



# Persistent Left SVC Draining to Right Atrium through Common Channel with Suprahepatic IVC: A Rare Finding

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## Abstract

### Keywords

- congenital abnormality
- tunneled central catheter
- persistent left superior vena cava

The knowledge of different anatomic venous variants of central vessels is essential to improve the safety of procedures like central venous access and tunneled central catheter (TCC) placement. Persistent left superior vena cava (PLSVC) is an uncommon variant seen in 0.5 to 2% of common population, in 80 to 90% of which PLSVC commonly drains into the right atrium (RA) via the coronary sinus. We describe a rare case of PLSVC draining into RA through common channel with suprahepatic inferior vena cava, encountered while placing TCC into left internal jugular vein. This report highlights the radiological findings and the implications of this anatomic anomaly.

## Introduction

Tunneled dialysis catheters are used as vascular access for hemodialysis (HD) in end-stage renal disease (ESRD) patients. The right internal jugular vein (IJV) is favored for catheter insertion because of the comparative straighter course to the superior vena cava (SVC) and right atrium (RA) with lower incidence of central vein stenosis. The left IJV is preferred only when the right IJV is afflicted with an obstructive pathology.<sup>1</sup>

Knowledge of the variant anatomy of central vessels is paramount so as to look out for any complications and increasing safety. A common variant is a persistent left superior vena cava (PLSVC). It has been observed in 0.5 to 2% of the common community with its incidence rising up to 10% in people suffering from inherent anomalies of the heart.<sup>2</sup> Isolated PLSVC with absent right SVC occurs in 0.09 to 0.13% of patients.<sup>3,4</sup> PLSVC commonly drains into the RA via the coronary sinus in as many as 80 to 90% of individuals with no significant sequelae.<sup>4</sup>

We present a case of PLSVC draining directly into IVC with an incidentally detected rare drainage pathway during the placement of a left IJV tunneled HD catheter.

## Case Report

A 27-year-old male with ESRD who was on maintenance HD for the last 3 months was admitted to our hospital with complaints of fever and chills and with serum creatinine 10.75 mg/dL. He was being dialyzed through HD catheter through left IJV. In view of suspicion of catheter related blood stream infection, left Juglar HD catheter removal with insertion of tunneled central catheter was planned. Computed tomography angiogram thorax showed left-sided SVC with common channel into IVC, draining separately from coronary sinus (► **Fig. 1A–F**). Note was made of common origin of right brachiocephalic artery and left common carotid artery, which is a common aortic arch variant (► **Fig. 1B**). No other anatomic variants were found on the computed tomography (CT). Echocardiography did not show any dilated coronary sinus that may be found in cases of PLSVC.

Under all aseptic precautions, left IJV was punctured using single wall needle under ultrasound guidance and the guide wire was passed. The dialysis catheter was tunneled from his left anterior upper chest wall. The guidewire was removed after passing a peel away introducer over it. The introducer showed

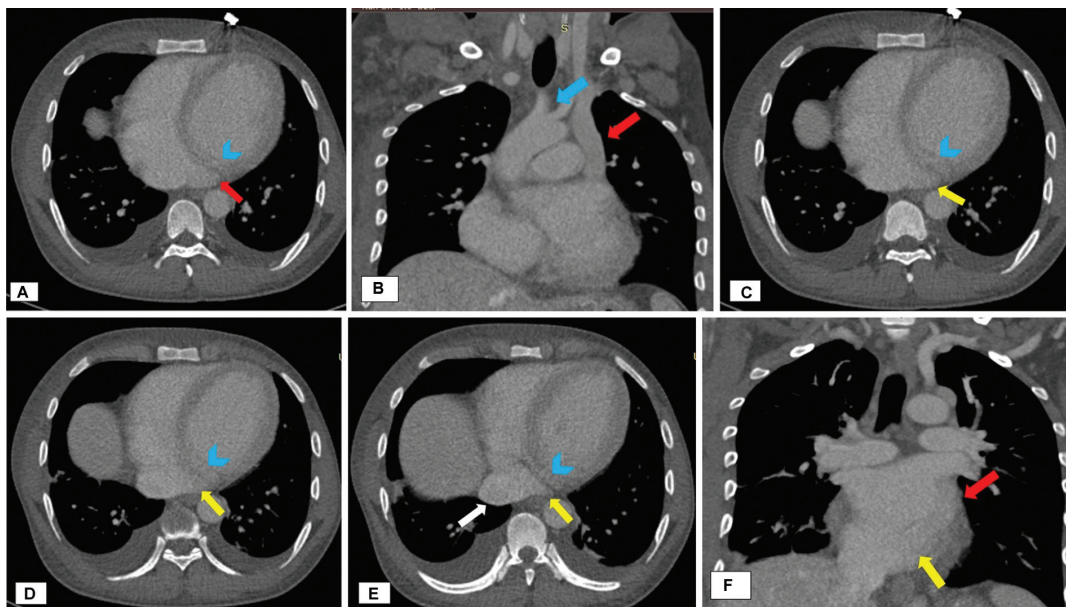
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**Fig. 1** A 27-year-old male with end-stage renal disease planned for left internal jugular vein tunneled hemodialysis catheter. (A, B) Computed tomography angiogram thorax (venous phase) axial with reformatted coronal image shows contrast opacified persistent left superior vena cava (red arrow) with no right superior vena cava and patent left innominate vein. (C–F) Further sections of computed tomography in serial axial and coronal reformatted images show contrast opacified persistent left superior vena cava joining into the suprahepatic inferior vena cava (white arrow) through a common channel (yellow arrow) that is draining separately and posterior to coronary sinus (light blue chevron). (A) Common origin of right brachiocephalic artery and left common carotid artery is seen (light blue arrow). Note is also made of bilateral pleural effusion.

frank venous blood exiting from it. The introducer was simultaneously peeled off as the tunneled HD catheter was passed through it. Both lumens of tunneled HD catheter showed frank venous blood on aspiration. On confirming position on fluoroscopy, digital subtraction venogram confirmed that the catheter courses through left SVC (→ Fig. 2A) with the contrast directly exiting to IVC then drained via a common channel into RA (→ Fig. 2B–F) There was no contrast filling of coronary sinus or right SVC. The tip of catheter was placed at junction of left-sided SVC and IVC just distal to junction of common channel and RA under fluoroscopic guidance.

#### Supplementary Material Video 1 CECT scan showing left SVC draining via common channel with IVC.

Online content including video sequences viewable at: <https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0044-1782209>.

Check aspirations and saline injection showed free flow in both the lumen that were flushed and closed with heparin lock.

No procedural complications were encountered. The catheter was effectively used for HD treatments. The temporary HD catheter was then subsequently removed.

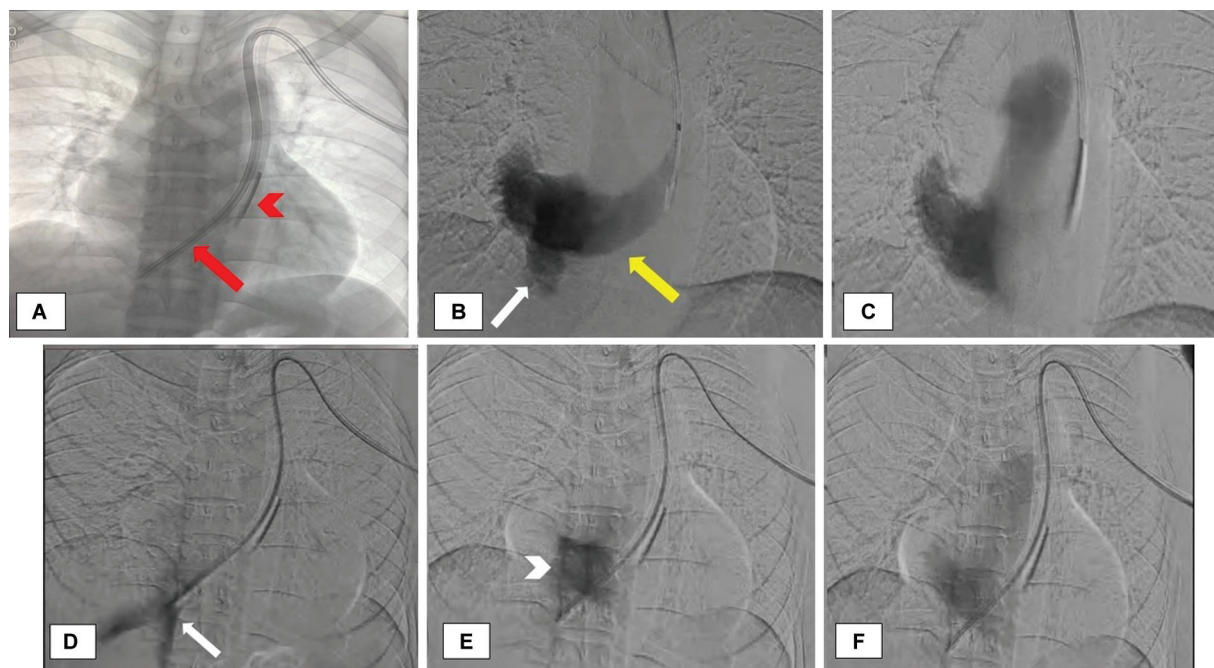
## Discussion

The tunneled HD catheter offers advantages like immediate use after placement with no repeated venepuncture with a cost of higher chances of infection and cardiovascular events.

Left SVC is the most common congenital abnormality of thoracic venous system. Embryologically, the superior and inferior cardinal veins (CV) drain the cranial and caudal parts of fetus after forming the right and left common CV to drain into heart. The cephalic part of SCV forms the IJV, whereas the caudal portion of right SCV forms the SVC, and the caudal portion of left SCV regresses and forms “ligament of Marshall.” The innominate veins are formed via the anastomosis between right and left SCVs. When the caudal portion of left SCV fails to regress, it forms PLSVC. Most commonly bilateral SVC are present with degeneration of innominate vein in some cases, while the PLSVC drains into coronary sinus.<sup>5</sup>

It can show association with other anomalies like atrial septal defect, coarctation of aorta, bicuspid aortic valve, and ostial atresia of coronary sinus.<sup>5</sup> These anomalies can be looked out for with echocardiography or cardiac CT/MRI and must be managed accordingly to the degree of symptomatology.

Normally, PLSVC can be used for tunneled HD catheter when right atrial drainage is assured by echocardiography and CT affirms the patency of a patent left brachiocephalic vein.<sup>1</sup> Under fluoroscopy guidance, the catheter is kept in PLSVC, draining to the RA with catheter tip lying above the coronary sinus.<sup>1</sup> In this case, left SVC was not seen to be draining into the coronary sinus. On the contrary, it was seen draining into the IVC that was then draining via a common channel into the RA. The tip of catheter needs to be kept at such a position so that adequate high flow is available for dialysis. Normally the tip of catheter is kept in RA for adequate high flow; in this scenario it was kept at junction of SVC and IVC in the common channel, just above the



**Fig. 2** A 27-year-old male with end-stage renal disease planned for left internal jugular vein (IJV) tunneled hemodialysis (HD) catheter. (A) Intraprocedural fluoroscopic image of thorax shows the tunneled HD catheter (red arrow) coursing through the left IJV and persistent left superior vena cava (SVC) with its tip just distal to the common channel. Note made of small left IJV hemodialysis catheter (red chevron). (B–D) Digital subtraction angiographic images showing the contrast flow (red arrows) from the HD catheter (B, C) and tunneled HD catheter (D–F) lying in persistent left SVC into the inferior vena cava (white arrow) and then flowing into the right atrium (white chevron) via a common channel (yellow arrow).

diaphragm, so that there was adequate blood flow for HD without compromising vital structures.

In our knowledge, no such case has been reported where the left SVC is draining directly into the IVC with common channel draining into the RA.

The left SVC probably causes difficulties in insertion of the catheter into the right heart but does not prohibit the insertion. In studies, during the placement of HD catheters, PLSVC is detected incidentally causing complications such as vascular thrombosis, supraventricular arrhythmia, cardiac arrest, and vascular erosion that need to be looked out for.<sup>5</sup>

In less than 10% of total cases with PLSVC, the PLSVC can be seen draining into left atrium resulting in a small right to left shunt. Venous procedures should be avoided in such cases due to higher risk of cyanosis, intracerebral abscess, embolic and paradoxical stroke. In cases of larger shunting/hypoxemia, surgical correction is indicated.<sup>6</sup>

## Conclusion

We reported a rare case of PLSVC draining directly into the IVC and then via a common channel into the RA during left IJV tunneled HD catheter insertion.

One should always place tunneled HD catheter under fluoroscopy guidance and after assessing preprocedure CT angiogram of thorax. An unusual track of guidewire is an

indication for performing venogram before placing the catheter blindly. Interventionists should have familiarity with the anatomical variation imaging and complications.

## Conflicts of Interest

None declared.

## Acknowledgments

None.

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