Nearly half a century of cardiac pacing evolution: A patient's journey through epicardial, transvenous, and leadless pacemakers

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This case report presents a medical history of a 64-year-old man. It dates back to 1976 when he underwent surgery for an atrial septal defect complicated by a persistent third-degree heart block. During the initial surgical intervention, he received a permanent pacemaker with epicardial leads, positioned abdominally. However, three years later, due to an exit block, he required implantation of a transvenous single-chamber ventricular pacemaker, repositioned in the pectoral region. Over the ensuing years, he underwent 5 replacements of the pulse generator. In 2023, he was admitted to the cardiology ward for a pocket infection resulting in pocket erosion. Transthoracic and transesophageal echocardiography revealed preserved ejection fraction (EF ~60%) and ruled out the presence of bacterial vegetation or severe valvular defects. Additionally, his medical history included persistent atrial fibrillation and hypertension.

The patient underwent transvenous lead extraction utilizing a Liberator Beacon Tip Locking Stylet, steel sheath, and an 11 Fr Evolution RL Controlled-Rotation Dilatator Sheath Set (Cook Vandergrift, Vandergrift, PA, US). During the procedure, a small segment of the ventricular electrode remained (<2 cm). Fluoroscopy indicated damaged epicardial leads. Subsequently, temporary cardiac pacing was initiated using an active fixation lead *via* jugular access, with the pulse generator positioned externally. Fortunately, no procedure-related complications were encountered.

Given the patient's good tolerance of right ventricular stimulation and previous pocket infection, a decision was made to implant a leadless pacemaker. The AVEIR VR (Abbott Cardiovascular, Plymouth, MN, US) leadless pacemaker, was selected (Figure 1C–D). The procedure, conducted *via* the standard right femoral approach with Amplatz Super Stiff, AVEIR Catheter RV, and Aveir Introducer 25F, proceeded uneventfully [1]. Upon reaching the right ventricle, ventriculography was performed to confirm optimal positioning (Supplementary material, *Videos S1–S2*). Once satisfactory parameters (sensing, impedance, threshold, and current of injury) were attained, the pacemaker was released (Supplementary material, *Video S3*). Following removal of the delivery and introducer sheaths, the venous access site was sutured. Post-procedurally, no complications were observed, and the patient was discharged the following day (Figure 1A–B) [2].

At the 1-month follow-up, the device demonstrated stable parameters, including a pacing threshold of 0.75 V @0.2 ms, R-wave >18 mV, and impedance of 710 ohms, with a ventricular stimulation percentage of 100% upon interrogation. The expected time until battery replacement was estimated to be approximately 14 years. Notably, no symptoms of heart failure were reported, and transthoracic echocardiography revealed intact left ventricular ejection fraction (EF ~60%) and no valvular defects.

Leadless pacemakers represent a valuable alternative to traditional transvenous systems, offering stable and secure pacing, particularly in patients at high risk of pocket infection or with limited venous access [3, 4].

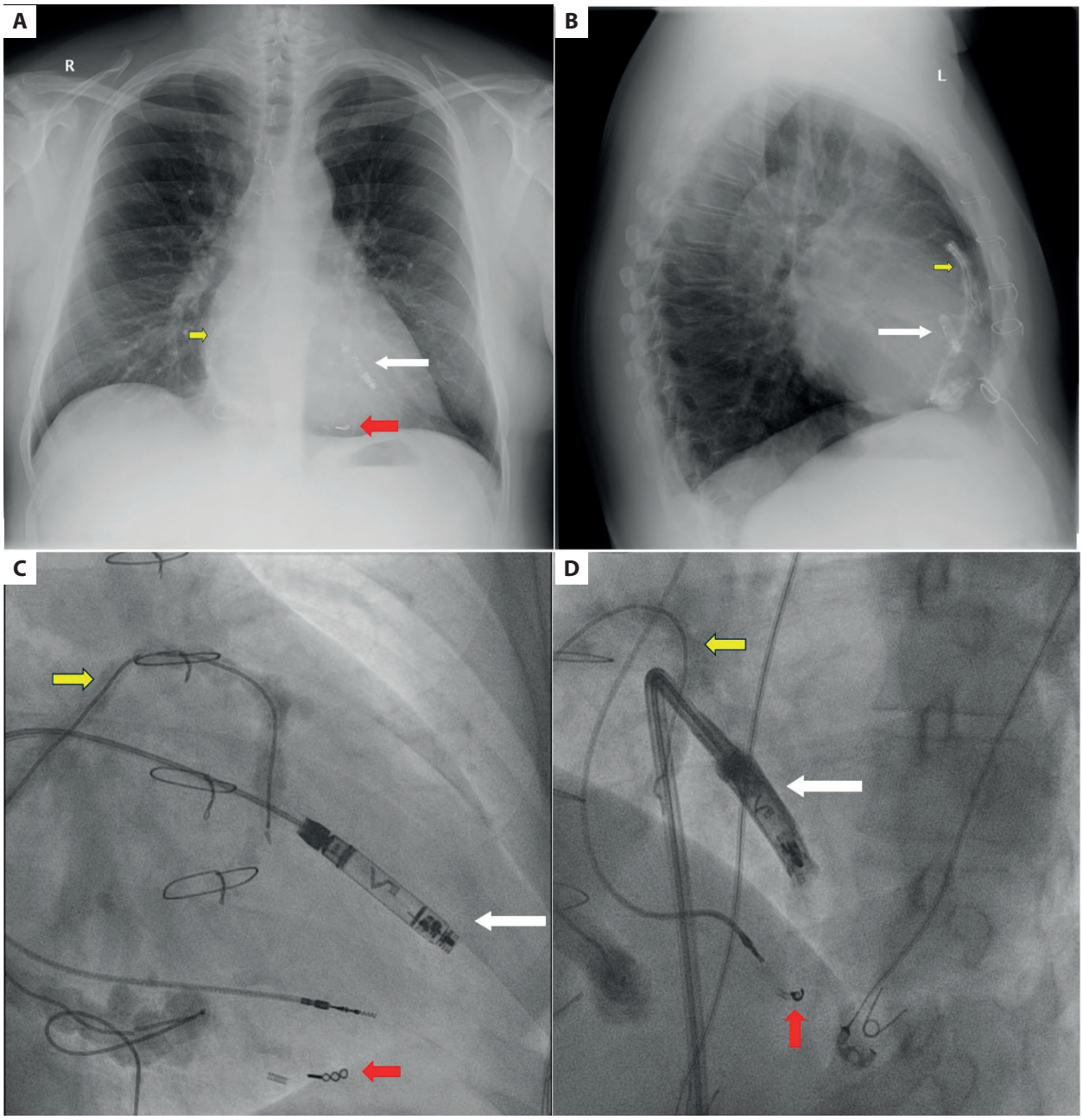

Figure 1. A–B. X-ray in the posteroanterior view and the lateral view presenting AVEIR VR (white arrows), fractured epicardial lead encased by calcification (yellow arrows) and the retained part of the ventricular lead (red arrows). **C.** Fluoroscopy in right anterior oblique position. **D.** Fluoroscopy in left anterior oblique position, (AVEIR VR with the delivery system)

This type of stimulation features a reduced risk of cardiovascular implantable electronic device-related infection and allows a safe and feasible implantation procedure at the time of or within a short period after transvenous lead extraction, which may support the patient for a lifetime, especially in the case of pacemaker dependency. This case highlights our patient's long journey through various modes of cardiac stimulation, mirroring the evolution of pacemaker technology. The treatment employed in this patient may be a cost-effective option for patients at high risk of infection related to cardiovascular implantable electronic devices [5].

Supplementary material

Supplementary material is available at https://journals.viamedica.pl/polish_heart_journal.

Article information

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