CASE REPORT

Implant of a Dual-chamber Implantable Cardioverter Defibrillator through a Persistent Left Superior Vena Cava

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SUMMARY

Persistent left superior vena cava (PLSVC) is the most common congenital defect in the thoracic venous system, with an incidence of 0.3% in the general population and of 5-10% in patients with congenital heart disease. This asymptomatic condition does not produce hemodynamic impairment; however, it should be recognized as its presence poses technical challenges in the introduction of catheters for hemodynamic measurements and for placement of pacemakers (PMs) and implantable cardioverter defibrillators (ICD) via the cephalic vein or the left suclavian vein.
In the present case report we describe the implantation of a dual-chamber ICD through a PLSVC discovered during the procedure. In addition, images from cardiac 64-row multidetector computed tomography (64-row CT) show the anatomic features of this variety.

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Key words > Superior vena cava - Cardiovascular Abnormalities - Automatic Implantable Cardioverter Defibrillator - Tomography - Multislice

Abbreviations >

RA	Right atrium	**RSVC**	Right superior vena cava
ICD	Implantable cardioverter defibrillator	**PLSVC**	Persistent left superior vena cava
PM	Pacemaker	**RV**	Right ventricle
CS	Coronary sinus		
64-Row MDCCT	64-row multidetector cardiac computed tomography		

BACKGROUND

Persistent left superior vena cava (PLSVC) occurs during embryonic development due to failure of obliteration of the left anterior cardinal vein as a consequence of a reduced compression by the right atrium (RA) and the left lung hilum. (1)

During extrauterine life, it is represented by the ligament of Marshall.

In 90% of cases it coexists with a right superior vena cava (RSVC) and drains into a large coronary sinus (CS).

Both venous systems are frequently connected by an innominate vein (70%). (2)

Although it is a benign condition, it may complicate the placement of pacemaker leads, especially in critical care settings and in absence of a RSVC. (3)

We describe the case of a patient with this anomaly, detected during the placement of a dual chamber implantable cardioverter defibrillator (ICD). The outcomes after one year of follow-up and the characterization of this condition with cardiac 64-row multidetector cardiac computed tomography (64-Row MDCCT) are also described.

CASE REPORT

An 82-year old man was admitted to the coronary care unit with an episode of sustained monomorphic ventricular tachycardia with severe hemodynamic compromise that reverted to sinus rhythm with electrical cardioversion. The patient had a history of coronary artery bypass graft surgery and aortic valve replacement 10 years before.

He was in functional class II, under optimal medical treatment and received amiodarone due to frequent and symptomatic ventricular premature beats.

During hospitalization the patient underwent several tests with the following results: normal lab tests; left ventricular ejection 30%; inferior wall necrosis; absence of myocardial ischemia; patent left internal mammary artery graft; and normal prosthetic aortic valve function.

A high output dual chamber ICD with dual-coil active-fixation leads was prescribed.

Using the route of the left subclavian artery, the guidewire was introduced under fluoroscopic guidance and unusually descended along the left border of the sternum, reaching the right chambers through the coronary sinus (CS), a typical finding in presence of a PLSVC.

The device was implanted through the PLSVC due to the impossibility to reach the RSVC.

The catheter was properly positioned in the RA; however, preshaped guidewires were needed to introduce the

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catheter into the right ventricle, and were fixed to the anterior and superior wall.

The following parameters were registered in the RA and RV: stimulation threshold 1 V and 0.7 V, respectively; impedance 700 ohms and 659 ohms, respectively; P wave amplitude 2mV and 7 mV, respectively.

The defibrillation threshold was < 15 J.

The 64-Row MDCCT demonstrated the presence of a double superior vena cava system with absence of innominate vein and a PLSVC draining into a large CS. The device was completely identified as well as its relation with the surrounding anatomic structures (Figures 1 and 2).

During 1-year follow-up, multiple appropriate and effective electrical shocks were delivered (including 36-J shock energy); no complications were reported.

DISCUSSION

Persistent left superior vena cava is the most common congenital defect in the thoracic venous system. (4)

Several anatomical variations have been described: the double superior vena cava system with a PLSVC draining into a large CS is the most frequent presentation (90%) with the presence of an innominate vein joining both venae cavae (70%). In our case, the 64-Row MDCCT demonstrated the presence of a double superior vena cava system with absence of the innominate vein.

Persistent left superior vena cava is considered a marker of congenital heart defects and is frequently associated with coarctation of the aorta, cor triatriatum, ventricular septal defect, type venous sinus atrial septal defect, and tetralogy of Fallot. (5, 6)

It frequently coexists with histological abnormalities of the sinus node, atrioventricular node and bundle of His, producing sinus node dysfunction, atrioventricular block, paroxysmal supraventricular tachycardia, atrial fibrillation and malignant ventricular arrhythmias that lead to sudden death. (7, 8)

Implantation of a cardiac PM or an ICD may be challenging in cases of RSVC atresia as it is difficult

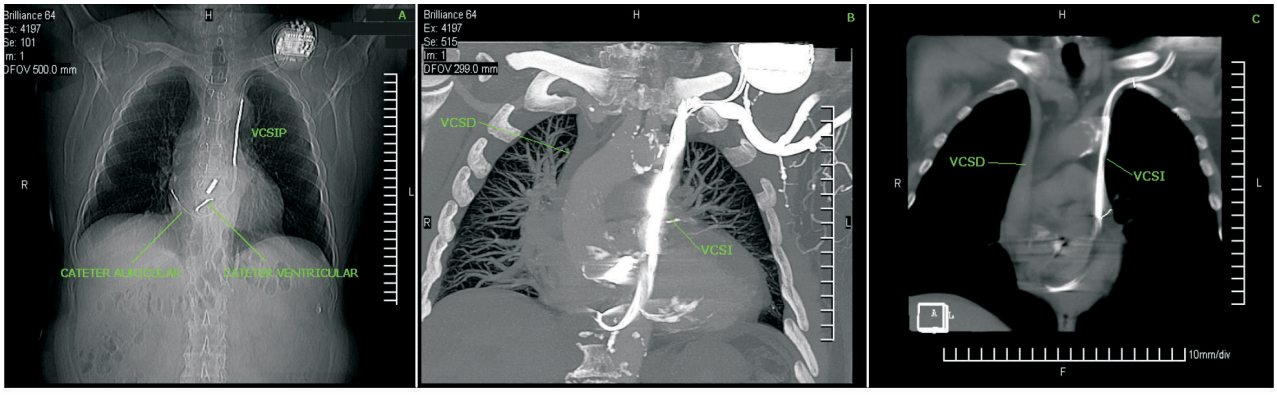

Fig. 1. 64-row MDCCT showing the ICD and its relation with the surrounding anatomic structures, the abnormal route of the catheters descending along the left parasternal border (**A**) and the presence of a double superior vena cava system (**B** y **C**).

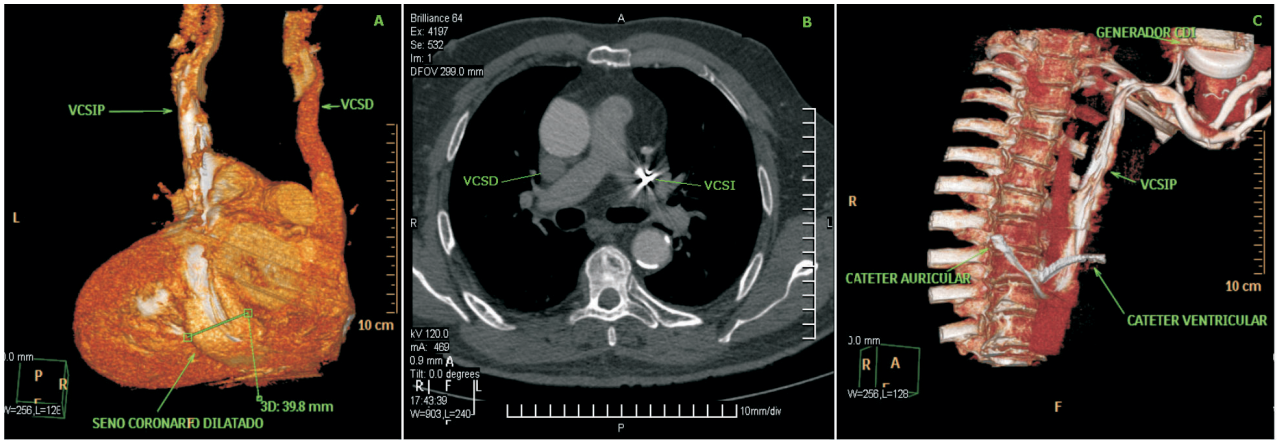

Fig. 2. PLSVC draining in a large CS (**A**), with absence of innominate vein (**B**). The ICD, the atrial and ventricular catheters, and their relation with the surrounding structures can be seen (**C**).

to insert and stabilize the catheter in the RV. Under these circumstances, it is advisable to use preshaped cardiac catheters and active-fixation leads. (3)

Some authors have described difficulties in obtaining adequate defibrillation thresholds and the presence of myopotential oversensing due to positioning of the catheter in the anterior and superior region of the RV. (9)

The coronary sinus can present dissection, perforation and thrombosis. (10)

Our case demonstrates that the implant of an ICD through a PLSVC is a valid option when the approach via the RSVC is not possible and is consistent with other reports.

During 1-year follow-up, multiple appropriate and effective electrical shocks were delivered (including high-shock energy) and there were no complications related to lesions of the venous system and surrounding anatomic structures, catheter displacements, or sensing, capture and defibrillation threshold abnormalities.

Finally, as far as we know, this is the first report of the use of 64-row MDCCT to characterize a PLSVC through which a dual-chamber ICD was implanted.

RESUMEN

Implante de un cardiodesfibrilador bicameral vía vena cava superior izquierda persistente

La vena cava superior izquierda persistente (VCSIP) es la anomalía congénita venosa del tórax más frecuente. Se encuentra en el 0,3% de la población general y en el 5-10% de los pacientes con cardiopatías congénitas. Generalmente evoluciona en forma asintomática y no genera trastornos hemodinámicos, pero su reconocimiento es importante, ya que puede dificultar la introducción de catéteres para mediciones hemodinámicas, los implantes de marcapasos cardíacos (MCP) y de cardiodesfibriladores automáticos implantables (CDAI), especialmente cuando se utiliza la vía cefálica o la subclavia izquierda.

En el caso clínico que se presenta se efectuó el implante de un CDAI bicameral vía VCSIP, descubierta durante el procedimiento. Asimismo, se muestran las características de esta variedad anatómica mediante tomografía cardíaca computarizada de 64 cortes (TCC64).

Palabras clave > Vena cava superior - Anomalías cardiovasculares - Desfibriladores implantables - Tomografía - Multicorte

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