

# Biatrial transplantation of a donor heart with a single left superior vena cava draining to coronary sinus



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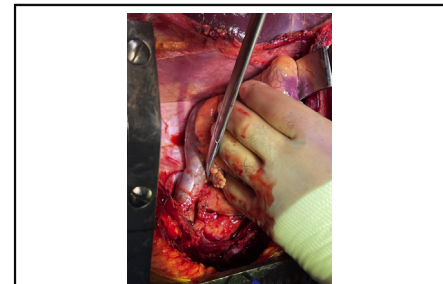
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Persistent left superior vena cava drainage to the coronary sinus.

## CENTRAL MESSAGE

We describe biatrial orthotopic heart transplantation of a donor heart with a single persistent left superior vena cava draining to the coronary sinus.

Video clip is available online.

Persistent left superior vena cava (PLSVC) is an uncommon venous malformation that is present in 0.3% to 0.5% of the general population and up to 10% of patients with grown-up congenital heart disease. Anatomical variations of PLSVC that have been reported are isolated left superior vena cava (LSVC) in 25% of patients and bilateral superior vena cava in 75% of patients with or without communicating vein. Patients with isolated LSVC usually have associated cardiac anomalies and situs disorder. However, there are reports of isolated LSVC without an associated cardiac disorder. In 80% to 90% of patients, the PLSVC drains into the right atrium through the coronary sinus. In the remaining 10% to 20% of patients, it drains directly into the left atrium, creating an obligatory right-to-left shunting.<sup>1,2</sup>

Transplanting a donor heart with persistent LSVC has been described before. However, this was a milder form presenting as a double variation with right and LSVC and, thus, bicaval orthotopic heart transplantation was performed.<sup>3</sup> In this Surgical Technique, we describe using biatrial orthotopic heart transplantation since there was no anatomical right superior vena cava (SVC) in the donor heart.

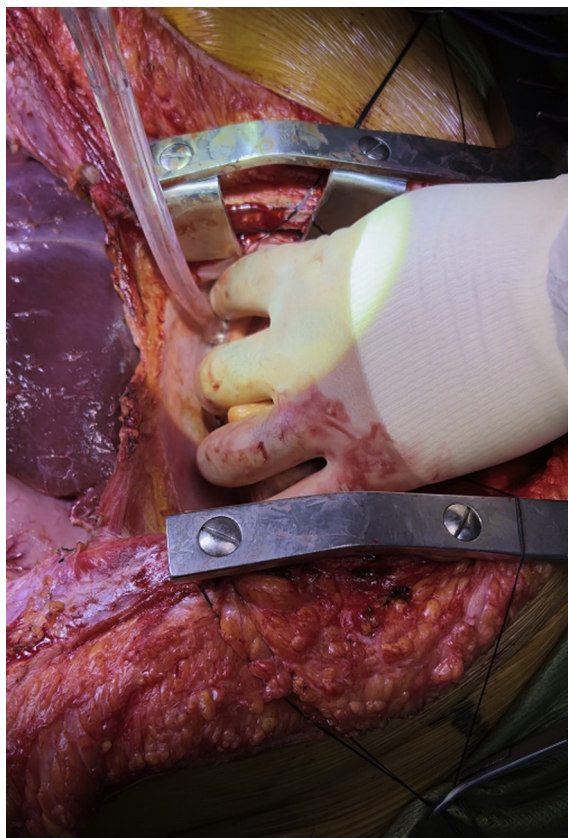
## TECHNIQUE

Our donor was a 28-year-old female patient who had died from a motor vehicle accident in which she was the driver and the vehicle collided with a tree. The donor was

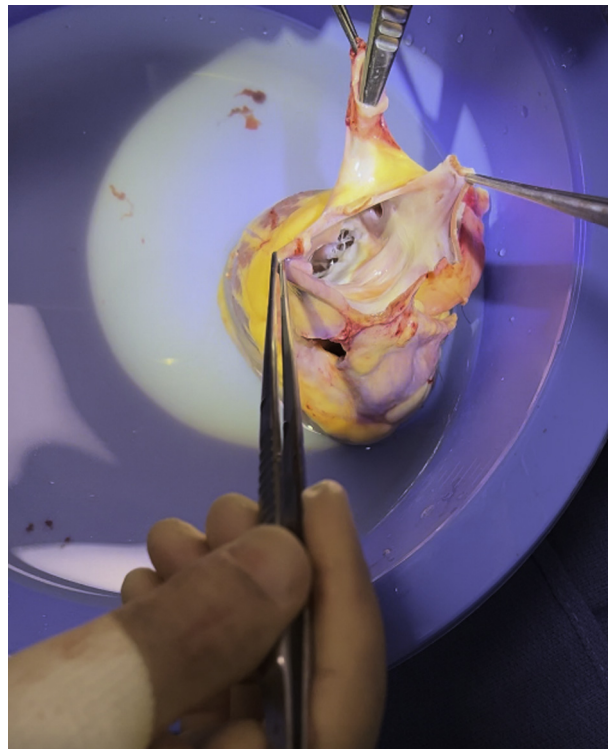
consented for research. Tomography scan of the chest showed fracture of the fifth and sixth ribs and did not report LSVC. Transthoracic echocardiogram demonstrated a normal biventricular function, ejection fraction of 65%, and no valvular abnormalities. However, the coronary sinus was reported to be larger than normal.

Intraoperative assessment of the donor heart confirmed the presence of an isolated PLSVC, as the right SVC was completely absent ([Video 1](#)). The LSVC drained directly into the dilated coronary sinus; the rest of the inspection revealed normal biventricular cardiac function and no apparent coronary artery abnormality or contusion. The LSVC diagnosis was an unexpected finding for the procurement and transplanting team. After careful consideration, we decided to delay acceptance of the donor heart until we had finished the procurement process and inspect it for associated anomalies at the back table ([Figure 1](#)).

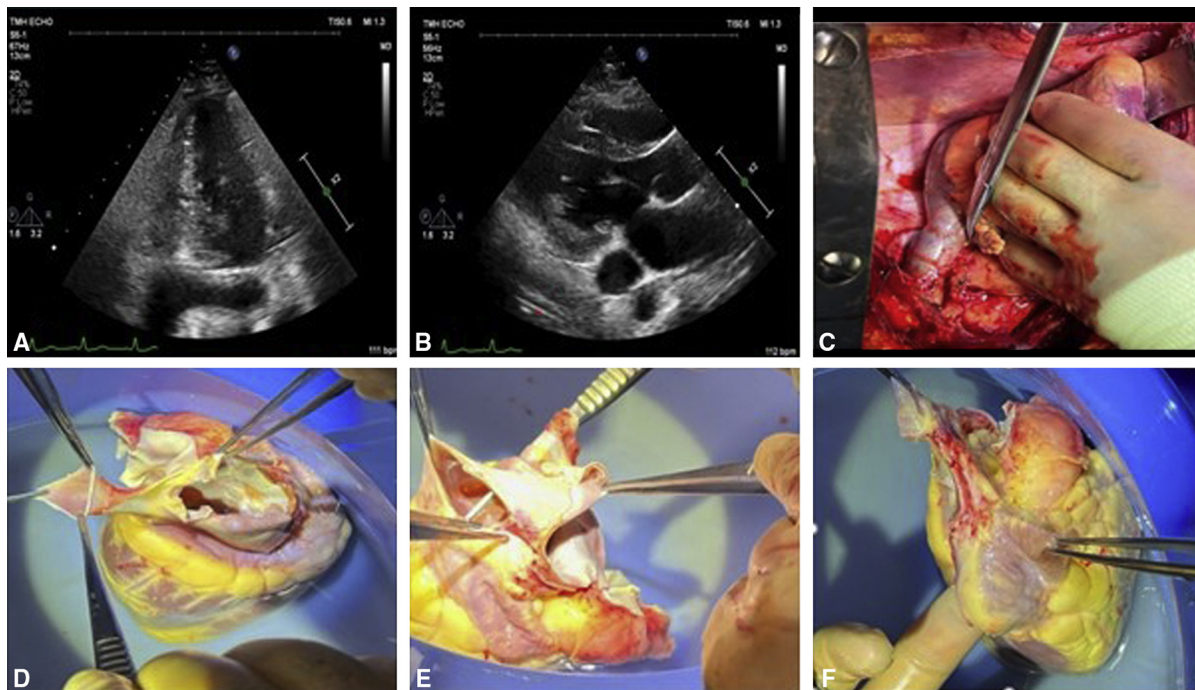
After the heart procurement, back-table inspection of major vessels and cavities showed direct communication of the LSVC with the coronary sinus, which opened directly to the right atrium through a large orifice. There was no communication between the left atrium and LSVC or any other anomalies. We decided to transplant the heart and used the SherpaPak (Paragonix Technologies, Inc) for cold preservation and transportation ([Video 2](#)).



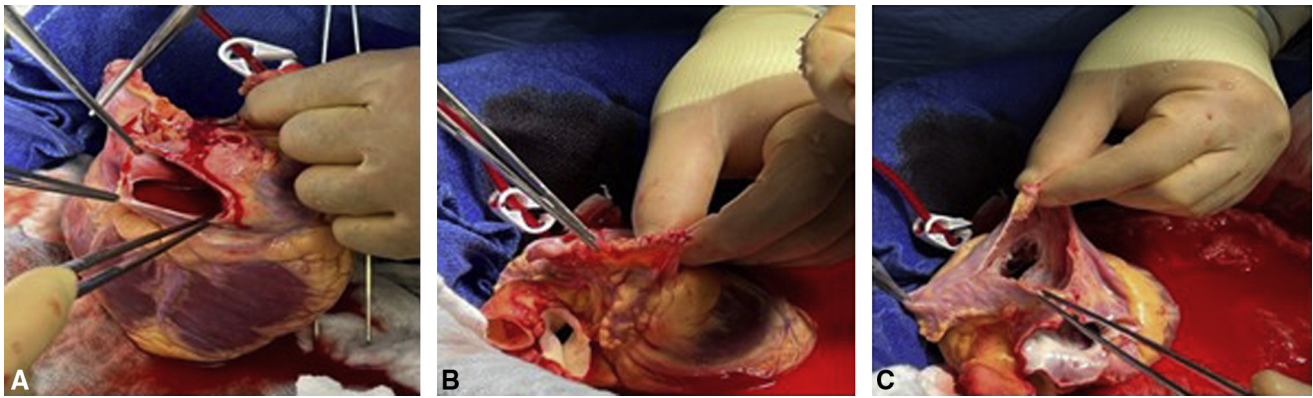
**VIDEO 1.** Persistent left superior vae. Video available at: [https://www.jtcvs.org/article/S2666-2507\(22\)00285-1/fulltext](https://www.jtcvs.org/article/S2666-2507(22)00285-1/fulltext).



**VIDEO 2.** Donor heart back table anatomical exploration. Video available at: [https://www.jtcvs.org/article/S2666-2507\(22\)00285-1/fulltext](https://www.jtcvs.org/article/S2666-2507(22)00285-1/fulltext).



**FIGURE 1.** A and B, Short- and long-access echocardiogram showing enlarged coronary sinus. C and D, Total LSVC connected to the coronary sinus in the donor heart. E, The LSVC opens to the sinus without connection to the left atrium. F, Right ventricular appendage with absent SVC. *LSVC*, Left superior vena cava; *SVC*, superior vena cava.



**FIGURE 2.** A, Antegrade cardioplegia showed normal distribution. B, Ligation and suturing of the L SVC. C, Extension of the inferior vena cava to accommodate biatrial anastomosis. L SVC, Left superior vena cava.

Before implantation, the heart was inspected once more and cardioplegia was delivered through the aortic root and blood return was inspected while the donor L SVC was clamped, normal coronary back flow to the right atrium was confirmed, inspecting the coronary sinus. Then, the L SVC was trimmed, leaving a few millimeters close to the heart, and the opening was oversewn with a continuous 5-0 polypropylene suture. The coronary sinus opening was still anatomically present and patent. The absence of a donor right SVC made the donor heart suitable for biatrial orthotopic transplantation, since this technique requires ligation of the SVC regardless (Figure 2). After the left atrial anastomosis, right atrial anastomosis was completed, extending the donor inferior vena cava opening toward the right atrial appendage.

We could also leave an extended recipient SVC and complete a modified bicaval technique by creating an opening in the donor right atrium to accommodate the recipient SVC. We preferred not to perform this alternative technique to avoid damaging the donor heart sinus node; in any case, it will be in close proximity.

The heart transplant recipient was a 68-year-old female patient with acute-on-chronic combined systolic and diastolic cardiomyopathy postradiotherapy and chemotherapy with Adriamycin, Cytosin, and paclitaxel for breast cancer. Biventricular function posttransplant was good. There was no tricuspid regurgitation, and we could observe the large opening of the coronary sinus on echocardiogram. The patient was discharged from the hospital without any complications.

Expanding the donor pool of hearts with L SVC should be performed with caution, as those hearts have associated anomalies, especially ostial atresia of the coronary sinus, bicuspid aortic valve, conduction system anomalies, and atrial septal defect.<sup>4</sup> In addition, these types of anomalies can present with perfusion and preservation challenges and might affect the function of the heart and could result in poor posttransplant outcome.<sup>5</sup>

Enlargement of the donor heart coronary sinus should raise the suspicion of L SVC, and a proper investigation should be performed before accepting the heart, such as computed tomography angiography and transesophageal echocardiogram if available and planned. If incidental findings occur during recovery, like in our case, other congenital anomalies should be excluded, and optimal care should be taken during perfusion and drainage. We advise accepting these donor hearts after cardiac recovery with careful inspection at the back table.

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