Upgrade to cardiac resynchronization therapy with robotic-assisted implantation of the left ventricular lead: Case report

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Cardiac resynchronization therapy is the cornerstone of modern electrotherapy [1, 2]; however, in some cases, implantation of the left ventricular lead into the cardiac venous system can be challenging, and the utmost precision is needed to optimally cannulate the targeted vein with a guidewire. In recent years, growing interest has been placed on robotic-assisted percutaneous coronary interventions, which allow maximizing the operator's manual accuracy, while potentially reducing fluoroscopy time and radiation exposure to both the operator and the patient [3]. However, to date, there have been no reports on robotic-assisted cardiac implantable electronic device implantation. Thus, we present the first case of a successful robotic-assisted implantation of the left ventricular lead.

A 63-year-old female patient, with a dual-chamber pacemaker implanted one year earlier due to symptomatic sinus node dysfunction, was admitted to the hospital on account of exercise intolerance and fatigue. Device interrogation showed double chamber pacing with closed loop stimulation 60/min programming, with 55% ventricular pacing despite algorithms prolonging atrioventricular (AV) delay. On the electrocardiogram, sinus rhythm with periodical atrial pacing was observed, along with first-degree AV block (PR of 280 ms) and left bundle branch block, with a native QRS width of 155 ms. On echocardiography, left ventricular ejection fraction was 37%, with evident interventricular dyssynchrony.

Considering the overall clinical status of the patient, we decided to upgrade cardiac resynchronization therapy with robotic-assisted implantation of the left ventricular lead. During the procedure, the coronary sinus was cannulated, and two small posterior veins were observed on venography. However, their angulation — immediately after the ostia — was very unfavorable for successful cannulation. Nonetheless, the middle cardiac vein gave rise to many large tributaries eventually leading to the postero-lateral wall of the left ventricle. A decision was made to attempt the implantation of the LV lead into one of the posterior veins, and if unsuccessful, the middle cardiac vein was selected as the second choice. Due to the anticipated potential difficulties in approaching the destination veins, a decision was made to utilize the R-One+ robotic assistance platform (Robocath, France) [4].

The over-the-wire 300 cm balance middleweight 0.014" guidewire was advanced using the widely available vascular extension line connected to the coronary sinus guide catheter. A few attempts to cannulate the posterior veins were unsuccessful and, eventually, the wire was successfully placed in the tributary of the middle cardiac vein, which supplied the postero-lateral LV wall. The left ventricular lead was then implanted into the destination vein with satisfactory sensing and pacing parameters and no signs of phrenic nerve stimulation. The consecutive steps of the procedure are summarized in Figure 1 and Supplementary material, *Video S1*. The patient was discharged the next day, without complications.

One of the major benefits of robotic-assisted guidewire manipulation is increased precision, as the system allows the operator to carefully move and rotate the guidewire, thus enabling successful cannulation of a wider spectrum of tributaries. Robotic-assisted percutaneous procedures will undoubtedly

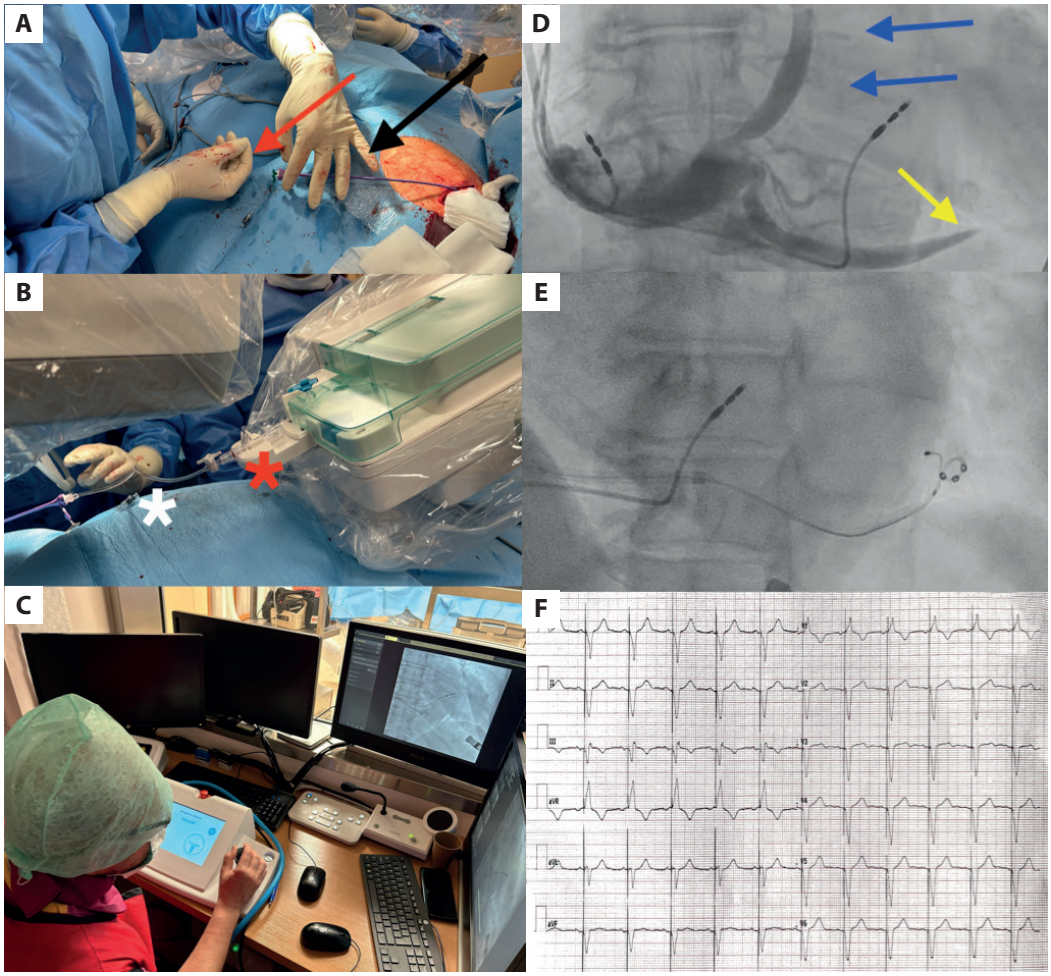

Figure 1: Robotic-assisted left ventricular lead implantation. **A.** View of the 300 cm balance middleweight 0.014" guidewire (red arrow) being introduced into the coronary sinus catheter (black arrow) using a dedicated advancement set. **B.** The R-One+ robotic assistance platform (Robocath, France), installed and connected with the coronary sinus catheter using the vascular extension line (white asterisk) *via* the system's dedicated Y-connector (red asterisk). **C.** The operator in the control room manipulating the guidewire. **D.** Coronary sinus venography demonstrating relatively scarce tributaries to the coronary sinus and the great cardiac vein (blue arrows) and a large middle cardiac vein (yellow arrow). **E.** Final position of the left ventricular lead implanted in the postero-lateral wall of the left ventricle. **F.** The patient's electrocardiogram after the procedure showing LV capture in lead V1 and a QRS duration of 152 ms

see rapid development in the coming years, with left ventricular lead placement as an interesting option for using this technology in patients requiring cardiac resynchronization therapy.

Supplementary material

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

Article information

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