

# Implantation of a cardiac resynchronization therapy-defibrillator device in a patient with persistent left superior vena cava

## Persistan sol üst vena kavası olan bir hastada kalp resenkronizasyon–defibrilatör cihaz takılması

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**Summary–** Presence of a persistent left superior vena cava (PLSVC) is generally clinically asymptomatic and discovered incidentally during central venous catheterization. However, PLSVC may cause technical difficulties during cardiac device implantation. An 82-year-old man with heart failure symptoms and an ejection fraction (EF) of 20% was scheduled for resynchronization therapy-defibrillator device (CRT-D) implantation. A PLSVC draining via a dilated coronary sinus into an enlarged right atrium was diagnosed. First, an active-fixation right ventricular lead was inserted into the right atrium through the PLSVC. The stylet was preshaped to facilitate its passage to the right ventricular apex. An atrial lead was positioned on the right atrium free wall, and an over-the-wire coronary sinus lead deployed to a stable position. CRT-D implantation procedure was successfully completed.

**Özet–** Persistan sol süperiyör vena kava (PSSVK) genellikle klinik belirti vermeyen ve merkezi toplardamar basınç ölçümleri sırasında rastlantısal olarak saptanan bir durumdur. Ancak bu durum kalp cihazlarının takılması sırasında bazı teknik zorluklara neden olabilir. Kalp yetersizliği belirtileri olan ve ejeksiyon fraksiyonu (EF) %20 bulunan 82 yaşında bir erkek hastaya kalp resenkronizasyon tedavisi-defibrilatör cihazı (CRT-D) takılması planlandı. İşlem sırasında genişlemiş koroner sinüs aracılığıyla sağ atriyuma açılan bir PSSVK saptandı. Öncelikle aktif sabitlenebilir sağ ventrikül lead'i PSSVK aracılığıyla sağ ventrikül apeksine yerleştirildi. Atriyum lead'i sağ atriyum serbest serbest duvarına yerleştirildi. Son olarak da kılavuz tel üzerinden koroner sinüs lead'i kararlı bir konumda konuşturuldu. CRT-D yerleştirme işlemi başarılı olarak tamamlandı.

A CRT-D is commonly used for treatment of heart failure in selected patients with low EF and wide QRS complex. Lead implantation can be challenging due to congenital anomalies, and particularly so in the presence of persistent left superior vena cava (PLSVC), a rare venous anomaly (0.3–1%).<sup>[1]</sup> This situation is clinically asymptomatic and is generally detected incidentally during central venous catheterization or cardiac device implantation.

### Abbreviations:

CRT-D	Resynchronization therapy-defibrillator device
CS	Coronary sinus
EF	Ejection fraction
PLSVC	Persistent left superior vena cava
RA	Right atrium
RV	Right ventricular

We reported a successful CRT-D implantation strategy via a PLSVC.

### CASE REPORT

An 82-year-old man with a history of previous coronary artery bypass grafting and aneurysmectomy surgery was admitted to our clinic with heart failure symptoms (NYHA Class III) and syncope despite optimal medical therapy. Electrocardiography showed a left bundle branch block with QRS duration of 162 ms. Echocardiography revealed an ejection fraction (EF) of 20% and mild mitral regurgitation. The patient was scheduled for CRT-D implantation.

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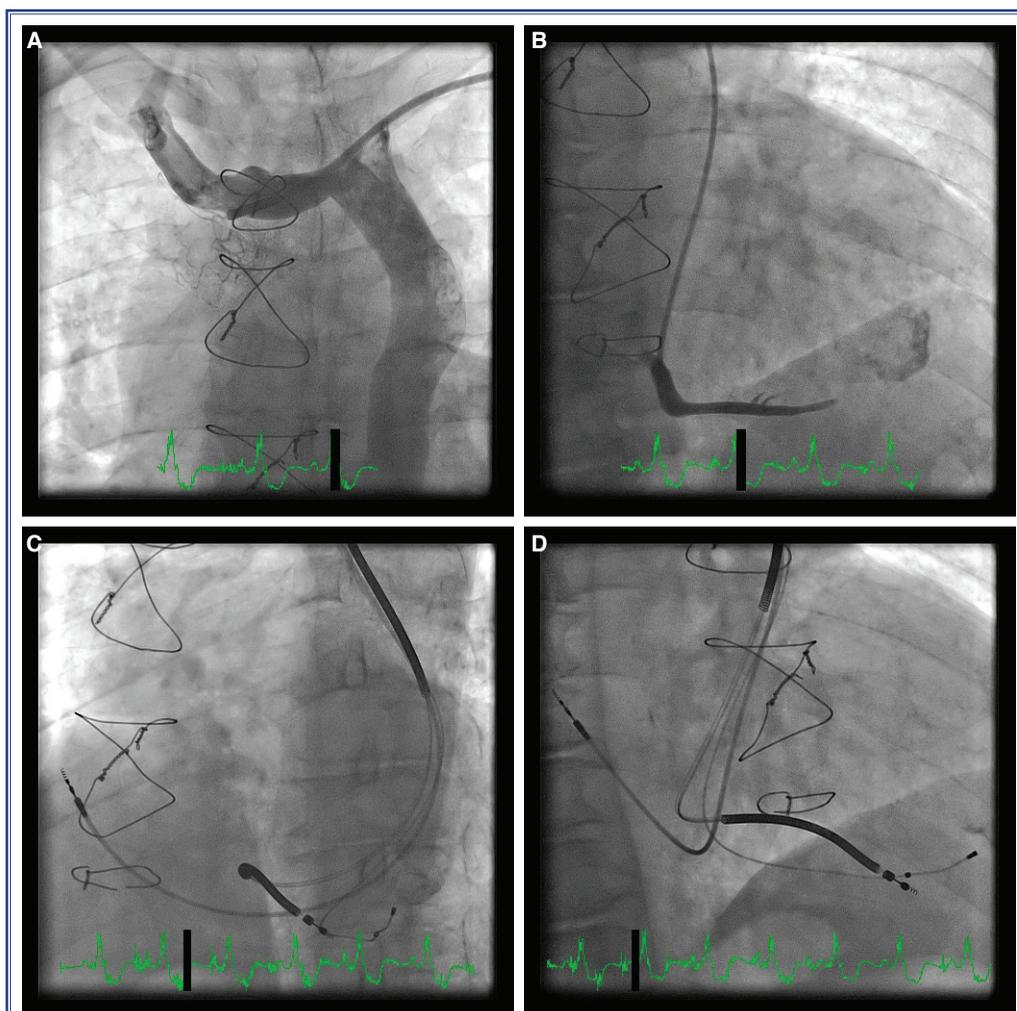


After insertion of the guidewire to the left subclavian vein, the course of the wire became unusual, descending at the left side of the sternum. We performed a venography which revealed a PLSVC draining via a dilated coronary sinus (CS) into an enlarged right atrium (RA) (Fig. 1a). We performed arteriography and multiple venographies to identify its exact anatomy. Initial CS venography was insufficient to identify the confluence of the CS and branches, and therefore the CS was selectively intubated with a 6 Fr Right Amplatz 1 catheter and a posterolateral vein was revealed (Fig. 1b). Firstly, a Medtronic 6947-65 active-fixation right ventricular (RV) lead was inserted into the RA through the PLSVC and the stylet preshaped (approximately 150°) to facilitate its passage to the

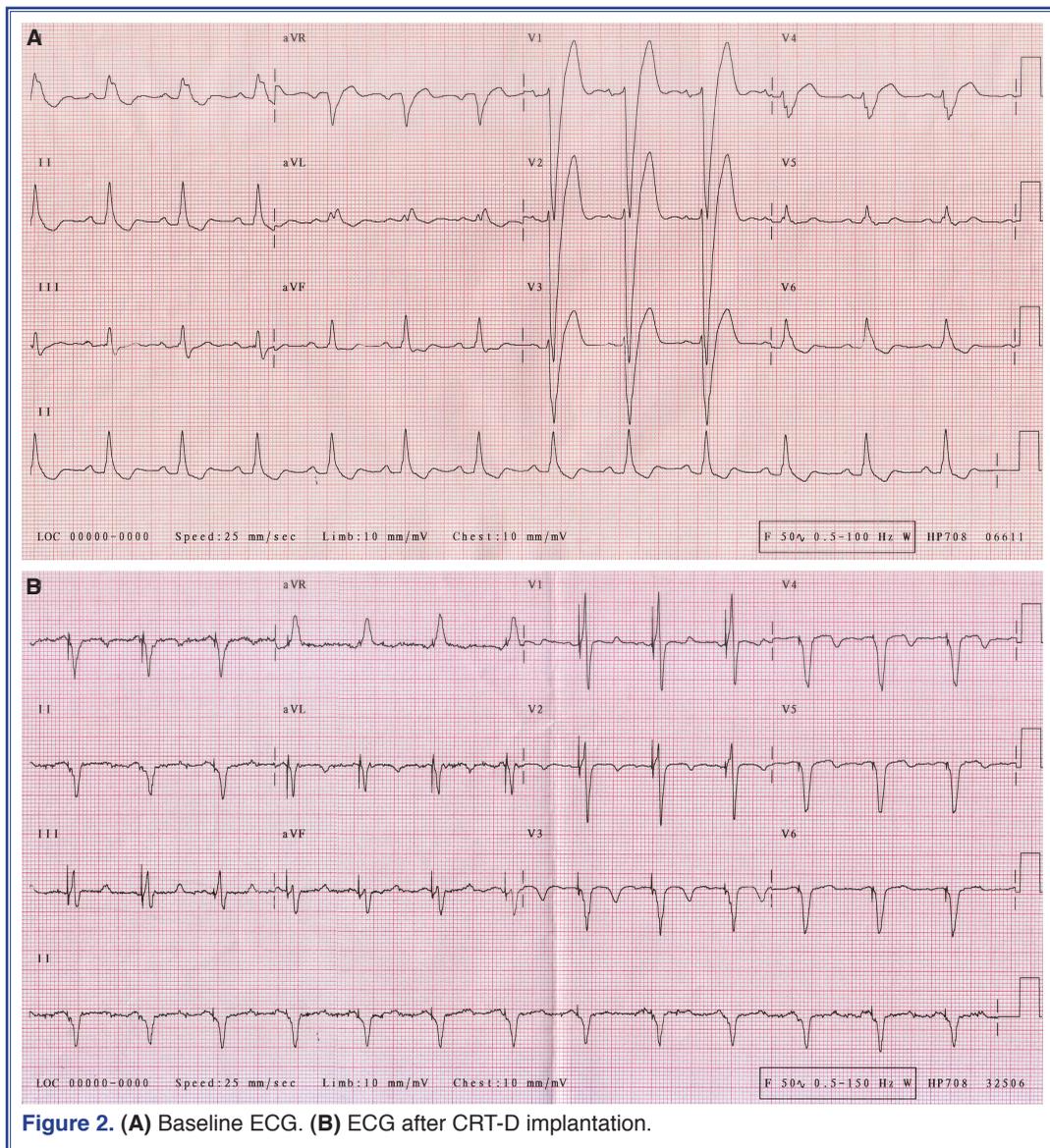
RV apex. A Medtronic 4076-52 active-fixation atrial lead was positioned on the RA free wall (Fig. 1c, d). Lastly, an over-the-wire Medtronic 4196-78CS lead was successfully deployed to a stable position with a capture threshold of 0.5V and an R wave of 9.2mV. A Concerto II CRT-D (D249TRK, Medtronic) device was connected and implantation was successfully completed (Fig. 1c, d). Baseline ECG and ECG after biventricular stimulation with narrowing QRS can be seen in Fig. 2a, b.

## DISCUSSION

CRT-D implantation using conventional methods may be difficult in PLSVC patients due to anatomic ab-



**Figure 1.** (A) Venography shows persistent left superior vena cava without a right-sided venous vessel. (B) Selective intubation of posterolateral vein with a 6 Fr Right Amplatz 1 catheter. (C) Positions of right atrial, right ventricular and coronary sinus leads in left anterior oblique projection. (D) Positions of right atrial, right ventricular and coronary sinus leads in right anterior oblique projection.



**Figure 2. (A)** Baseline ECG. **(B)** ECG after CRT-D implantation.

normalities and limited suitable materials. Prior information of the individual anatomy and imaging (computed tomography or magnetic resonance) are helpful for planning the procedure and choosing suitable materials, but are rarely discovered prior to implantation. Diagnosis of PLSVC in an 82-year-old patient with a previous history of cardiac surgery was surprising.

An unexpected course of the guidewire or lead, descending on the left side of the thorax, should alert the operator to PLSVC. Although venography is not routinely required,<sup>[2]</sup> it is helpful with PLSVC patients in order to identify the venous anatomy. In centres which lack experience with this anomaly, an implantation procedure may be aborted due to an un-

expected PLSVC. Nevertheless, successful ICD and CRT-D implantations have been previously reported.<sup>[3-5]</sup> PLSVC may show some anatomic variations. In about 20% of patients,<sup>[5]</sup> the right superior vena cava is absent, as it was in the case presented here, thus rendering a right-sided approach impossible. Some problem may be encountered.

Implanting the RV lead may be problematic because advancing the ventricular lead through the PLSVC means it enters the right atrium in a direction away from the tricuspid valve. A preshaped stylet or a wide loop formation into the right atrium forcing the lead tip into the RV may solve this problem, as it did in our case. Secondly, active fixation leads must be

used to avoid possible lead displacements because of the sharp angulations between the CS and RV apex. Lastly, venography may be insufficient in contrast to identify the confluence of the CS and its anatomy. Therefore, selective intubation may be necessary. We successfully intubated with a 6 Fr Right Amplatz 1 catheter, but a variety of catheters may be needed. Another alternative for detecting target vessels for CS lead implantation is the visualization of cardiac veins after left main angiography.<sup>[2]</sup>

To conclude, cardiac device implantation may be complicated via a PLSVC, but is successfully performed in experienced centres. Understanding the individual anatomy is essential in order to choose appropriate materials and implantation strategy.

**Conflict-of-interest issues regarding the authorship or article: None declared.**

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**Key words:** Cardiac resynchronization therapy devices; heart failure/therapy; vena cava, superior/abnormalities.

**Anahtar sözcükler:** Kalp resenkronizasyon tedavi cihazı; kalp yetersizliği/televi; vena kava, süperiyor/anormallik.