

CAS CLINIQUE / CASE REPORT

CARDIAC DEFIBRILLATOR IMPLANTATION via PERSISTENT LEFT SUPERIOR VENA CAVA

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Ghassan Fouad NAKAD¹, Hamid BAYEH³, Bernard ABI SALEH²

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ABSTRACT • Persistent left superior vena cava (PLSVC) is an uncommon anomaly. We describe a case of a left-sided implantation of an implantable cardioverter defibrillator (ICD) through a PLSVC, assessing the technical approach to such a procedure, along with a review of the clinical implications that might ensue.

Learning objectives: LSVC is a rare anatomical venous variation. Knowledge of its presence and clinical implications will render a lead implantation safer and will limit complications that might ensue.

Keywords: persistent left-sided superior vena cava, abnormal thoracic veins anatomy, cardioverter defibrillator (ICD) implantation, venography, coronary sinus

CASE REPORT

A 62-year-old gentleman with ischemic cardiomyopathy and an ejection fraction estimated at 30% got admitted to the hospital for recurrent syncope, and was found to have non sustained ventricular tachycardia on ECG monitoring. He was referred to the electrophysiology (EP) laboratory for implantation of an implantable cardioverter defibrillator (ICD).

In the EP lab, under sterile fashion, a left infraclavicular incision was made for creation of the pocket then the left subclavian vein was accessed utilizing the first rib approach. A guide wire was advanced into the vein but it took a vertical course. We confirmed that the venous system was accessed, not the subclavian artery, by examining the color and the flow of the blood. Advancing the wire further down resulted in a horizontal shape of the wire at the diaphragmatic side of the heart followed by a loop in the right lateral edge of the cardiac silhouette. The dilator was first advanced without the sheath and a venography was performed confirming the presence of a persistent left superior vena cava (PLSVC).

¹Faculty of Medical Sciences, Lebanese University, Beirut, Lebanon.

²American University of Beirut Medical Center, Beirut.

³Notre-Dame des Secours University Medical Center, Jbeil, Lebanon.

Corresponding authors : Ghassan Fouad Nakad, MD, and Bernard Abi Saleh, MD, contributed equally to this work.

e-mail: ghassan_nakad@hotmail.com
ba47@aub.edu.lb

Nakad GF, Bayeh H, Abi Saleh B. Implantation d'un défibrillateur cardiaque interne à travers une veine cave supérieure gauche. J Med Liban 2015 ; 63 (2) : 94-96.

RÉSUMÉ • La persistante de la veine cave supérieure gauche est une variante anatomique peu fréquente.

Nous rapportons un cas d'implantation d'un défibrillateur cardiaque interne à travers une veine cave supérieure gauche, en prenant compte de l'aspect technique et en décrivant les implications cliniques associées à une telle procédure.

At this point a 9 French sheath was advanced then an active fixation dual coil lead (Reliance, 0184, 59 cm, Boston Scientific, MN, USA) was inserted down the PLSVC through the coronary sinus and first parked in the right atrium.

A soft stylet was shaped manually creating a large J curve. This was advanced into the lead and an extreme counterclock steering of the stylet prolapsed the lead in the right ventricle outflow tract. The stylet was then withdrawn about 1 cm and gently the whole system was pulled back. This allowed the tip of the lead to fall to a mid-septal position. Measurement of the R waves there showed amplitude of more than 12 mV so we decided to fix the lead in that position (Figure 1).

The lead was secured to the muscle then connected to the generator. Defibrillation was performed at 15 joules delivered energy after induction of ventricular fibrillation

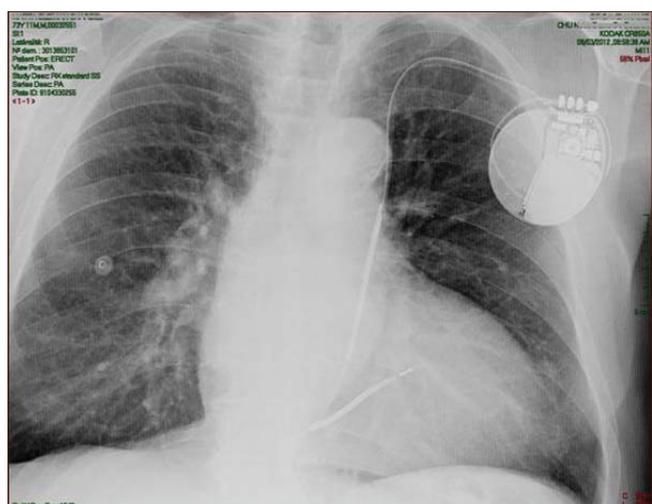


FIGURE 1

Chest X-ray of our patient showing the implanted ICD with the lead going down the left superior vena cava.

with a T-shock method. This successfully defibrillated the patient back to sinus rhythm. The pocket was closed and there were no complications.

At two months follow-up the lead thresholds and impedance were stable.

DISCUSSION

PLSVC is seen in 0.3%-0.5% of the normal population and 1.5%-10% of patients with other congenital heart abnormalities [1]. In addition, about 10% of these subjects with congenital cardiac abnormalities do not have a right superior vena cava [2].

The persistence of a left superior vena cava (LSVC) is due to an abnormal development of the sinus venosus in the early stages of fetal life. In the 4-mm embryo, this structure consists of three distinct parts, namely, the right horn, the transverse part, and the left horn, and collects three pairs of veins: the omphalomesenteric veins, the umbilical veins, and the common cardinal veins. In the case of patency of the left cardinal vein, its drainage reaches the right atrium through the coronary sinus.

In 92% of cases, drainage occurs in the right atrium; in the remainder of cases, drainage occurs in the left atrium because of failure to form the coronary sinus [3]. It causes a right-to-left shunt and poses a risk of systemic embolization of air or thrombus when cannulated. The pathological substrate of an isolated LSVC also causes dilatation of the coronary sinus, leading to stretching of the atrioventricular (AV) node and its bundle. The electrocardiogram often shows a leftward deviation of the P-wave axis and a shortened PR interval [4]. Most commonly associated malformations are atrial septal defects (16%), endocardial cushion defects (11%) and tetralogy of Fallot (9%) [5].

Isolated cases of LSVC persistence in patients undergoing central venous line, pacemaker or cardiac defibrillator implantation have been reported in the literature [4, 6-7].

Clinical awareness of this entity is a must as several other associations and complications are present with the PLSVC [8].

PRACTICAL IMPLICATIONS

Does the incidental finding of a PLSVC preclude a modification in the therapeutic approach? Do we have to switch to a right-sided implantation, or even resort to epicardial leads if right vena cava is not accessible?

Several cases are published regarding successful pacemaker or defibrillator lead implantations via PLSVC. The major anatomical obstacle for this procedure is right ventricular lead implantation due to the tip of the lead deflecting away from the tricuspid annulus.

Several techniques have been proposed to overcome this issue. Manual reshaping of the stylet into a U-shaped stylet can be performed. Loop formation in the right atrium allows for more support to cross the tricuspid

valve. Otherwise the ventricular lead can be placed in the left ventricular branch of the coronary sinus [8]. ICD lead implantation via PLSVC using a coronary sinus delivery system is an option as well [9-10].

The majority of authors presented implantation via PLSVC as technically difficult, time consuming and requiring prolonged fluoroscopy. Biffi *et al.* compared patients implanted through LSVC and classically; the fluoroscopy time was similar to right sided but procedure time was longer [3]. This shows that anatomical conditions of some patients with PLSVC are not always an obstacle for successful implantation. Crossing over to a right-sided approach might require additional procedure time, echocardiography or contrast venography to ensure RSVC presence, and may cause greater discomfort to the patients.

One other concern is that of the defibrillation threshold and the shock vector required to achieve an effective defibrillation of the heart in the presence of PLSVC versus right-sided implants. There is no clear data on this issue, but in theory, having the second coil of the dual coil lead in the PLSVC, which is a more posterior structure than the right SVC, will redirect the shocking vector posteriorly, the fact that should lower defibrillation threshold (DFT). A review of the available literature concludes to the following:

It is known that left-side ICDs may convey a lower DFT compared to right-sided systems. The average increase in DFT is about 50% [11-12].

More so, Butter *et al.* demonstrated that in animals the addition of a shocking electrode in a coronary vein parked in the middle of the LV free wall establishes a biventricular defibrillation reducing DFTs [13]. This has not been interpolated yet to human subjects due to non-availability of defibrillation leads small enough to fit a small coronary sinus branch.

In addition, known methods to decrease DFTs in human rely partly on adding a posterior coil through the left brachiocephalic vein, the left subclavian vein, the azygous vein, the left coronary sinus if possible or subcutaneously [14]. Having the second coil placed in the PLSVC provides a posteriorly directed shocking vector for optimal DFTs.

In our patient, we have not performed a proper DFT but the defibrillator was tested at 15 joules once after induction of ventricular fibrillation with a T-shock method. This successfully defibrillated the heart back to sinus rhythm.

CONCLUSION

In our patient, the presence of a LPSVC, although challenging, did not constitute a major obstacle for placement of the ICD lead in the right ventricle through the coronary sinus. Switching to a right-sided approach did not seem necessary. Although such procedures are safe and bear good results, comparative studies of implantation through a PLSVC or switching to the right side are lacking.

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