

Case Report

First dual-chamber leadless pacemaker implantation at Meitra United Heart Centre, Kasaragod: a regional milestone in an octogenarian with sick sinus syndrome: a case report

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ABSTRACT

Leadless pacemaker technology has advanced to enable dual-chamber atrioventricular synchronous pacing through implant-to-implant communication between two independent leadless devices. We report the first AVEIR dual-chamber leadless pacemaker implantation performed at Meitra United Heart Centre (MUHC), marking a regional milestone for Kasaragod, Kannur, Coastal Karnataka, and Goa. An 86-year-old woman presented with sick sinus syndrome complicated by tachy-brady syndrome and presyncopal episodes. She underwent successful implantation of a dual-chamber leadless pacemaker via femoral venous access under general anesthesia using the Innvation Pinnacle Agile Cath Lab at MUHC. Optimal electrical parameters were achieved, with a right ventricular threshold of 0.5 V at 0.4 ms and impedance of 750 Ω , and a right atrial threshold of 1.0 V at 0.4 ms and impedance of 310 Ω . Device-to-device communication was 100%. Postoperatively, the patient developed left femoral vein thrombosis, which was managed with anticoagulation therapy, and she was discharged in stable condition. This case demonstrates that dual-chamber leadless pacing is feasible in an octogenarian with sick sinus syndrome and may serve as an alternative to conventional transvenous pacing systems, while emphasizing the need to consider vascular access complications such as femoral vein thrombosis during patient selection.

Keywords: Leadless pacemaker, Dual-chamber pacing, Sick sinus syndrome, Octogenarian, Femoral vein thrombosis, Cardiac rhythm management

INTRODUCTION

The application of cardiac pacing techniques is a critical approach in the treatment of bradyarrhythmias since the advent of the implantable pacemaker technology. Conventional transvenous pacemakers are associated with procedure-related and long-term complications, including infection, lead fracture, venous thrombosis, and tricuspid valve dysfunction.^{1,2} Leadless pacemaker technology has reduced these risks through the use of self-contained intracardiac devices. The dual-chamber leadless pacemaker system used in this case is based on the implant-to-implant (i2i™) communication between independent atrial and ventricular implants, which

facilitates atrioventricular pacing and removes the need for transvenous leads.^{3,4} There is limited real-world data on dual-chamber leadless pacemaker, especially in elderly patients and in there are limited settings. We report the first dual-chamber leadless pacemaker implantation performed at MUHC, Kasaragod-a pioneering achievement led by Dr. Bharathesh and his team that marks the first such procedure across Kasaragod, Kannur, Coastal Karnataka, and Goa, placing this institution among the few centers in India, and the third in the state of Kerala, to offer this advanced leadless pacing technology. This case involves an 86-year-old Indian female with sick sinus syndrome, including a procedural complication of femoral vein

thrombosis, thereby demonstrating the clinical feasibility of this new technology.

CASE REPORT

An 86-year-old woman with hypertension presented with generalized weakness, 8-10 episodes of vomiting, and presyncopal episodes accompanied by drowsiness. She had a history of presyncopal attacks in the past. The patient was conscious with a blood pressure of 130/80 mmHg, a pulse rate of 46 bpm, and oxygen saturation of 98%. There were no cardiovascular abnormalities, and the pulmonary examination appeared normal. Electrocardiography demonstrated ST-T changes, sinus pauses, and tachy-brady syndrome, which confirmed the diagnosis of sick sinus syndrome. Echocardiography showed no regional wall motion abnormalities (RWMA) and had good left ventricular systolic function. Coronary angiography showed minor coronary artery disease (CAD). The patient developed hypoxic encephalopathy, which was managed by supportive care. After careful consideration of available options and discussion, dual-chamber leadless pacemaker devices (SN:1426701-right atrium [RA]; SN:1426865-right ventricle [RV]) were implanted using delivery catheter (SN:11086880). Ultrasound guidance was used to achieve right femoral venous access under general anesthesia. The procedure was performed in the Innvolution Pinnacle Agile Cath Lab whose high-resolution imaging and optimized radiation protocols contributed to procedural precision and patient safety. Right ventricular and right atrial appendage angiography was performed using a 6-French angled pigtail catheter in left anterior oblique (LAO)/ right anterior oblique (RAO) views. A 0.035-inch Amplatz extra-stiff wire was placed inside the superior vena cava. A 25F introducer sheath with active irrigation was then inserted sequentially into the RA-inferior vena cava (IVC) junction using sequential dilation (6Fr-20Fr Coons dilators). The RV device was

prepared ex vivo, loaded into the delivery system with a protective sleeve, and advanced to the IVC. After interrogation using the device programmer, the device was deflected using a steerable introducer and 30 mm snare system, which was placed initially at the mid-interventricular septum. Thereafter, optimal results were obtained at mid-outflow septum after suboptimal parameters at mid-IVS and apical septum. Fluoroscopy confirmed the septal apposition. Helix testing was completed after deployment (1.5 rotations) with tug testing confirming stability. RV final parameters: threshold 0.5V at 0.4 ms, impedance 750Ω, R-wave sensing 5.2 mV. The RA device was also similarly prepared and advanced. Positioning at the RA nodal region was carried out using septography (PA/LAO/RAO views) and RAA angiography. After optimal sensing, helix deployment, and tug testing ensured stability. RA final parameters: threshold 1.0V at 0.4ms, impedance 310Ω, P-wave sensing 0.8mV. The devices successfully communicated via i2i™ achieving 100% throughput (RV→RA and RA→RV), signal strength **/**, and setting levels 5/4. Both devices were programmed per Table 1. Post-procedure echocardiography ruled out pericardial effusion, and hemostasis was achieved through figure-of-8 suture.

The patient experienced edema in the left lower extremities. Deep vein thrombosis (DVT) in both the superficial and deep femoral veins was identified through venous Doppler ultrasonography. Heparin was initiated for anticoagulation, followed by apixaban 2.5 mg twice daily. Edema subsided with treatment. The patient received intravenous (IV) fluids, antibiotics, amiodarone 200 mg daily, and metoprolol XL 50 mg daily. The patient’s vital signs were BP 110/70 mmHg, pulse 70 bpm (paced), SpO₂ 98%. The patient was stable and conscious on discharge. The medications prescribed were apixaban (12 days), amiodarone (12 days), metoprolol (12 days), and iron supplements. The patient improved symptomatically.

Table 1: Device parameters at implantation and programmed settings.

Parameters	Right atrium (1426701)	Right ventricle (1426865)	i2i communication
Threshold (V@0.4ms)	1.0	0.5	RV→RA: 100%
P/R wave (mV)	0.8	5.2	RA→RV: 100%
Impedance (Ω)	310	750	Signal: **/**
Output (V/ms)	2.5@0.4	2.0@0.2	Level: 5/4
Sensitivity (mV)	0.5	2.0	Mode: AAI+VVI
Base rate (bpm)	70	40	Polarity: Bipolar

DISCUSSION

This case illustrates the effective implantation of a dual-chamber leadless pacemaker system in a sick sinus syndrome patient. The dual-chamber leadless pacemaker system allows dual-chamber pacing through implant-to-implant communication between two independent devices. The atrioventricular synchrony with i2i™ technology is achieved using conducted electrical signals without transvenous leads while maintaining dual-chamber

functionality.³ Technical feasibility was demonstrated by optimal electrical parameters at implantation and 100 percent bidirectional communication throughput.

The benefits of leadless systems include elimination of lead fracture, reduced infection risk, decreased tricuspid valve dysfunction, maintaining venous access, and improved cosmetic outcomes.^{1,2,5} However, they require large-bore access to the femur, which caused postoperative DVT in this case. One of the known complications of

leadless pacemaker implantation is femoral vein thrombosis, especially while using 25F introducer sheaths.⁶ This emphasizes the importance of meticulous technique, anticoagulation consideration, and postoperative surveillance.

The challenge associated with the procedure to attain the optimal RV positioning (repositioning between mid-IVS and apical septum to mid-outflow septum) underscores the significance of real-time parameter settings and the experience of the operator. Innvolution's Pinnacle Agile Cath Lab supported the procedure with high-resolution imaging and low-dose radiation fluoroscopy, enabling safe femoral access, precise needle placement, accurate catheter navigation, and reliable intracardiac device positioning with timely recognition of procedural complications. The AAI+VVI pacing mode is different from the conventional DDD pacing mode but has adequate rate support for sick sinus syndrome.⁷

Long-term outcomes such as device life span, parameter stability, and extraction strategies require further investigation.^{8,9} This case provides real-world evidence of the feasibility and early safety of a dual-chamber leadless pacemaker system as an alternative in appropriately selected patients.

CONCLUSION

This case demonstrates that first dual-chamber leadless pacing can be safely implanted in an octogenarian with sick sinus syndrome, using the optimal electrical parameters and reliable i2i™ communication. Innvolution's Pinnacle Agile Cath Lab at MUHC played a critical role in this procedure, offering real-time high-resolution fluoroscopic imaging and low-dose radiation exposure, facilitating accurate lead placement and controlled pacemaker implantation. This milestone highlights the ability of regional centers to provide cutting-edge cardiac services to underserved populations. The occurrence of contralateral femoral vein thrombosis indicates the role of postoperative monitoring of vascular complications. Prospective studies evaluating long-term performance of devices, parameter stability, and complication rates in elderly populations are warranted.

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REFERENCES

1. Knops RE, Ip JE, Doshi R, Exner DV, Defaye P, Canby R, et al. One-Year Safety and Performance of a Dual-Chamber Leadless Pacemaker. *Circ Arrhythm Electrophysiol.* 2025;18(4):e013619.
2. Tjong FV, Reddy VY. Permanent Leadless Cardiac Pacemaker Therapy: A Comprehensive Review. *Circulation.* 2017;135(15):1458-70.
3. Knops RE, Reddy VY, Ip JE, Doshi R, Exner DV, Defaye P, et al. A Dual-Chamber Leadless Pacemaker. *N Engl J Med.* 2023;388(25):2360-70.
4. Steinwender C, Khelae SK, Garweg C, Chan JYS, Ritter P, Johansen JB, et al. Atrioventricular Synchronous Pacing Using a Leadless Ventricular Pacemaker: Results from the MARVEL 2 Study. *JACC Clin Electrophysiol.* 2020;6(1):94-106.
5. Reynolds D, Duray GZ, Omar R, Soejima K, Neuzil P, Zhang S, et al. A Leadless Intracardiac Transcatheter Pacing System. *N Engl J Med.* 2016;374(6):533-41.
6. Hayashi T, Shishido KS, Moriyama NM, Tobita KT, Murakami MM, Saito SS. Deep vein thrombosis after leadless pacemaker implantation. *European Heart Journal.* 2022;43(Suppl 2):ehac544.479.
7. Boveda S, Lenarczyk R, Haugaa KH, Iliodromitis K, Finlay M, Lane D, et al. Use of leadless pacemakers in Europe: results of the European Heart Rhythm Association survey. *Europace.* 2018;20(3):555-9.
8. Duray GZ, Ritter P, El-Chami M, Narasimhan C, Omar R, Tolosana JM, et al. Long-term performance of a transcatheter pacing system: 12-Month results from the Micra Transcatheter Pacing Study. *Heart Rhythm.* 2017;14(5):702-9.
9. Grubman E, Ritter P, Ellis CR, Giocondo M, Augustini R, Neuzil P, et al. To retrieve, or not to retrieve: System revisions with the Micra transcatheter pacemaker. *Heart Rhythm.* 2017;14(12):1801-6.

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