Successful implantation of a biventricular pacing and defibrillator device via a persistent left superior vena cava

Uspešna ugradnja resinhronizaciono-defibrilatorskog aparata preko perzistentne leve gornje šuplje vene

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Abstract

Introduction. Persistent left superior vena cava (PLSVC) is the most common variation in the thoracic venous system. PLSVC is found in 0.3% to 0.5% of the population and in 5% to 10% of patients with other congenital heart defects (atrial septal defect, bicuspid aortic valve, coarctation of aorta, coronary sinus ostial atresia and cor triatriatum) 1–6. Several subtypes of PLSVC can be distinguished. In about 20% of patients, as well as in the presented case, the right superior vena cava (RSVC) is absent resulting in drainage of venous blood from the head and both arms through the left brachiocephalic vein, PLSVC and the coronary sinus into the right atrium 7. This condition is typically asymptomatic, usually incidentally discovered during pacemaker implantation can complicate lead placement through the subclavian approach. We reported a case of a successful biventricular pacing and defibrillator device implantation (CRT-D) via a persistent left superior vena cava in a 55-year-old man with dilated cardiomyopathy and severe heart failure.

Case report. We reported a successful implantation of a biventricular pacing and defibrillator device (CRT-D) via a persistent left superior vena cava in a 55-year-old man with dilated cardiomyopathy and severe heart failure. A persistent left superior vena cava was detected during CRT-D implantation. We managed to position electrodes in the right ventricular outflow tract, a posterior branch of the coronary sinus and in the right atrium.

Conclusion. Congenital anomalies of thoracic veins may complicate lead placement on the appropriate and stable position. The presented case demonstrates a successful biventricular pacing and defibrillator therapy device implantation in a patient with dilated cardiomyopathy and severe heart failure.

Key words: vena cava superior; vascular malformations; cardiac pacing artificial; defibrillator implantable; treatment outcome.

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a patient with dilatative cardiomyopathy and severe heart failure.

**Case report**

A 55-year-old man with weakness, fatigue, dizziness, syncope and the history of idiopathic dilated cardiomyopathy underwent implantation of a biventricular pacemaker and defibrillator therapy device. ECG showed a wide left bundle branch block with the duration of 180 msec (Figure 1). The patient was categorized as the New York Heart Association (NYHA) functional class III.

![Fig. 1 – Electrocardiography (ECG) on admission showed a wide left bundle branch block with the duration of 180 msec.](image1)

An echocardiogram showed an enlarged left ventricular cavity (end-diastolic diameter 7.8 cm and end-systolic diameter 6.2 cm) with severe impaired left ventricular ejection fraction (LVEF) of 15%, wide coronary sinus and moderate to severe mitral regurgitation. Coronary angiography showed normal coronary arteries.

After cannulation of the left subclavian vein, the guidewire passed along the left side of the mediastinum when the left superior vena cava became evident. An active fixation ventricular defibrillator (ICD) lead was placed through a curved guiding stylet on the right ventricle outflow tract. The stimulation threshold was 1.5 V at 0.5 ms with the impedance of 530 Ω, high-voltage shock impedance was 47 Ω and R wave amplitude was 8.9 mV. A sub-selection catheter and the guidewire facilitate placement of unipolar left ventricular electrode in the posterior branch of the coronary sinus. Its stimulation threshold was 1.25 V at 0.5 ms, R wave amplitude was 12 mV and impedance was 300 Ω. A passive fixation right atrial lead was positioned using a standard atrial stylet in the septum of the right atrium. The stimulation threshold was 0.5 V at 0.5 ms with the impedance of 680 Ω and P wave amplitude of 4.7 mV (Figures 2 and 3).

There were no other complications in the course of the procedure.

After a 6-month follow-up, the patient fitted into NYHA functional class I, sensing and capture threshold remained stable and ventricular pacing was more than 95%. ECG showed narrowing of QRS to 120 msec (Figure 4). There was a mild mitral regurgitation, and LVEF was 40%, showing an excellent response to CRT-D.

![Fig. 2 – Antero-posterior (AP) view: an active fixation of ventricular defibrillator lead positioned in the outflow tract of the right ventricle; an unipolar left ventricular electrode positioned in the posterior branch of the coronary sinus; a passive fixation atrial lead positioned in the septum of the right atrium.](image2)

![Fig. 3 – Left anterior oblique (LAO) 45° view: a right ventricular defibrillation lead, left ventricular unipolar lead and atrial lead insertion place.](image3)

![Fig. 4 – Electrocardiolography (ECG) showing biventricular stimulation with narrowing of QRS to 120 msec.](image4)
Discussion

Although the left superior vena cava may complicate or completely disable biventricular pacemaker and defibrillator devices implantation, several cases of successful implantation have been described in the literature 7, 9, 10. However, some difficulties may occur during this procedure. Right ventricular lead placement is the major problem. In patients with the nominate vein which connects the right and left superior vena cava, right ventricular lead implantation is usually achievable through this one using a conventional method 7. Typically, the PLSVC drains directly into the right atrium through the greatly enlarged coronary sinus because of a significant increase in blood flow 7. When an electrode is introduced into the right atrium, the tip of the right ventricular lead usually tends to deflect away from the tricuspid annulus. There are several methods to overcome this difficulty. Biffi et al. 11 used a manually formed U-shaped stylet, requiring considerable manoeuvring, forming a loop in the right atrium, using the right atrial free wall for support. Srimannarayana et al. 12 reported the use of atrial J-shaped stylet for ventricular lead placement 12. Konstantino et al. 13 demonstrated ventricular lead placement into the right ventricular outflow tract using a coronary sinus delivery system. These techniques allow acute angulation of ventricular electrode to reach right ventricular through the tricuspid valve, which is the critical juncture mostly requiring additional complex maneuvers. These maneuvers have not been completely described in the published literature so far 14, 15.

In the presented case of ICD lead implantation we used a manually formed U-shaped stylet with the rotation of electrode in clockwise direction toward the tricuspid valve annulus and after a sudden withdrawal of the stylet, the ventricular lead got into the right ventricle across the tricuspid valve. The atrium lead was implanted using J-shaped stylet, but with counterclockwise rotation in the right atrium septum. It is advisable to apply both maneuvers in the direction of rotation opposite to the one done during the conventional biventricular pacemaker device lead implantation.

The left ventricular lead, if possible, is introduced through the PLSVC into the coronary sinus and implanted in the appropriate coronary vein. The difficulty in coronary sinus cannulation is still one of the reasons for failing biventricular pacing system in implantation. Balloon-occlusion retrograde angiography is not possible because of coronary sinus dilation. Coronary cannulation vein requires a lead to be manipulated through sharp angles. Sometimes, left coronary angiography is performed in order to evaluate possible position for left ventricular lead placement. However, this can lead to large contrast volume and prolonged angiographic time. In the case, we used the sub-selection catheter with a curve of 90° and a guidewire which facilitates unipolar left ventricular electrode placement in the posterior branch of the coronary sinus.

Conclusion

Despite venous abnormalities, biventricular pacing and defibrillator device implantation via a persistent left superior vena cava is feasible. According to our findings, these maneuvers have not been completely described in the published literature so far. We hope that these techniques may facilitate lead implantation via the left superior vena cava.

REFERENCES


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