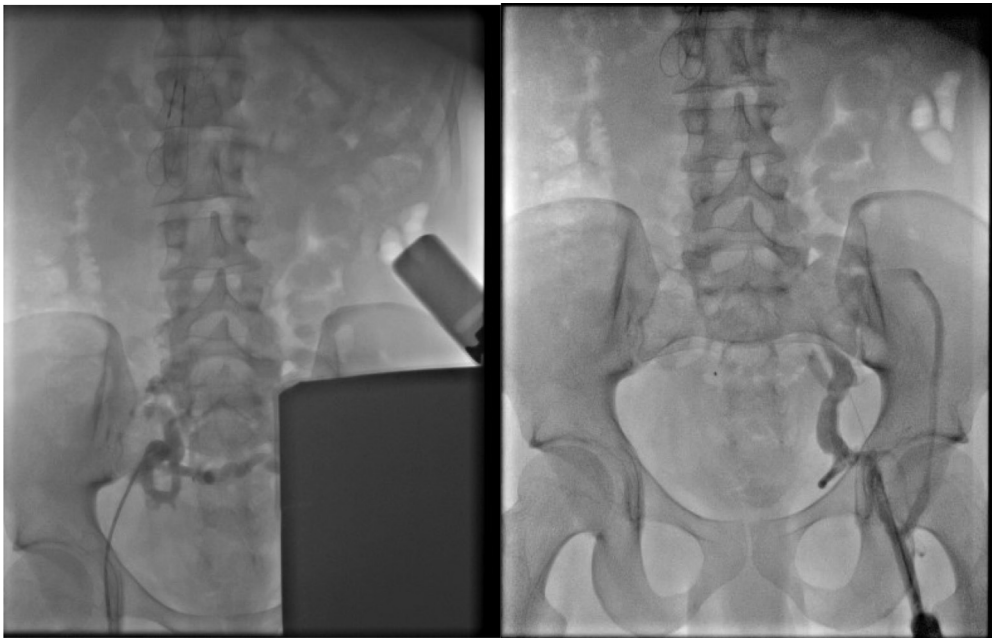


Figure 1 Venogram showing occluded lower-extremity veins.

delivery sheath and dilator were advanced to the lower right atrium. The leadless pacemaker delivery system was introduced through the sheath and was used to cross the tricuspid valve, where the device was positioned and deployed in the mid right ventricular septum (Figures 2 and 3). Capture thresholds were consistently below 1.0 mV. Upon removal of the delivery system, hemostasis was achieved via a figure-of-eight stitch within the pocket and the wound was closed in a traditional fashion primarily. On subsequent follow-up, pacing thresholds remained below 1.0 mV, and there has been no evidence of recurrent local or systemic infection.

Discussion

In the present case, several options were available for device implantation. These included traditional transvenous system, epicardial lead placement, and Micra leadless pacemaker, which is what this patient ultimately received. We decided upon the leadless pacemaker because it fulfilled the patient’s pacemaker requirements without necessitating reimplantation of another transvenous system on the contralateral side in a patient with high risk for recurrent infection. Additionally, implantation from the left subclavian vein is much like the standard femoral approach, allowing for the Micra delivery system to be easily deflected through a single bend, facilitating implantation. Furthermore, surgical

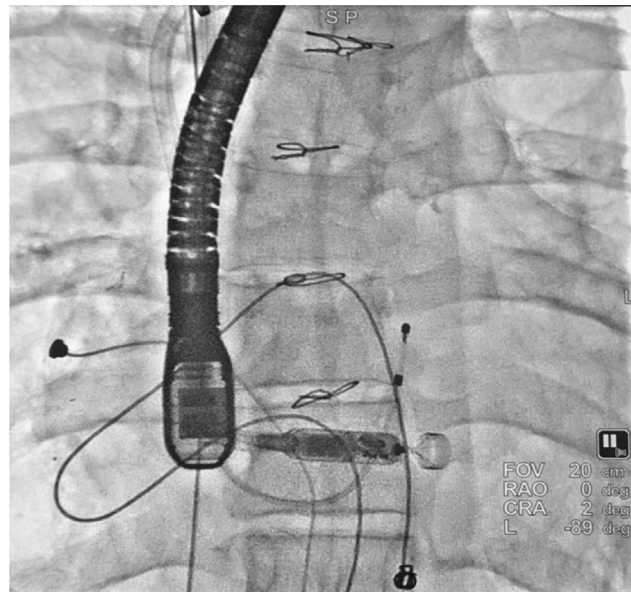


Figure 2 Position prior to deployment; anteroposterior view.

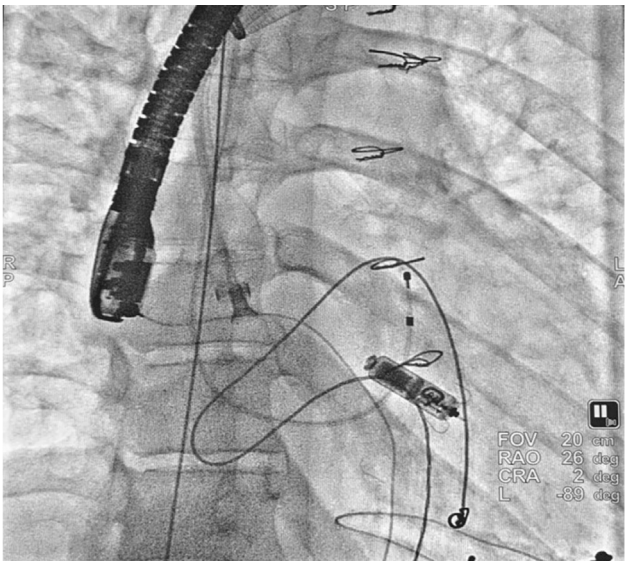


Figure 3 Position prior to deployment; right anterior oblique view.

epicardial lead placement, aside from being a more invasive approach, could prove difficult and unsuccessful in a patient with abandoned epicardial leads and prior sternotomy.

The Micra leadless pacemaker has been shown to be a safe and efficacious alternative to the traditional transvenous pacemaker, with registry studies showing reduced complications associated with the pocket and leads in transvenous systems. Specifically, El-Chami and colleagues¹ compared the performance of the Micra from the worldwide postapproval registry to a historical transvenous control and showed a low rate of procedure related infection (3 out of 1817) and dislodgement (1 out of 1817), making the Micra an appealing alternative in our dependent patient who is at high risk of recurrent infection.

In a separate study using the Micra postapproval registry, El-Chami and colleagues² identified 105 patients with prior cardiac implantable electronic device (CIED) infection who underwent Micra implant within 30 days of device explant. Explant occurred a median of 6 days before Micra implant, with 37% occurring on the day of Micra implant. Mean follow-up was 8.5 ± 7 months, and there were no Micra devices explanted owing to infection. Additionally, Kypta and colleagues³ showed safety and feasibility of leadless pacemaker implantation in 6 patients with CIED infection requiring extraction. Two of these patients were implanted during the same procedure, prior to extraction, and none had recurrent infection over 12 weeks of follow-up. Similarly, in a small case series published by Beurskens and colleagues,⁴ 17 patients underwent successful leadless pacemaker implantation after extraction of an infected conventional transvenous pacemaker. These patients were followed for a mean of 20 ± 14 months with no recurrent device infections. Interestingly, 7 patients in their series met DDD pacing indications; however, none developed pacemaker syndrome in follow-up.

What makes the leadless system appealing in our patient's situation is the ability to introduce the delivery system through the same access site used for device extraction. As such, not only is the procedure uncomplicated by precluding transvenous reimplantation, but there is no need for obtaining further access sites in the groin for leadless pacemaker implantation. Additionally, the lack of a pocket, generator, and leads eliminates the risk of future pocket infections and lead complications in an already complicated congenital heart patient with prior surgeries, coming off of his first

CIED infection. Finally, the patient was pacemaker dependent and required temporary transvenous pacing during the procedure, which was achieved from the right internal jugular vein. Thus, implanting from the left subclavian system decreased the risk of dislodging the temporary pacing wire during device deployment.

Although it was not a consideration in this particular case, Micra as an alternative to so-called "semi-permanent or tempo-permanent" pacing is a consideration. Because our patient had a pocket infection, immediate reimplantation after extraction is supported by the most recent updated 2017 HRS Expert Consensus Statement.⁵ However, in the case of endocarditis, where bridge to permanent reimplantation following extraction in dependent patients is usually done via temporary pacing wire or "semi-permanent" pacing, leadless pacemakers may be a reasonable alternative. Especially when considering the need for prolonged hospitalization, mandated bedrest, and risk for further or prolonged infection in an already infected patient, traditional bridges to permanent implantation are less appealing. Further prospective randomized data would of course be needed to support this observational claim.

Conclusion

Leadless pacemaker implantation can be safely and feasibly done via a left subclavian vein approach. This approach maybe be particularly helpful in postextraction patients who are pacemaker dependent, as well as those with limited vascular access when the standard femoral approach is not feasible.

References

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