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First aveir VR leadless pacemaker implantations in Poland *via* internal jugular vein access

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The incidence of cardiac electronic device infections and lead dysfunction has increased recently. A leadless pacemaker (LP) appears to be an ideal option in traditional pacemaker's complications cases. However, the decision to implant an LP or determine the appropriate approach should carefully weigh the associated risks and benefits, according to available expert opinion [1].

Infective endocarditis (IE) is an inflammatory condition still associated with a high mortality rate. Recent studies suggest that the occurrence of IE is extremely low among patients with LPs, making this therapy a viable option to consider [2].

We presented two cases of successful LP implantation *via* the internal jugular vein access (IJVA).

Case 1. A 69-year-old male patient with IE of a mechanical aortic prosthesis caused by methicillin-sensitive *Staphylococcus aureus* was admitted to our center for surgical treatment.

The patient underwent surgical aortic valve replacement, mitral valve replacement, and tricuspid valve (TV) replacement, with epicardial electrodes implanted for temporary pacing. During the postoperative period, complete atrioventricular block and a high stimulation threshold of the epicardial electrode were observed. The patient was pacing-dependent. Considering the presence of IE and the implanted TV biological prosthesis, LP implantation was decided upon. On May 21, 2024, a single-chamber LP (Abbott, Aveir VR, Sylmar, CA, US) was implanted during targeted antibiotic therapy. The procedure duration was 270 minutes, with 55 minutes of fluoroscopy time and a total radiation dose of 2034 mGy. Initial attempts over 210 minutes to implant the LP *via* the typical femoral access (FA) approach were unsuccessful. Three different operators attempted to cross the TV with the delivery catheter but were unable to proceed due to the sharp angle between the TV annulus and the inferior vena cava after TV replacement. Consequently, the approach was converted to the right IJVA. This switch allowed for a fast and successful LP release within 60 minutes, positioning the device on the interventricular septum (IVS). The IJVA point was closed with a Z-shaped hemostatic suture. On the eighth day after the procedure, a hematoma was observed in the neck access region. At that time, the international normalized ratio was 5.6. The hematoma required surgical drainage, which was performed at the bedside under local anesthesia without any complications (Figure 1D). At the 3-month follow-up, the remaining capacity to replacement was 97%, with an estimated longevity of 12.3 years.

Case 2. An 87-year-old male patient with a history of chronic heart failure, permanent atrial fibrillation, and complete atrioventricular block following transcatheter aortic valve replacement one year earlier was referred to our department for a heart team decision. His history included previous cardiac resynchronization therapy pacemaker implantation, which was subsequently removed due to infection, followed by implantation of a temporary pacemaker. The patient had positive blood cultures for *Escherichia coli* and *Enterococcus faecium*, with a chronically elevated C-reactive protein level and an infected chronic wound in the left ankle. Prior to the index hospitalization, an attempt to implant a Medtronic Micra (Medtronic, Minneapolis, MN, US) LP *via* FA was unsuccessful due to the tortuous course of the vessels. Given the high risk of infection and limited vascular access *via* the femoral veins, a collective decision was made to proceed with the implantation of an active fixation LP (Abbott, Aveir VR, Sylmar, CA, US) *via* the right IJVA [3]. The procedure was performed on July 11, 2024. The operating room layout was specially prepared for the IJVA (Figure 1A). Venous access was achieved using ultrasound-guided puncture of the right internal jugular vein, and two automated Perclose ProGlide sutures (Abbott) were placed. After gaining vascular

access, the LP was advanced into the right ventricle and positioned against the distal part of the IVS, confirmed by transesophageal echocardiography. Initial mapping of the target location demonstrated correct parameters for current of injury, sensing, impedance, and pacing threshold, enabling active fixation of the LP. The sheath was removed while leaving the guidewire in place, and the Perclose ProGlide sutures were tightened. The guidewire was subsequently removed, and the sutures were retightened to ensure hemostasis. At the 3-month follow-up, the remaining capacity to replacement was 98%, with an estimated longevity of 14.3 years.

The recently published POL-ENDO study revealed that in-hospital mortality rates for IE in Poland were higher compared to the European population [4]. Płońska-Gościniak et al. [5] reported that electrodes were responsible for more than 68% of cardiac device-related IE cases in Poland, highlighting the potential role of LPs in addressing this issue.

The standard implantation of LP *via* the FA can be challenging due to complicated vascular anatomy and the presence of valve prostheses, which can create difficulties in delivering the LP to the IVS. For this reason, the IJVA may offer significant advantages. This method appears particularly beneficial for patients with congenital heart diseases, tortuous femoral veins, or pediatric patients [6].

In alignment with these considerations, we successfully performed LP implantations *via* the IJVA in two consecutive patients with challenging anatomy, including tortuous vessels and the presence of TV prostheses with IE. The hematoma complication observed in the first case, which fortunately resolved without sequelae, suggests that vein closure using a closing device or a surgical method, as employed in the second case, may be advisable.

To our knowledge, these cases represent the first successful Aveir VR implantations *via* the IJVA in Poland. LP implantation is a feasible therapy option to consider in case of IE.

Article information

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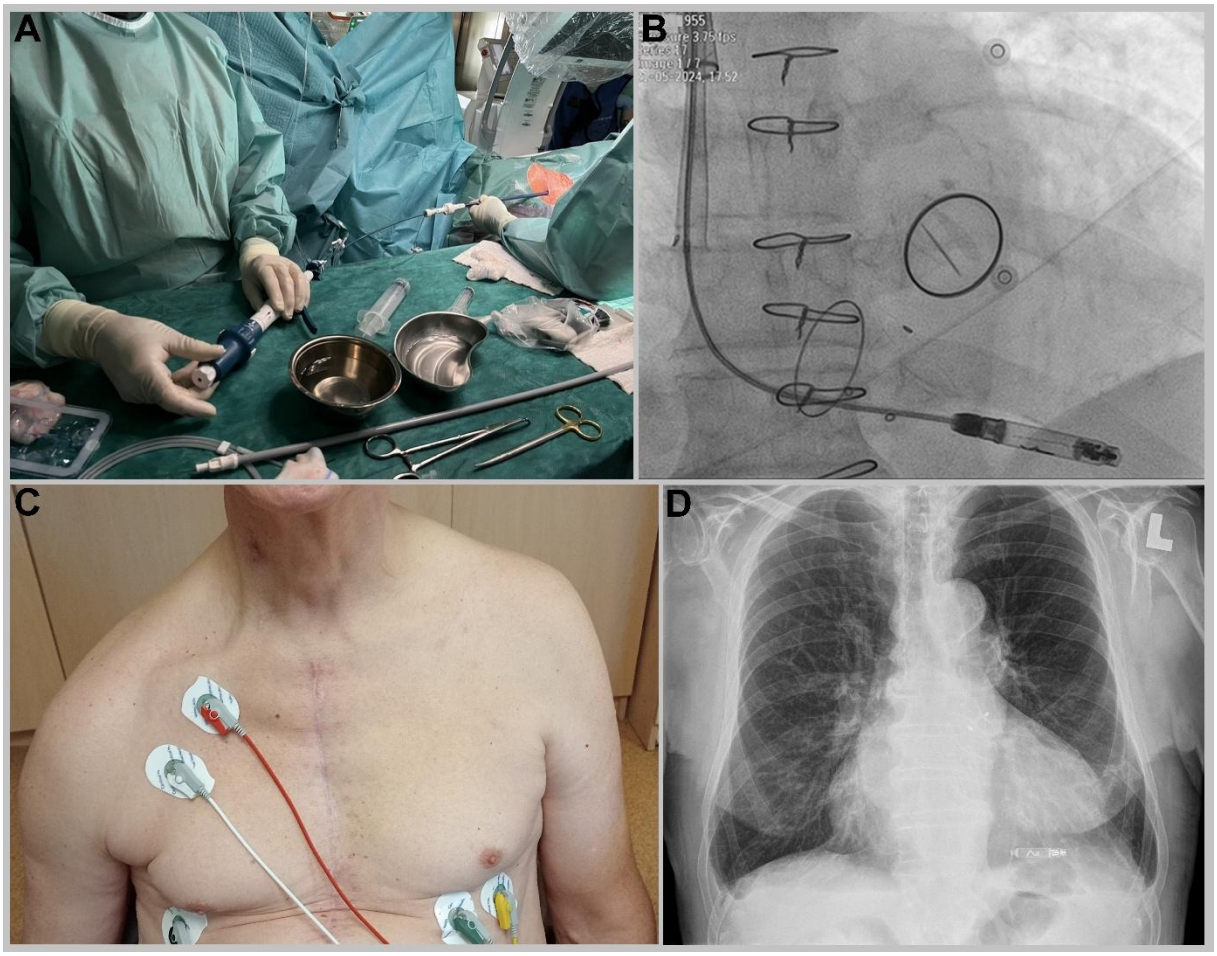

Figure 1. A. The operating room layout prepared for right internal jugular vein vascular access. **B.** Leadless pacemaker positioning on the interventricular septum *via* right internal jugular vein. **C.** 5 month follow up, the jugular vein access point is presented with small scar after neck hematoma, typical Aveir interrogation for device measurements. **D.** Chest radiograph demonstrating leadless pacemaker location in the interventricular septum