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

**Short title:** Robotic-assisted left ventricular lead implantation

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

A 63-year old female patient, with an implanted dual-chamber pacemaker due to symptomatic sinus node dysfunction, one year prior to present hospitalization, was admitted to the hospital on account of exercise intolerance and fatigue. Device interrogation showed DDD-CLS 60/min programming, with 55% of ventricular pacing despite algorithms prolonging AV delay. In the electrocardiogram, the sinus rhythm with periodical atrial pacing was observed, along with AV I degree block (PR of 280 ms) and left bundle branch block with a native QRS width of 155

ms. In echocardiography, left ventricular ejection fraction was 37%, with an evident interventricular dyssynchrony.

Taking into consideration the overall clinical context of the patient, the decision on an upgrade to cardiac resynchronization therapy was made. During the procedure, the coronary sinus was cannulated, and two small posterior veins were observed in venography. However, their angulations immediately after ostia were very unfavourable for a successful cannulation. Nonetheless, the middle cardiac vein generated many large tributaries eventually leading to the postero-lateral wall of the left ventricle. The decision has been made to attempt the implantation of the LV lead into one of the posterior veins, and if unsuccessful, the middle cardiac vein has been selected as a zone of the second choice. Due to the anticipated potentially troublesome approach to the destination veins, the decision was made to utilize the R-One+ robotic assistance platform (Robocath, France) [2].

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. Few attempts to cannulate the posterior veins were unsuccessful and, eventually the wire was successfully placed in the middle cardiac vein's tributary supplying 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 on the next day, without complications.

One of doubtless benefits of robotic-assisted guidewire manipulations are increased precision, as the system allows to carefully move and rotate the guidewire, thus enabling a wider spectrum of tributaries to be successfully cannulated. The robotic-assisted percutaneous procedures will undoubtedly see a major development in the coming years, with the left ventricular lead placement posing as an interesting utilization of such technology in patients requiring cardiac resynchronization therapy.

### **Supplementary material**

Supplementary material is available at [https://journals.viamedica.pl/polish\\_heart\\_journal](https://journals.viamedica.pl/polish_heart_journal).

### **Article information**

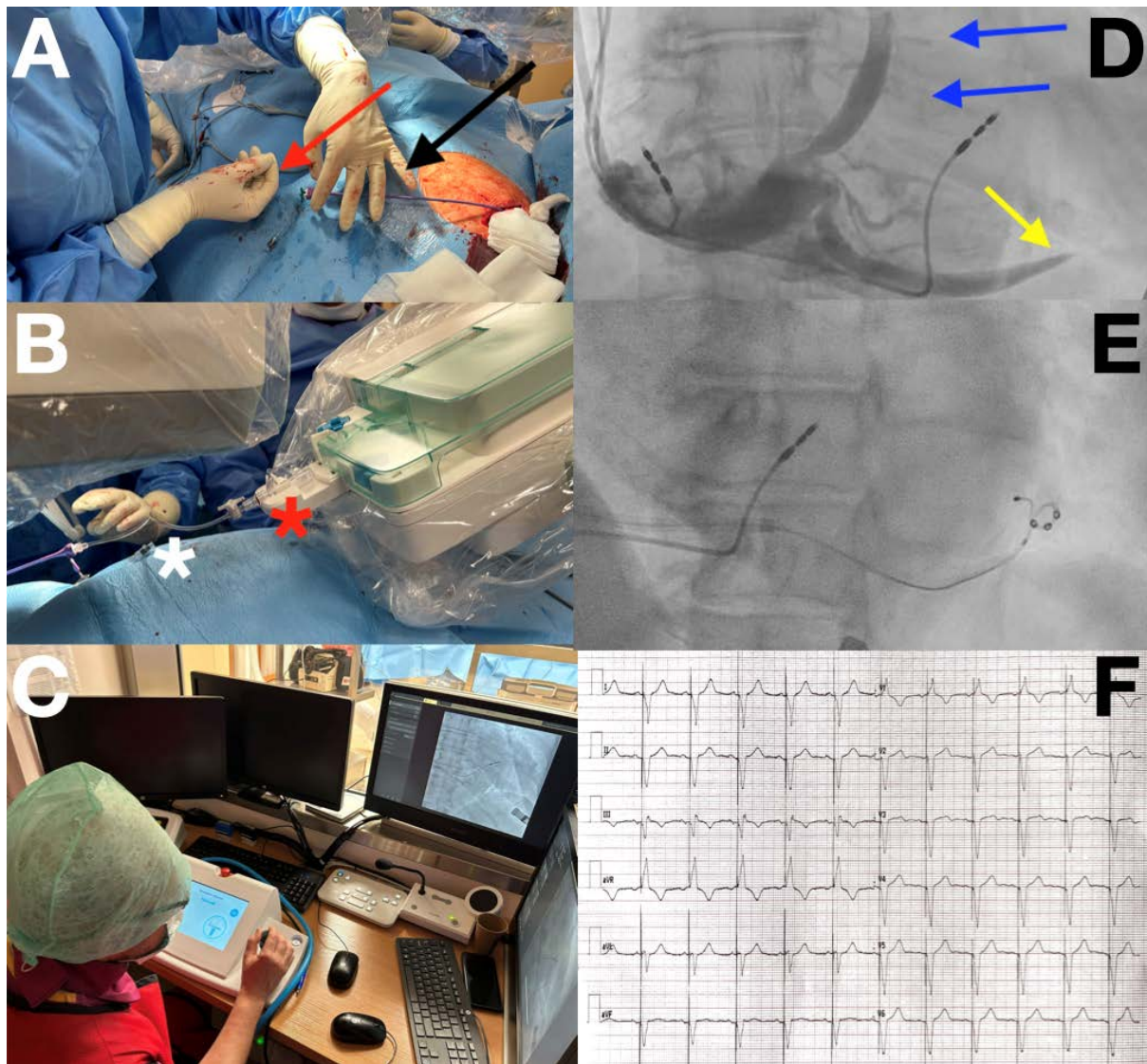
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**Figure 1:** Robotic-assisted left ventricular lead implantation. **A.** The view of the 300 cm balance middleweight 0.014" guidewire (red arrow) being introduced into the coronary sinus catheter (black arrow) using the dedicated advancement set. **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 positioned in the control room controlling the movement of the guidewire. **D.** Coronary sinus venography demonstrating relatively scarce tributaries to the coronary sinus and great cardiac vein (blue arrows), and a large middle cardiac vein (yellow arrow). **E.** The 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 demonstrating LV capture in the V1 lead and QRS duration of 152 ms