Combined implantation of dual-chamber ICD and optimizer through a persistent left superior vena cava

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Introduction

Cardiac contractility modulation (CCM) is a relatively new treatment for patients with an advanced heart failure having reduced left ventricular ejection fraction (LVEF), which is particularly indicated in patients with a sinus rhythm, narrow QRS complex,

and 25%–35% LVEF (1). Studies have demonstrated improvements in NYHA class, quality of life, and exercise capacity (2–5).

To date, there is a requirement for an atrial lead for P-wave sensing and two ventricular leads for therapy delivery comprising high-energy nonexcitatory impulses during the absolute refractory period of the myocardium (4). According to the current heart failure guidelines, most patients eligible for CCM treatment also have an indication for an implantable cardioverter–defibrillator (ICD) (6, 7), which should be conducted before or at the same time.

Routinely, ICD is placed through the left-sided venous system and the CCM system to the right side (4) without any problems. Nevertheless, in patients with venous anomalies, the implantation process can be challenging. Here we describe the first successful implant of both ICD and a CCM device in a patient with a persistent left superior vena cava (PLSVC).

Case Report

We report a case of a 70-year-old male patient with ischemic cardiomyopathy and dyspnea NYHA class III with major restrictions. His LVEF was 29%. He had already been treated with coronary artery bypass grafting and heart failure therapy comprising ß-blockers, ACE inhibitors, and diuretics. ECG revealed a sinus rhythm (61 beats/min), which was not eligible for cardiac resynchronization therapy. Holter ECG demonstrated intermittent sinus bradycardia and rare sinus-atrial blocks.

Thus, a dual-chamber ICD was indicated for primary prevention of sudden cardiac death and for antibradycardiac pacing. During the ICD implant procedure, intraoperative phlebography revealed that the patient had PLSVC with an absence of the right SVC (Fig. 1a). The dual-chamber ICD was successfully implanted. Optimizer implantation with three leads was performed 6 weeks later through the right subclavian vein and PLSVC. Peri- and post-procedural device interrogation revealed no cross talk.

Follow-up data at 4 years after implantation revealed a mild increase in LVEF (33%) and a significant improvement of dyspnea symptoms (NYHA II). Spiroergometry revealed an improvement in peak oxygen uptake from 10.4 mL/kg/min at baseline to 13.6 mL/kg/min at last follow-up. During follow-ups, the patient felt well without any cardiac decompensation and need for hospitalization because of cardiac issues.

Discussion

CCM therapy has proven to be an effective treatment for patients with an advanced heart failure having left ventricular reduced ejection fraction (2, 3). Nevertheless, in patients with anatomical anomalies, device implantation can be challenging. PLSVC remains one of the most common venous anomalies. Reports in the current literature indicate that PLSVC can be found in up to 0.5% of all patients and up to 4% of all patients with congenital heart disease (8, 9). Because they usually remain asymptomatic, most cases are discovered during invasive diagnostics,

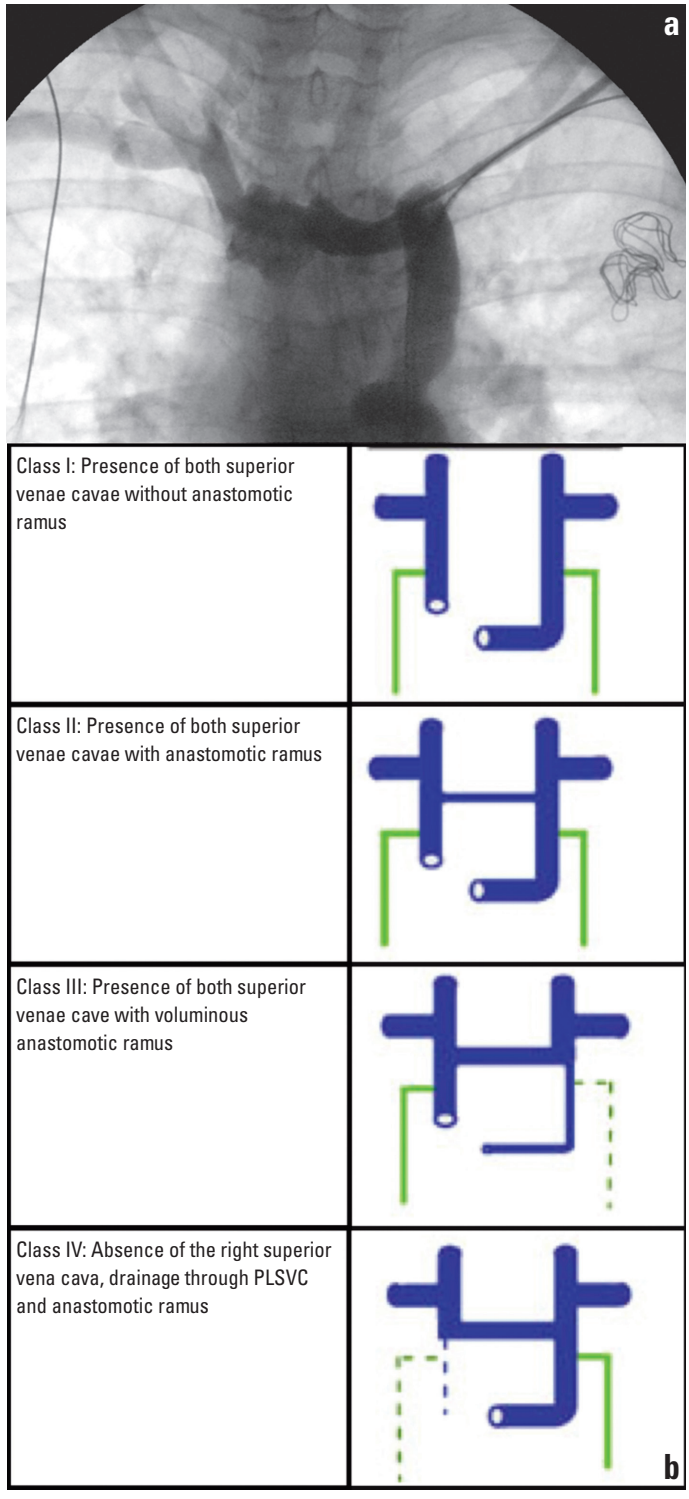

Figure 1. (a) Intraoperative phlebography of the patient. (b) Modified figure according to Ref. 10. Four different classes of PLSVC. In the above reported case, we encountered a class IV, which is the rarest case of PLSVC (Ref. 10)

such as catheterization (9) or device implantation as in our case. A classification of PLSVC has been suggested by Uemura et al. (10) because of its high variability. PLSVC appear in four different classes (Fig. 1b) and additional subgroups according to the

presence and thickness of the right SVC, an anastomotic ramus between both the brachiocephalic veins and azygos veins (10).

Because PLSVC is usually associated with an enlarged and dilated coronary venous system and ends in the right atrium (8, 9), an implantation can be performed in a standard fashion. However, with an increasing number of leads, the probability of venous occlusion and lead dislodgment increases. We report the feasibility of the first combined implantation of CCM and dual-chamber ICD with a total of five leads through PLSVC (Figs. 2a and b).

Conclusion

In this case, we demonstrated that combined implantation of ICD and CCM through PLSVC is technically feasible, safe, and effective. Therefore, we recommend that this therapy should not be withheld from patients with these anatomical variances.

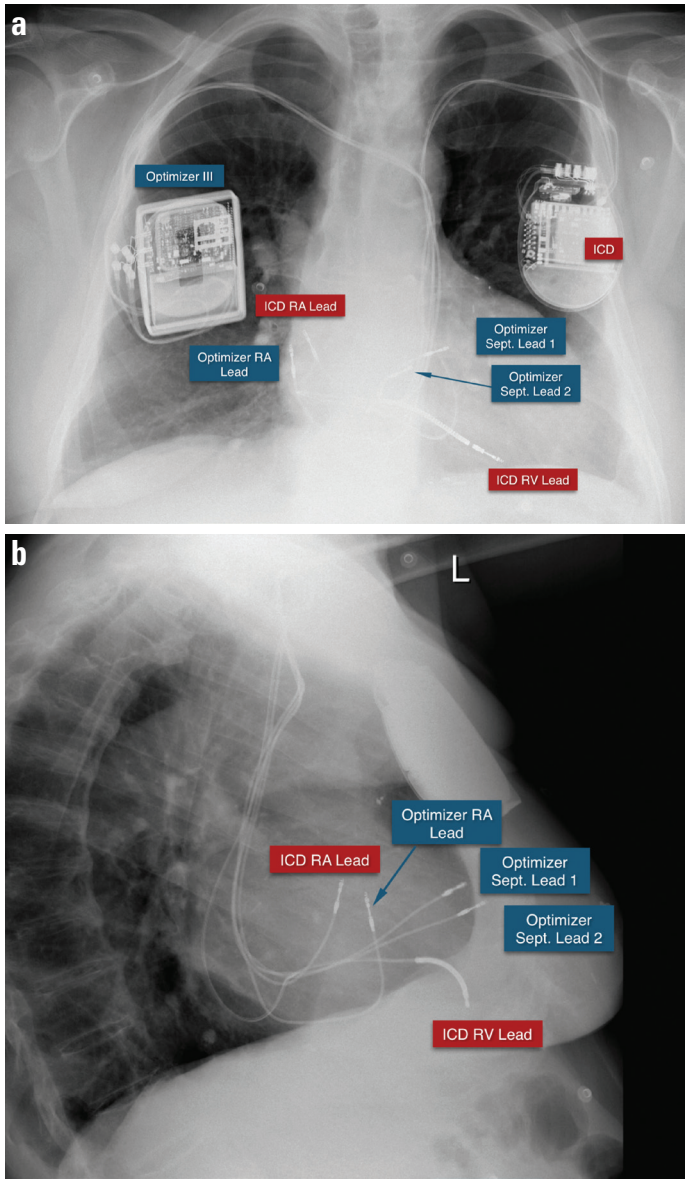

Figure 2. (a) Post-procedural PA chest X-ray revealing both devices. RA, right atrium; RV, right ventricle; sept, septal. (b) Post-procedural lateral chest X-ray

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