Erciyes Med J 2018; 40(3): 172-4 • DOI: 10.5152/etd.2017.0123

# Persistent Left Superior Vena Cava and Left Sided Inferior Vena Cava Coincidance with Coronary Sinus Aneurysm: A Surprise on Transient Cardiac Pacemaker Implantation

CASE REPORT

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ABSTRACT

Systemic venous anomalies without other congenital heart defects are usually asymptomatic and often found incidentally during a vascular intervention or other surgery. A 60-year-old man with DDD cardiac permanent pacemaker was admitted to the emergency department with syncope and total atrioventricular block due to end-of-life of the permanent pacemaker. The lead of the transient pacemaker could not be advanced via transfemoral access to the right ventricle. Venography revealed that the left-sided inferior vena cava drained into the persistent left superior vena cava, and both continued with the coronary sinus. To avoid unexpected events, venography should be performed to detect venous congenital anomalies during transient or persistent pacemaker implantation.

**Keywords:** Persistent left superior vena cava, left-sided inferior vena cava, pacemaker end-of-life, atrioventricular total block

**Cite this article as:** Ozdemir E, Yakar Tuluce S, Emren SV, Kahya Eren N, Nazli C, Tokac M. Persistent Left Superior Vena Cava and Left Sided Inferior Vena Cava Coincidance with Coronary Sinus Aneurysm: A Surprise on Transient Cardiac Pacemaker Implantation. Erciyes Med J 2018; 40(3): 172-4.

This case has been presented as a verbal presentation at the 33th Turkish Cardiology Congress with International Participation.

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**Submitted** 19.10.2017

**Accepted** 26.04.2018

**Available Online Date** 09.04.2018

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## INTRODUCTION

Systemic venous anomalies without other congenital heart defects are usually asymptomatic and often found incidentally during a vascular intervention or other surgery. Left-sided inferior vena cava (LSIVC) draining into persistent left superior vena cava (PLSVC) is a rare cause for coronary sinus (CS) dilatation, but CS dilatation is a well-known cause of PLSVC and can be detected on echocardiography. However, LSIVC without right atrial communication cannot be easily detected with echocardiography. In this case, we detected a combination of PLSVC and LSIVC during transient pacemaker implantation in a patient who was admitted to our clinic due to end-of-life of DDD pacemaker.

## CASE REPORT

A 60-year-old man with a DDD pacemaker that had been implanted 5 years ago due to sick sinus syndrome was admitted to our emergency department with syncope and complete atrioventricular block on ECG. No telemetric communication could be succeeded and cardiac pacemaker generator was accepted as end-of-life. We decided to implant a transient cardiac pacemaker via transfemoral venous access; however, the lead of the transient pacemaker could not be advanced to the right ventricle. Therefore, we performed femoral venography while revealed LSIVC continuing with PLSVC and both draining into the right atrium (RA) via CS. We also performed venography via the right brachial vein and observed that only the right superior vena cava (SVC) directly drained into RA (Figure 1). An external transient cardiac pacemaker was used until an emergency DDD generator was exchanged. Computed tomography (CT) confirmed the combination of LSIVC and PLSVC draining into RA via CS (Figure 2), and transthoracic echocardiography revealed dilated CS (Figure 3B). CT showed an aberrant hepatic vein directly draining into RA (Figure 3A). We observed by using CT that, after the creation of IVC by both common iliac veins, IVC have been took a position on the left of the aorta (Figure 4).

## DISCUSSION

Persistent left superior vena cava (PLSVC) is the most common thoracic venous anomaly, with a prevalence of 0.3%–0.5% in the general population (1). It occurs when the left superior cardinal vein does not regress. It is commonly became in isolation but can be together with other vascular abnormalities. The most commonly seen form is PLSVC draining into CS, and PLSVC is commonly associated with a smaller caliber right SVC (2). LSIVC is relatively less prevalent (0.2%–0.5%) than PLSVC (3) and develops due to the persistence of the left supracardinal vein(4). LSIVC usually ends at the left renal vein and crosses anteriorly to join the normal pre-hepatic segment of IVC. More rarely cases of LSIVC, possible routes for the return of blood to RA are via the azygos vein to SVC, via the left

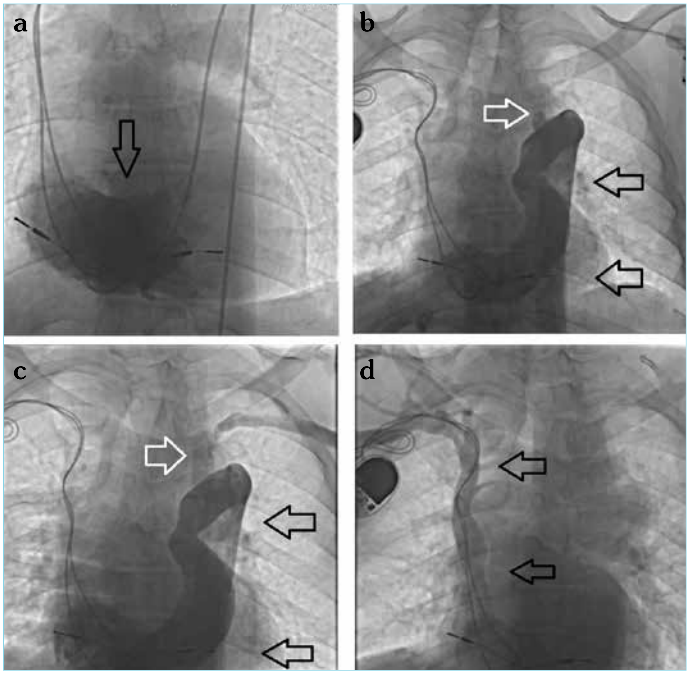


Figure 1. a-d. **Angiography figures, (a) Dilated CS shown with black arrow; (b) and (c) PLSVC(marked with white arrow) and LSIVC(marked with black arrows) become a combination and drained to CS; (d) Right SVC shown on venography drained to RA and leads inside.**

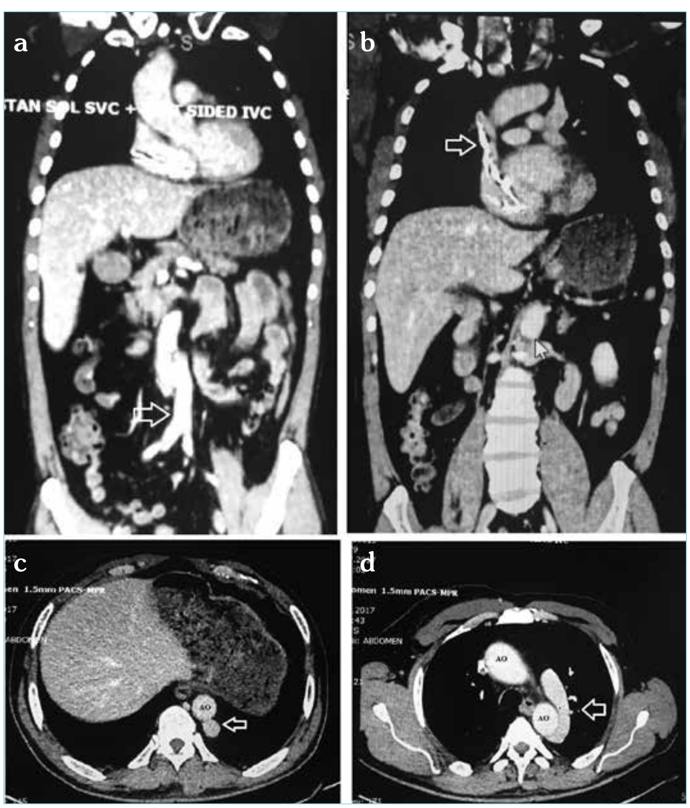


Figure 2. a-d. **CT venography figures, (a) LSIVC (marked with arrow); (b) cardiac pacemaker leads (marked with arrow); (c) IVC (arrow) posed on the left of aorta (Ao); (d) PLSVC (arrow) can seen on left of the aorta(Ao).**

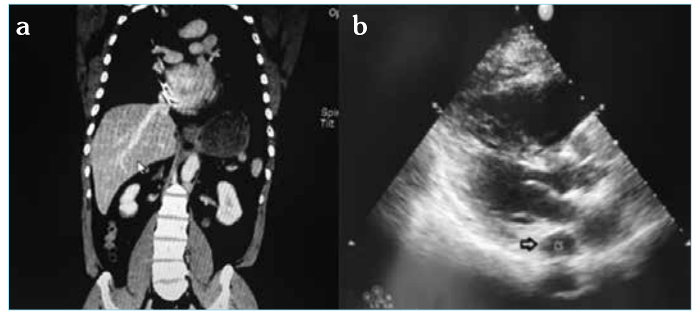


Figure 3. a, b. **(a) An aberrant hepatic vein shown with arrow draining directly to right atrium detected at CT. (b) Dilated coronary sinus (CS) shown on transthoracic echocardiography.**

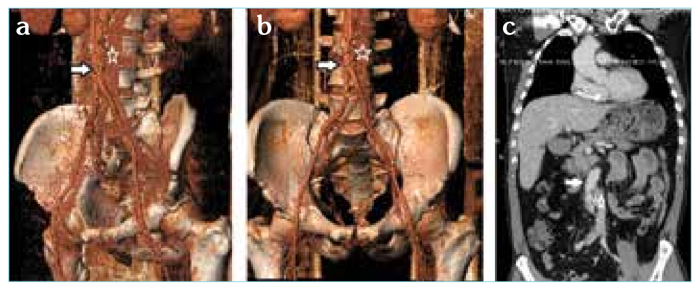


Figure 4. a-c. **(a) IVC (marked with white star) is seen on the left side of aorta (marked with white arrow) at oblique layer of reconstructed CT image; (b) IVC (marked with white star) is seen on the left side of aorta (marked with white arrow) at vertical layer of reconstructed CT image; (c) IVC (marked with white star) is seen on the left side of aorta (marked with white arrow) at CT image.**

brachiocephalic vein to the right SVC, or via the hemiazygos vein to PLSVC(3). Both interrupted IVC and LSIVC can have a continuation with azygos and hemiazygos veins on the upper position of renal veins. The main difference between interrupted IVC and LSIVC is the position of IVC on the side of aorta, under the renal veins. As in our case, IVC takes a position on the left of aorta at LSIVC, but IVC's infrarenal position is normal at interrupted IVC as the right side of the aorta (5).Various procedures involving the right side of the heart such as electrophysiologic studies, right heart catheterization, and temporary pacing are usually performed from IVC via the transfemoral approach. Unexpected anatomic anomalies of IVC can make these procedures difficult.

These variations can pose a greater risk in the setting of central venous interventions. In any suspected patient, venous imaging is therefore required to define the pattern of cardiac venous return. Permanent pacemaker and cardioverter-defibrillator implantation in patients with PLSVC can also become complicated because of the difficulties in reaching the right heartdue to the anomalous venous anatomy and problems associated with lead instability and displacement (6). Lead placement by PLSVC access is relatively rare and can be associated with arrhythmia, cardiac injury, and CS thrombosis (7).

On the other side, there are some cases in the literature on pacemaker and defibrillators implanted via PLSVC and CS to right side of the heart. Vukmirovic et al. (8) and Kapetanopoulos et al. (9) have reported the implantation of CRT via PLSVC. Petrac et al. (11) reported five patients with PLSVC who underwent cardiac device implantation (three cardiac pacemakers, one CRT, and one

VVI ICD). They described CRT implantation epicardial, VVI ICD implantation via right SVC. Other ones performed via PLSVC to CS, so they implanted leads to the right side of heart using CS access. In 1995, Favale et al. (10) presented two cases with successfully implanted ICD via PLSVC and absent left SVC and reported that transvenous ICDs can be successfully used in patients with PLSVC, although the implantation technique deviates substantially from traditional methods (10).

In these cases, the long-term outcome of patients with persistent LSVC and implanted cardiac devices is mostly influenced by the presence of underlying heart disease (11).

Our patient had a 5-year-old DDD cardiac pacemaker implanted via the right subclavian vein access instead of the left subclavian vein; however, there was no information regarding LSIVC and PLSVC concomitance from his previous hospital records. Known venous variations or anomalies cannot be easily detected, so 5 years ago, if left subclavian vein access was preferred instead of right subclavian vein, the interventionist faced an unexpected failure or complication. CS dilatation is a well-known cause of PLSVC and can be detected on echocardiography, whereas LSIVC draining into PLSVC is a rare cause for CS dilatation. However, LSIVC without right atrial communication cannot be easily detected with echocardiography. Thus, venography should be performed before performing permanent pacemaker implantation to ensure procedure safety and to refrain from complications. These anomalies of the major veins are usually detected during interventions aiming to reach the right side of the heart. Venography is necessary to be sure about the unexpected anatomic variations to reveal venous congenital anomalies.

## CONCLUSION

Anomalies of systemic venous drainage should be kept in mind in patients who underwent interventional procedures relating to the right side of the heart. Subclavian venography is successful to avoid unexpected failures before the implantation of devices or catheter.

**Informed Consent:** Written informed consent was obtained from patient's family who participated in this study.

**Peer-review:** Externally peer-reviewed.

**Author Contributions:** Conceived and designed the experiments or case: E.Ö., M.T. Performed the experiments or case: S.T., CN. Analyzed the data: V.E. Wrote the paper: E.Ö., V.E. All authors have read and approved the final manuscript.

**Conflict of Interest:** The authors have no conflict of interest to declare.

**Financial Disclosure:** The authors declared that this study has received no financial support.

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