

## EP CASE REPORT

# Innovative implantation of a leadless pacemaker in a 19 kg paediatric patient via the right internal jugular vein

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Paediatric transvenous pacemaker placement may be associated with significant comorbidities, but may be needed in mitochondrial DNA deletion syndrome.<sup>1-3</sup>

A 7-year-old, 19 kg, woman with mitochondrial DNA deletion syndrome involving progressive bifascicular infra-Hisian block, presented for pacemaker placement. Her comorbidities included thrombocytopenia, sideroblastic anaemia, chronic immunosuppression, diabetes mellitus, chronic kidney disease, failure-to-thrive with gastric tube, and 10-year life-expectancy. Discussion determined need for ventricular-only pacemaker. Given her comorbidities, parents opted for transvenous vs. of epicardial system. Ultrasound measurement of her right internal jugular vein (RIJ) revealed 12 mm diameter with Valsalva. Due to her comorbidities/future infection risk, including need for kidney transplant soon, and discussion regarding risk of lifelong transvenous pacing vs. large-bore venous access, parents opted for leadless pacemaker implantation.

A 5-Fr sheath was placed via Seldinger technique in the right femoral vein and 4-Fr non-steerable quadripolar lead was passed into the right ventricle to serve as a guide/back-up pacing. Under general anaesthesia, with positive-pressure delivered (13 mm RIJ diameter), RIJ access was performed using the Seldinger technique utilizing ultrasound. Dilation by 2-Fr steps (6–27-Fr delivery sheath) was performed and proprietary 27-Fr outer diameter (23-Fr inner diameter) sheath was advanced into the right atrium over wire, under fluoroscopy. Heparin was given. The delivery catheter was advanced through the sheath and sheath withdrawn into the superior vena cava.

Delivery catheter was deflected across the tricuspid valve into the right ventricle, following previously placed quadripolar catheter. Contrast injection (20 mL) under biplane fluoroscopy confirmed anteroseptal position, in the setting of small right ventricular size and to



**Figure 1** Leadless pacemaker via right internal jugular access with contrast injection in left oblique view (30°) (left) with right side of page demonstrating AP chest X-ray with leadless pacemaker in place (right). APUPRT, anterior-posterior up-right.

avoid tricuspid valve obstruction (Figure 1). One deployment was made with threshold of 1 V@0.24 ms, R-wave 5 mV, and impedance of 480 Ohms. Tug testing demonstrated three of four times connected. No re-captures were needed. The deployment catheter was gently removed from the heart/sheath. While awaiting activated clotting time (and while awaiting protamine test dose, required due to insulin reaction) prior to removal of 27-Fr sheath, the patient's blood pressures decreased (10 mmHg). Echocardiogram was obtained and demonstrated moderate pericardial effusion without tamponade physiology. Given patient's history of thrombocytopenia/anaemia, decision was made to place a pericardial drain (8.2 Fr) under ultrasound guidance. Protamine was given. The sheath was removed under fluoroscopic guidance and figure of 8-stitch was placed in the RIJ access area. Blood products were given and she was sent to the cardiac intensive care unit. Echocardiogram demonstrated one tine near the right ventricular free wall, which likely perforated this area during deployment (without superior vena-cava/atrial perforation). The pericardial drain was placed to water seal within 24 h, after echocardiographic confirmation of pericardial effusion relief, and removed within 48 h. Twenty-four hour post-device testing revealed threshold of 0.5 V@0.24 ms, R-wave of 6.2 mV, and impedance of 530 Ohms.

Two-week follow-up revealed a well-appearing patient without evidence of effusion, well-healing scars and similar pacemaker values: threshold 0.5 V@0.24 ms, R-wave 5 mV, and impedance of 510 Ohms with similar values at 4 months (however, R-wave 7.8 mV).

Implantation of the Micra leadless pacemaker is possible in smaller patients via RIJ access when shorter life expectancies or surgical removal possible, with consideration of echo guidance/smaller ventricular size.

**Conflict of interest:** none declared.

## References

1. Gross GJ, Chiu CC, Hamilton RM, Kirsh JA, Stephenson EA. Natural history of postoperative heart block in congenital heart disease: implications for pacing intervention. *Heart Rhythm* 2006;**3**:601–4.
2. Fortescue EB, Berul CI, Cecchin F, Walsh EP, Triedman JK, Alexander ME. Patient, procedural and hardware factors associated with pacemaker lead failures in pediatrics and congenital heart disease. *Heart Rhythm* 2004;**1**:150–9.
3. Kabunga P, Lau AK, Phan K, Puranik R, Liang C, Davis RL *et al*. Systematic review of cardiac electrical disease in Kearns-Sayre syndrome and mitochondrial cytopathy. *Int J Cardiol* 2015;**181**:303–10.