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Transhepatic Left Ventricular Only Pacing After Left Bundle Branch Area Pacing Attempt with High Pacing Threshold

A 50-year-old male with a permanent dual chamber pacemaker (DDD) 23 years ago was referred for a rapid increase in right ventricular (RV) pacing impedance. His left ventricular (LV) ejection fraction was 45%. Since the patient was pacemaker-dependent, the insertion of a new RV lead was planned. However, the venography and imaging studies revealed both left and right subclavian veins to be occluded/non-accessible. We failed also to cross the lesion by percutaneous approach. Then, we planned the extraction procedure as a first stage with the thought that it can provide a new venous route via extraction sheath; however, the patient did not accept the procedure as its high risk. Therefore, the surgical epicardial LV lead was implanted and connected to the left subpectoral pocket by using the previous functional right atrial (RA) lead for DDD pacing. Unfortunately, 1 month later, the patent presented with a left-sided pocket infection, and we had to remove all endocardial RA and RV leads using the lead extraction system. We could not again pass the calcified superior vena cava despite the successful lead extraction. Due to an active pocket infection, the surgically placed pacemaker was removed from the skin leaving the epicardial LV lead in place to remove or drain the infected fluid. A leadless pacemaker was an option, but due to financial constraints could not be done for this patient. The femoral venous access could not be taken due to the non-availability of 69 cm RV lead. The hepatic vein was the only available access to implant a DDD pacemaker. With the assistance of vascular interventional radiology, a transhepatic

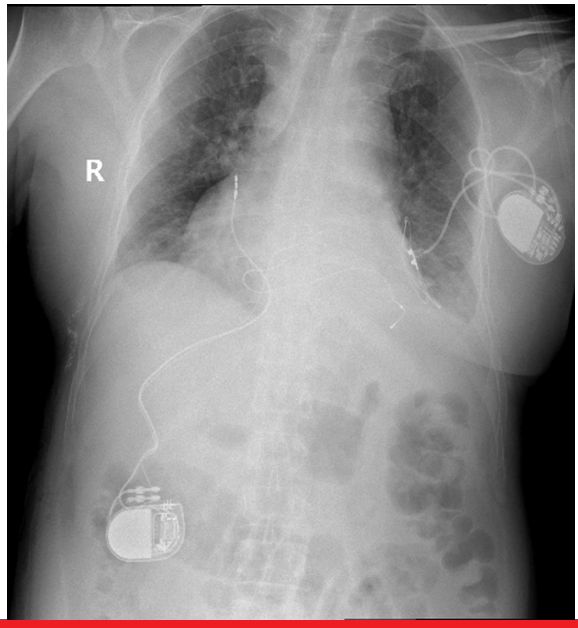

Figure 1. The permanent pacemakers implanted by transhepatic and surgical epicardial are seen.

E-PAGE ORIGINAL IMAGE

Ahmet Korkmaz[1]
Mustafa Özdemir[2]
Gözde Ertunç Açıkgöz[3]
Levent Mavioğlu[4]
İrem Dilara Can[1]
Meryem Kara[1]
Hande Elif Özcan Çetin[1]
Özcan Özeke[1]
Serkan Çay[1]
Fırat Özcan[1]
Yusuf Bayram Özoğul[3]
Dursun Aras[5]
Serkan Topaloğlu[1]

[1]*Department of Cardiology, University of Health Sciences, Ankara City Hospital, Ankara, Turkey*
[2]*Department of Radiology, University of Health Sciences, Ankara City Hospital, Ankara, Turkey*
[3]*Department of Surgical Oncology, University of Health Sciences, Ankara City Hospital, Ankara, Turkey*
[4]*Department of Cardiovascular Surgery, University of Health Sciences, Ankara City Hospital, Ankara, Turkey*
[5]*Department of Cardiology, İstanbul Medipol University, İstanbul, Turkey*

Corresponding author:
Özcan Özeke
✉ ozcanozeke@gmail.com

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venous catheter was placed via the middle hepatic vein (Supplementary Video 1), and 2 wires were inserted through this 1 transhepatic catheter. These were used to place both an RA lead (Supplementary Video 2) and then a left bundle pacing area pacing (LBBAP) lead (Supplementary Videos 3 and 4). However, since we could not reduce the unipolar and bipolar pacing thresholds below 2.5/0.4 mV by the LBBAP, we considered continuing to procedure via biventricular pacing. We decided not to perform second transhepatic access to implant third leads due to the patient's previous complicated course. Therefore, LV-only pacing via coronary sinus leads was implanted (Figure 1, Supplementary Videos 5 and 6). We provided more than the usual redundancy in the RA to minimize dislodgement of the lead due to respirophasic diaphragmatic excursions and gravity. The pulse generator was located on the right upper abdomen. The control hepatic ultrasound showed no apparent complication (Supplementary Video 7). Two months later, the epicardial lead was left in place after removing the pacemaker battery after confirmation of the no transhepatic leads dysfunction. Awareness about the utility of transhepatic access for permanent pacing in a variety of clinical situations where traditional central access was not possible will be an option for such patients.

Informed Consent: Written informed consent was obtained.

Supplementary Video 1: Chiba Needle insertion in hepatic vein via Seldinger technique.

Supplementary Video 2: The right atrial active-fixation lead was positioned in the right atrial appendage.

Supplementary Video 3: We localized to the left bundle pacing area via a deflectable ablation catheter.

Supplementary Video 4: The implantation of the left bundle pacing area pacing lead.

Supplementary Video 5: The coronary sinus angiogram shows the posterolateral branch.

Supplementary Video 6: The permanent pacemaker through the transhepatic route with a pacemaker battery in the right upper abdomen.

Supplementary Video 7: Hepatic ultrasound showed no any complication after the procedure.