Transvenous Left Ventricular Epicardial Pacing in a Patient with Tricuspid Mechanical Prosthesis

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Patients with tricuspid mechanical prosthetic valve cannot receive transvenous right ventricular lead implantation, and they generally have surgical epicardial lead implantation instead, which is a more invasive procedure. A 56-year-old man, who had undergone surgery for tricuspid mechanical prosthetic valve replacement seven years previously, had symptomatic sinus nodal dysfunction and required permanent pacemaker implantation. The patient underwent transvenous dual-chamber pacemaker implantation. A left ventricular epicardial electrode lead was successfully implanted through the coronary vein. We demonstrated the feasibility of applying the transvenous left ventricular epicardial approach for anti-bradycardia pacing, which can be used when the trans-tricuspid approach is not appropriate.

Key Words: Bradycardia • Left ventricular epicardial pacing • Tricuspid mechanical prosthesis

CASE REPORT

A 56-year-old man presenting with a history of severe tricuspid valve regurgitation had received valvular replacement surgery with a mechanical prosthetic valve seven years before. He had had several syncopal episodes recently. His physical examination was not revealing. Twelve-lead ECG showed normal sinus rhythm. Holter ECG recordings documented 64 episodes of sinus pause, maximally up to 2.05 seconds (Figure 1). Most of the episodes occurred between 2 pm and 3 pm. Under the impression of sinus nodal dysfunction with recurrent syncope, he was hospitalized for permanent pacemaker implantation. After accessing the left subclavian vein, a long sheath was advanced to canulate the coronary sinus. Venography of the coronary veins was performed to establish their anatomy for occlusion with a wedge balloon catheter (Figure 2A). A 5-Fr, over-the-wire passive-fixation left ventricular lead (Attain 4193, Medtronic) was driven into the posterolateral branch of the cardiac vein. The capture threshold of the left ventricular lead was 0.75 V, and the impedance was 650 ohms. An active-fixation right atrial lead (Capsurefix 5076, Medtronic) was then successfully anchored at the right atrial appendage (Figure 2B). Both leads were connected to a rate-adaptive generator (Versa DR, Medtronic), which was placed in a left subfascial prepectoral pocket. The paced atrio-ventricular interval was programmed to 250 ms to minimize unnecessary ventricular pacing. The patient handled the whole procedure well and was discharged from the hospital uneventfully. To date, he is still doing fine with the pacemaker at ten months after the implantation.

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DISCUSSION

Both atrial-based pacing and dual-chamber pacing

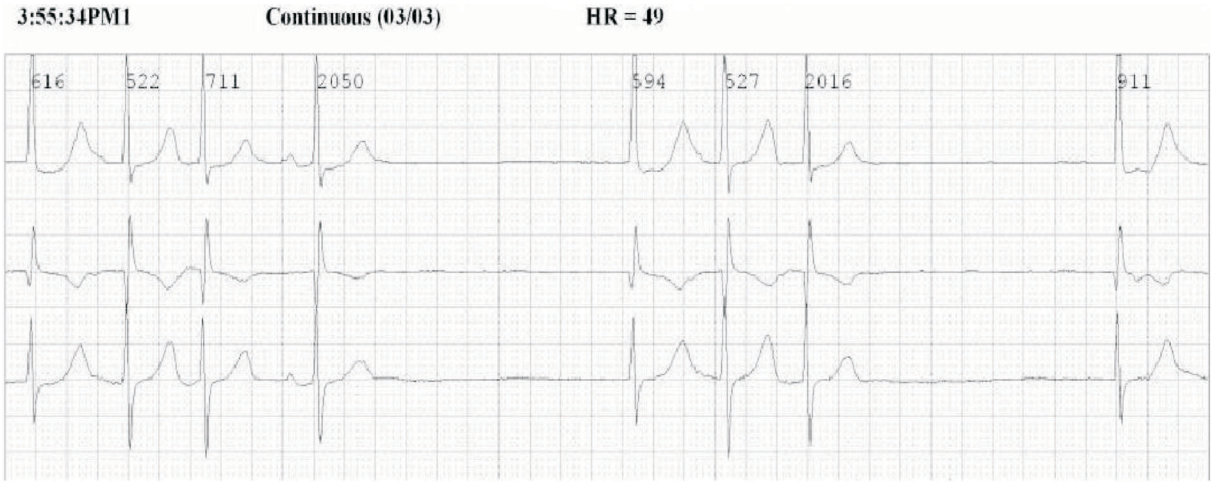

Figure 1. *The Holter ECG strip documents two sinus pauses of 2 seconds followed by junctional escape beats.*

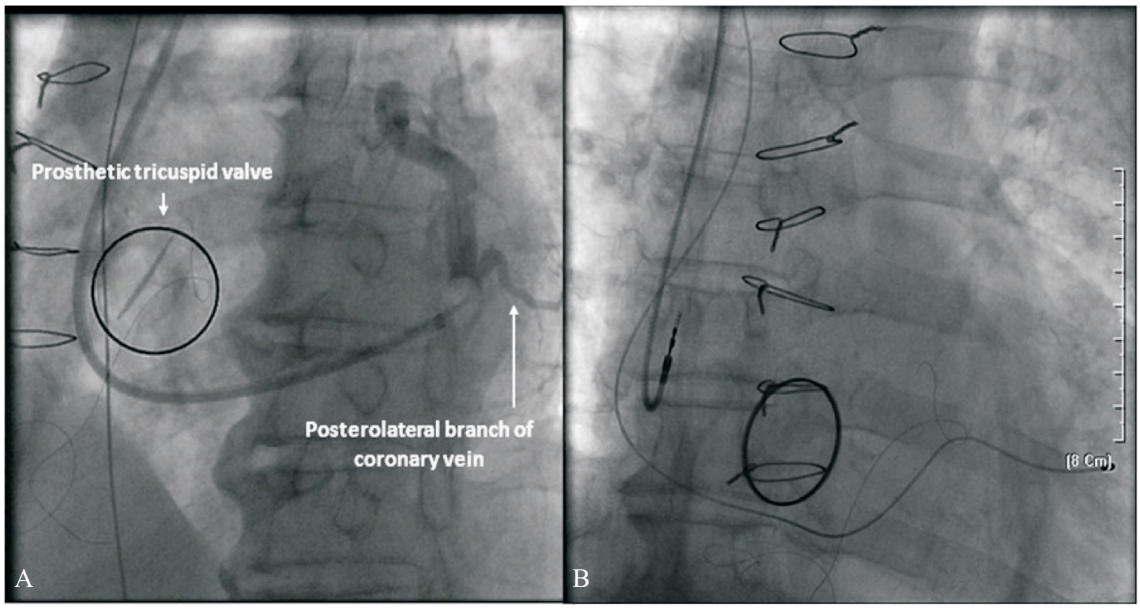

Figure 2. *(A) Coronary sinus venogram in left anterior oblique view shows the posterior lateral branch of the coronary vein and the mechanical prosthetic tricuspid valve. (B) The AP view shows the prosthetic valve, the right atrial lead, and the left ventricular pacing lead via coronary sinus.*

can suitably meet the therapeutic needs of patients with sick sinus syndrome. Future atrio-ventricular conduction block is the major concern in the setting of single-chamber atrial-based pacing for sinus nodal dysfunction, with incidence reported to be approximately 0.6% per year in a meta-analysis[1] or 37% in a 177-patient trial.[2] Pre-operative electrophysiologic study can help in detecting concurrent atrio-ventricular conduction disturbance but cannot guarantee future conduction patency. Moreover, it can be risky to map the His-region during the electrophysiologic procedure, as the catheter may pass the mechanical valve and result in an unexpected event. Consequently, the dual-chamber mode is a better choice with regard to safety concerns. However, inappropriate ventricular pacing in such a pacemaker mode might result in increased morbidity, such as increased left atrial diameter, and decreased left ventricular fractional shortening.[1]

Transvenous right ventricular endocardial pacing lead is not suitable in patients with mechanical tricuspid

prosthetic valve because a lead placed across such a valve may cause acute valvular dysfunction.[2] Epicardial lead implantation through an anterolateral thoracotomy or sternotomy has been commonly used in the past. However, such approaches are highly invasive and carry certain surgical risks. Compared to surgical epicardial implantation, transvenous left ventricular epicardial lead implantation via coronary vein is much less invasive.

The first successful left ventricular permanent pacing via the great cardiac vein was performed by Anagnostopoulos et al. in 1970.[3] Hansky et al. demonstrated satisfactory results for left ventricular pacing in seven patients with mechanical tricuspid valve and one patient after tricuspid valve repair. All devices functioned well with no complications. A similar procedure can be applied in patients with congenital heart diseases, such as Ebstein's anomaly.[4,5]

Capture and sensing thresholds upon implantation were not affected by types of pacemaker leads implanted and by the branches of cardiac veins selected for implantation. However, capture threshold was significantly lower when the tip of the electrodes could be driven distally into the branch of the vein, as compared to the proximal site near the ostium of the coronary sinus.[6]

In cases where right ventricular endocardial pacing is not feasible, transvenous left ventricular epicardial pacing offers a less invasive alternative for ventricular lead implantation.

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