Letter to the Editor

PCI techniques to aid implantation of CRT-D in a senior patient with persistent left superior vena cava

Qiang WU*,#, Sha YU*, Ya-Ping AN, Bao-Lin CHEN
Department of Cardiology, Guizhou Provincial People’s Hospital, Guiyang, Guizhou, China

J Geriatr Cardiol 2016; 13: 639–642. doi:10.11909/j.issn.1671-5411.2016.07.001

Keywords: Cardiac resynchronization therapy; Heart failure; Implantation; Left superior vena cava

Persistent left superior vena cava (PLSVC) is a rare congenital anomaly of the vena cava, affecting about 0.5% of the general population, which poses a particular obstacle during transvenous electronic device implantation. Here, we report a successful cardiac resynchronization therapy-defibrillator device (CRT-D) implantation strategy in which techniques and devices for percutaneous coronary intervention were used via a PLSVC.

A 73-year-old man was admitted to our hospital due to 13 years progressive exertional dyspnea with New York Heart Association (NYHA) class III. Transthoracic echocardiography (TTE) revealed abnormal left ventricular parameters with a left ventricular end-diastolic dimension of 65.9 mm and an ejection fraction (EF) of 21%. Mechanical dyssynchrony between the left ventricular septum and the free wall area was also observed via the TTE. The electrocardiography showed sinus rhythm, and complete left bundle branch block with a QRS duration of 160 ms (Figure 1A). The 24-h Holter monitoring electrocardiogram detected a frequent ventricular tachycardia and premature ventricular contractions. A diagnostic coronary angiography indicated three branch lesions in this patient, with a chronic total occlusion lesion in the right coronary artery.

As a result, the patient was diagnosed with ischemic cardiomyopathy on the basis of the clinical features, the diagnostic coronary angiography, the progressive exontional dyspnea and transthoracic echocardiography. CRT-D implantation with Class I recommendation was explicit considering the presence of overt ventricular dyssynchrony, complete left bundle branch block (LBBB), NYHA class III and frequent ventricular arrhythmia. The patient approved the procedure with a written informed consent.

The left subclavian vein puncture was uncomplicated. After the insertion of the guide wire, the locus of the guide wire on the left podoid implied the presence of PLSVC. Antegrade venography was performed and confirmed that PLSVC was drained into the right atrium via a giant coronary sinus, without any vein connecting to the right superior vena cava (RSVC), (Figure 2A). We failed to find any identifiable coronary sinus tributaries in retrograde venography via the right subclavian vein because it was impossible to occlude the enlarged coronary sinus temporarily (Figure 2B).

Though microcatheter angiography confirmed the guide wires were ultimately placed into two posterolateral veins through the RSVC, the left ventricular lead (QUICK-FLEXTM μ, 1258T, St. Jude Medical, USA) could not be positioned in the coronary veins due to small vascular diameter.

Selective coronary sinus tributaries venography was then successfully performed through the PLSVC by using a 5 F Judkins-type angiographic catheter (JR 4.0) (Figure 2C). Three guide wires were eventually placed into three lateral veins respectively. A guiding sheath (CPS PL-STR, St. Jude Medical, USA) was then used to replace the angiographic catheter. Finally, the left ventricular lead was successfully positioned in a lateral vein under the support of two other wires. Subsequently, a double-coil defibrillator active-fixation lead (DURATATM, 7120, St. Jude Medical, USA) was positioned at the right ventricular apex and an active-fixation lead (TENDRILTSTM, 188T, St. Jude Medical, USA) was placed into the right atrial appendage via the RSVC. The right heart leads were secured and reached the left subfascial prepectoral pocket across the subepidermis.

After detecting acute parameters (threshold: left ventricle 0.8 V, right ventricle 0.7 V, right atrium 1.0 V, at 0.48 ms; wave potential: right ventricle 18 mV, right atrium 4.0 mV; impedance: left ventricle 1040 Ω, right ventricle 760 Ω, right atrium 560 Ω), all leads were eventually connected to a CRT-D device (V-350, St. Jude Medical, USA).

*The first two authors contributed equally to this work.
#Correspondence to: gzzgywq@126.com

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PLSVC is observed in 0.3%–0.5% of the general population as established by autopsy.\textsuperscript{[1]} It results from a degradation failure of the left common cardinal vein, and is usually asymptomatic. This congenital anomaly has rarely been reported as a contingent finding during cardiac device implantation for the treatment of sick sinus node syndrome, atrio-ventricular block, non-standing ventricular tachycardia or heart failure.\textsuperscript{[2,3]} Diagnosis of a PLSVC in a senior patient (73-year-old) was surprising and really rare, especially in patients who needed a CRT-D implantation. The possibility of PLSVC should always be kept in mind when the guide wire declined on the left side of the thorax, as it was an incidental discovery during a cardiac device implantation.

For the convenience of cannulation and the effectiveness of defibrillation, it is a better decision to implant the CRT-D through a left pectoral approach. Taking into account the difficulties in positioning the right ventricular lead via PLSVC, we attempted to place the three leads of CRT-D via right subclavian vein in this case. However, the left
Figure 2. Chest radiograph and angiogram. (A): Venography shows persistent left superior vena cava with right superior vena cava; (B): retrograde coronary venogram, angiographic balloon failed to occlude the lumen of the vein; (C): selective coronary sinus tributaries venography with a JR catheter; and (D): positions of right atrial, right ventricular and coronary sinus leads in anteroposterior projection.

ventricular lead has failed to implant in any coronary sinus tributary through right subclavian vein due to the giant coronary sinus, the degraded image of retrograde coronary sinus venography, and the small tributaries in which the leads could not be manipulated.

In the present case, selective coronary sinus tributaries venography was successfully performed through the left subclavian vein and PLSVC with a JR coronary arteriography catheter. We then replaced the coronary arteriography catheter with the guiding sheath. Under the guidance of clear images of selective coronary sinus tributaries venography and the support of buddy wires, the left ventricular lead was successfully positioned in a lateral branch through PLSVC.

The majority of PLSVC patients also have RSVC. The device implantation via the RSVC is therefore feasible and safe. The implantation of the device in patients with isolated PLSVC has proven more difficult due to the technically challenge in lead placement as well as in specific heart diseases, although there have been some reports about successful defibrillator or pacemaker lead implantations through PLSVC.\(^3-5\) Thus, a left-side transvenous implantation or open chest surgery is mandatory due to the special anatomic abnormalities in some patients.\(^6\) The successful CRT-D implantation in the present case indicates that it is feasible and safe to position the left ventricular lead via PLSVC, in which the techniques and instruments for percutaneous coronary intervention are helpful.

Acknowledgements

This work is supported by grants from the Guizhou provincial health and Family Planning Commission of science and Technology Fund of China (GZWKJ2014-1-047) and the Guizhou Province, the governor funds of outstanding scientific and technological education of China (2012-12). The authors of this article do not have potential conflicts of interest.
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