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Usefulness of a lead delivery system consisting of a fixed-shaped sheath and a lumenless bipolar lead in a patient with absent right and persistent left superior vena cava: A case report

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ABSTRACT

We report the case of an 84-year-old female with symptomatic bradycardia due to a complete atrioventricular block, who carried absent right and persistent left superior vena cava (SVC). Implantation of a pacing lead, particularly within the right ventricle (RV) in a patient with this venous anomaly is accompanied by technical difficulties. However, the apparatus consisting of a fixed-curve sheath (Model C315-S10, Medtronic, Inc., Minneapolis, MN, USA) and a lumenless fixed-screw pacing lead (Model 3830, Medtronic), allowed a rapid delivery into the RV without any complications. By rotating the Model C315-S10 sheath in the counterclockwise direction in the right atrium, its tip faced the tricuspid orifice, advanced across the tricuspid valve and confronted the RV lower septum near the apex. Then the RV-lead was fixed with acceptable pacing and sensing parameters. Utilizing a lumenless pacing lead and a preformed sheath to deliver it is a novel approach that could be helpful in pacemaker implantation in patients with absent right and persistent left SVC.

1. Introduction

In patients with persistent left superior vena cava (PLSVC), implantation of permanent pacemaker leads into the right ventricle (RV) via the left subclavian vein has remained technically challenging. In some patients, the endocardial approach seems impossible and sometimes epicardial pacing is necessary. To overcome this problem, various techniques using custom- or ready-made stylets or a coronary sinus (CS) cannulation sheath have been described in the literature [1–6]. However, they heavily depend on the operator's skill or experience, so that they can often be time-consuming, which may increase radiation exposure. We present an easier and more feasible procedure for RV-lead placement in a patient with PLSVC, utilizing a lumenless pacing lead and a preformed sheath to deliver it.

2. Case report

An 84-year-old woman with a history of hypertension was admitted to our hospital with a complaint of exertional dyspnea and leg edema for one week. Twelve-lead electrocardiogram diagnosed a complete atrioventricular block with a junctional escape rhythm at 43 beats per minute and transthoracic echocardiography showed a left ventricular ejection fraction of 60% with moderate sclerotic change of the aortic valve. A temporary transvenous pacemaker electrode was inserted through the right femoral vein because venography from the right internal jugular one was compatible with PLSVC with the absence of right superior vena cava (RSVC). The diagnosis was confirmed by a contrast-enhanced computed tomography (CT) subsequently performed (Figure1). The CT scan also revealed right azygos vein draining directly into postero-upper part of the right atrium (RA), which was extremely rare in Japanese subjects with PLSVC [7]. She underwent a permanent pacemaker implantation for symptomatic bradycardia. After puncture of the left subclavian vein, a conventional outer-sheath was indwelled. Next, a fixed-curve sheath with a 40 cm length and a 7 French (Fr) diameter (Model C315-S10, Medtronic, Inc., Minneapolis, MN, USA) (Figure 2) was introduced over a 0.375 mm guide wire into the RA through PLSVC. Then, by turning the sheath to the counterclockwise, its tip turned toward the tricuspid orifice, advanced across the tricuspid valve (TV) and confronted the RV lower septum near the

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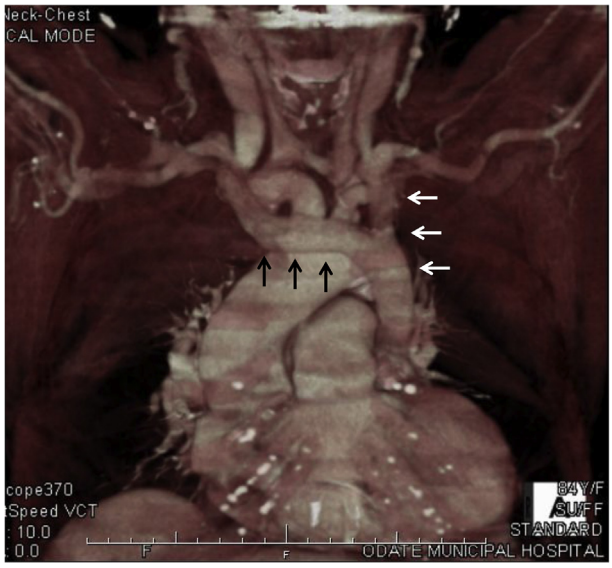

Fig. 1. Contrast-enhanced computed tomography revealed persistent left superior vena cava (white arrows) and the right brachiocephalic vein (black arrows) draining directly into it.

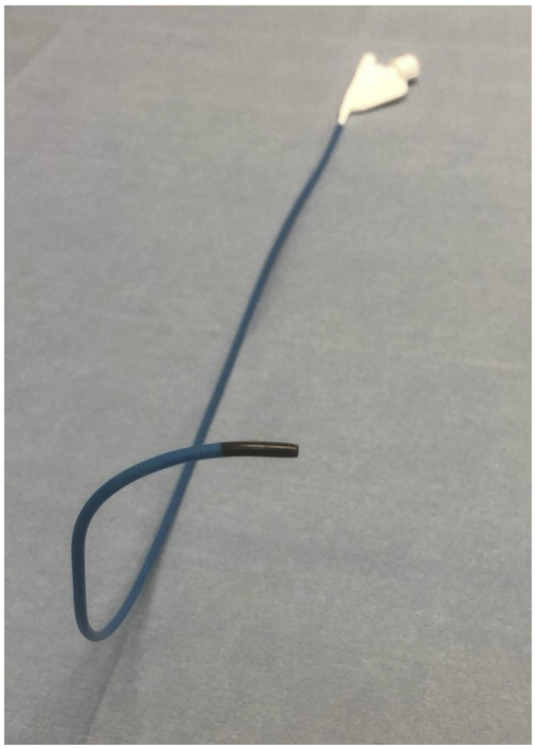

Fig. 2. C315-S10 delivery sheath with a 5.5 French (Fr) inner diameter and a 7 Fr outer diameter has proximal and distal curves, whose surfaces are directed perpendicularly to each other.

apex without any difficulty (Figure 3). There, a 4.1 Fr diameter, lumenless pacing lead (Model 3830, Medtronic) was fixed there. The sheath was easily removed using a peel-away technique. Ahead of implanting the RV-lead, the model 3830 lead was placed at the RA lateral wall using another curved sheath (C315-H40, Medtronic). The procedure was not so complicated because the lead naturally proceeded toward the RA lateral wall, which was coaxially aligned with the CS ostium. Intraoperatively and after implantation, pacing and sensing parameters in both the RA and RV leads were acceptable, and the patient remained free from heart failure.

3. Discussion

In implanting pacemakers or defibrillators, we unusually encounter PLSVC, which is a congenital venous anomaly with an incidence of 0.5% in the general population and 5–10% in congenital heart disease [8]. Absence of RSVC is exceedingly rare with this anomaly, and is reported in approximately less than 0.1% of the general population [9]. Pacemaker implantation for a patient with PLSVC and absent RSVC is accompanied by technical difficulties because pacing leads need to be placed through PLSVC. In particular, locating a pacing lead into the RV is a very complicated process. The explanation for this is that the ostium of the CS is not aligned with the tricuspid orifice and that a loop must be made before a lead can pass the TV. Various methods have been proposed to facilitate this procedure. Common techniques of implantation via PLSVC consist of curving the stylets in different angles in order to direct the tip of the electrode leaving from the CS toward the tricuspid orifice and introduce it into the RV [1–5]. The alternative method to guide a pacing lead into the RV in such anomalous anatomy is using one of the curved long venous access sheaths for CS cannulation during cardiac resynchronization therapy [6].

However, it is thought that there are several problems with these techniques previously reported. First, the tip of a pacing lead tends to be unstable after passing through the TV because it is necessary to withdraw the deformed stylet back or to replace it with the straight one for deploying the lead at the site aimed at. Second, these proposed methods necessitate considerable technique, and depend on the experience and skill of an operator. The same success may not be achieved in other hands. On the contrary, the lead delivery system we reports here do not need special techniques but a simple procedure including three steps: 1) to introduce the delivery sheath in the RA on the guidewire 2) to rotate it counterclockwise and 3) to screw a pacing lead into position. With these 3 steps, the RV-lead could be located in the RV septum. Given the easiness of our maneuver, it is probable that all operators could readily use it with equal effectiveness.

Venous stenosis and occlusion in the presence of endocardial leads constitute one of the complications of permanent cardiac pacing [10,11], which is also concern with our case. The occlusion of the vessels can be critical because venous return of the head and upper limbs all drains into PLSVC. Therefore, the Model 3830 lead with a smaller diameter, is favorable to prevent a potentially fatal complication of coronary sinus thrombosis.

To the best of our knowledge, this is the first report of pacemaker implantation using the C315 sheath and 3830 leads in a patient with PLSVC with absent RSVC. The method we described above could be a new therapeutic approach with high feasibility and safety in patients with such venous anomaly.

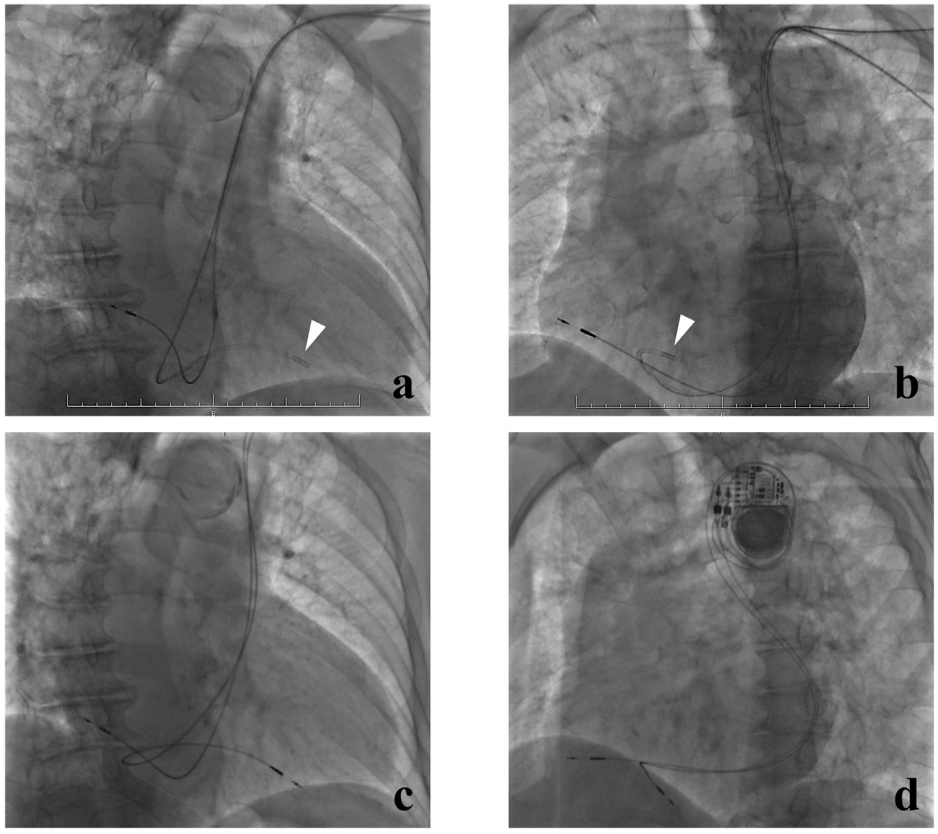

Fig. 3. Turning the C315-S10 sheath to the counterclockwise allowed its tip (white arrow-head) to turn toward the tricuspid orifice, advance across the tricuspid valve and confront the right ventricular lower septum near the apex. a) Right anterior oblique (RAO) view. b) Left anterior oblique (LAO view). c) RAO view of the pacemaker leads. (d) LAO view of the pacemaker leads.

Conflicts of interest

None declared.

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