CLINICAL CASE - TEST YOURSELF | Vascular Imaging

A case of aberrant central venous catheter position on chest X-ray: Ectopic placement or benign finding?

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SUBMISSION: 10/07/2025 | ACCEPTANCE: 28/10/2025

PART A

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A 59 year old male patient with no significant medical history was admitted to the nephrology department with acute kidney injury. An uncuffed left jugular central venous dialysis catheter was inserted at the bed-side. The procedure was uneventful, with blood aspirated from the catheter revealing low oxygen pressure, consistent with venous blood. A chest x-ray was performed, which demonstrated an aberrant catheter course on the left mediastinal heart border (Fig.1). No previous imaging was available and there was no history of previous vascular interventions. A non contrast chest CT scan was performed to clarify the catheter's position (Fig. 2, 3).

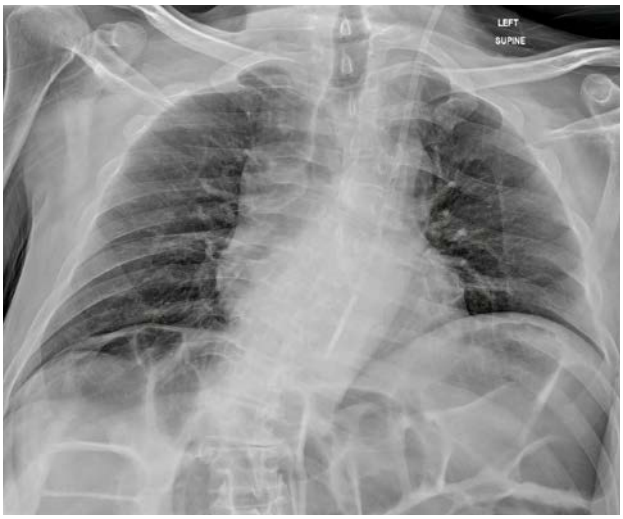

Figure 1. *Chest x-ray.*

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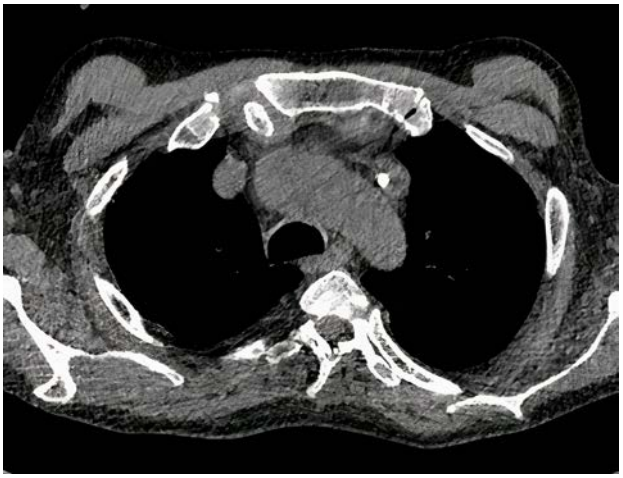

Figure 2. *Non contrast chest CT.*

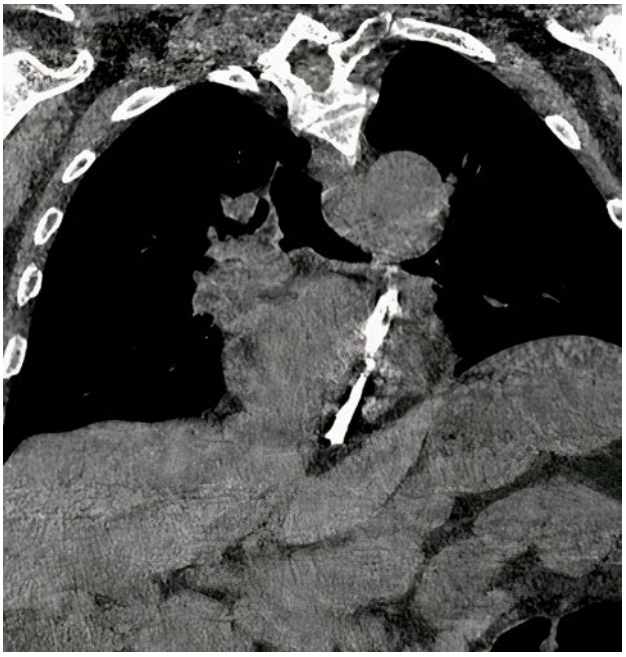

Figure 3. *Non contrast chest CT.*

PART B

Diagnosis

Duplication of the superior vena cava (SVC)

Non-contrast CT of the chest demonstrated the catheter's correct insertion in the left internal jugular vein. Throughout its course it remained in a vascular structure arising from the confluence of the left internal jugular and left subclavian vein, coursing laterally to the aortic arch, anteriorly to the left hilum and terminating at the anatomical site of the coronary sinus. This vessel was identified as a persistent left superior vena cava (PLSVC) (Fig. 2, 3). The presence of a hypoplastic bridging vein between the PLSVC and the SVC, identified as a left brachiocephalic vein, was also noted (Fig. 2).

Superior vena cava duplication (SVCD) is an anatomical variant of the chest venous anatomy occurring in approximately 0,3% of the general population. In patients with congenital heart disease the rate is significantly higher, between 10-11%. This anatomical variant occurs due to the persistence of the left anterior cardinal vein during embryonic development, which normally regresses. In cases of duplication, there is typically a right SVC that drains into the right atrium and a left SVC that drains into the coronary sinus and right atrium (~90%) or, less commonly, directly into the left atrium (~8-10%) [1].

Various modalities can be utilised for evaluation: Echocardiography, which is both cheap and widely available and may detect the condition perinatally, being however operator dependent and often difficult to interpret; Computed Tomography with IV contrast, which offers the best spatial resolution, multiplanar imaging and reformatting, with the drawbacks of ionizing radiation and possible contrast allergy and nephrotoxicity; Magnetic Resonance Imaging, which doesn't have the aforementioned cons of a CT scan but isn't as widely available and Angiography, which is the gold standard but due to its invasive nature, radiation and iodinated contrast burden isn't routinely used for this specific condition's diagnosis but may detect it incidentally [2].

The differential diagnosis for a suspected PLSVC includes both vascular and non-vascular structures. Vascular structures include the vertical vein, levoatriocardinal vein, left superior intercostal vein, aberrant left brachiocephalic vein, pericardiophrenic vein, and vascular structures secondary to surgery.

The distinction between them requires the identification of the vessel's origin and drainage site and the course between them according to mediastinal structures, the expected direction of blood flow and the presence of concomitant findings of other cardiac or non-car-

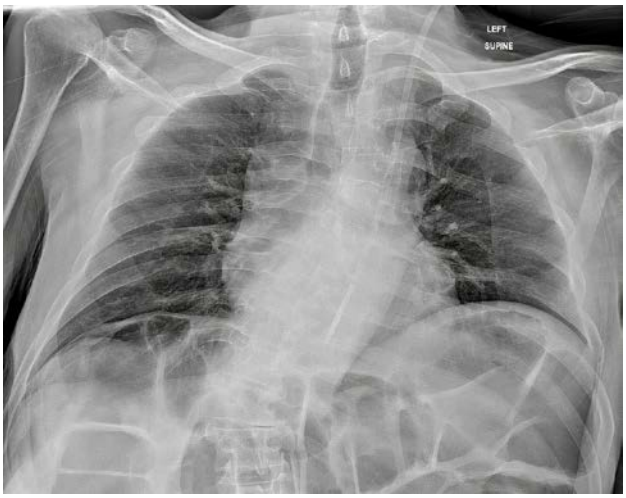

Figure 1. *Chest x-ray demonstrating an aberrant central venous catheter course.*

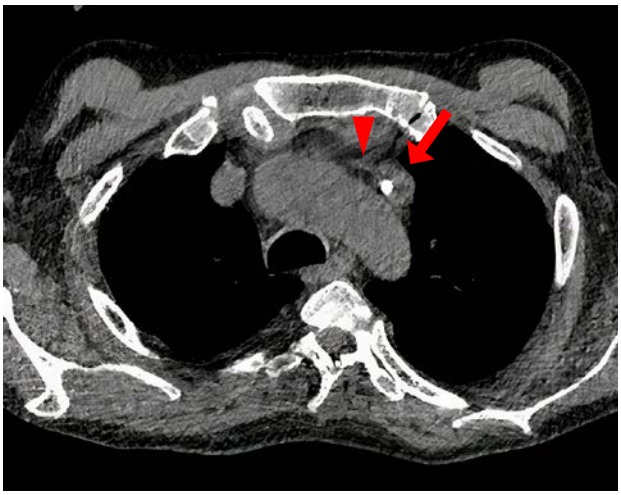

Figure 2. *Chest CT demonstrating a persistent left superior vena cava with the catheter within (arrow) and a hypoplastic left brachiocephalic vein (arrowhead).*

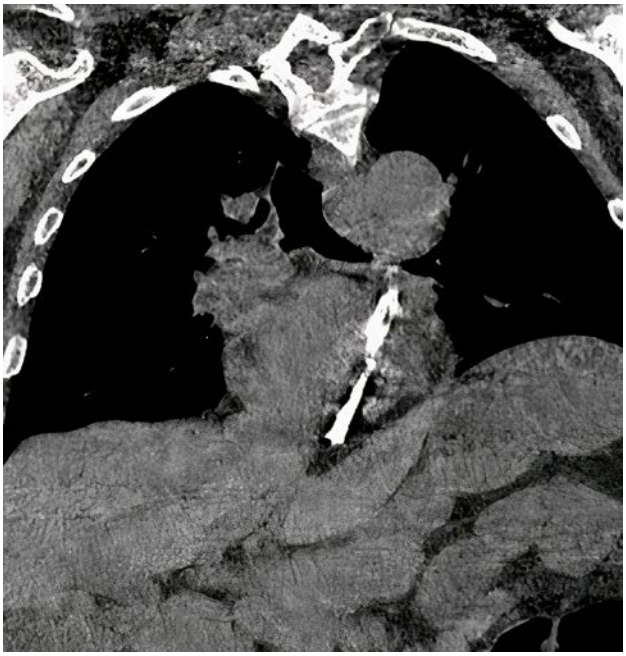

Figure 3. *Coronal plane reformatting of the chest CT demonstrating the position of the catheter's tip.*

diac diseases. Additionally, masses such as enlarged lymph nodes and neurofibromas arising from the phrenic nerve may mimic a PSLVC [2].

Although patients are usually asymptomatic in the coronary sinus and right atrium draining variant, there is an association between PLSVC and supraventricular arrhythmias, as well as an increase in the difficulty of interventional procedures such as cardiovascular electronic device implantation [3].

Additionally, arrhythmias, cardiogenic shock, cardiac tamponade, and coronary sinus thrombosis can develop due to catheterization [4], highlighting the importance of knowing of the variant's presence before any interventions.

There are cases of successful hemodialysis through a catheter inserted in a PLSVC, as long as echocardiography confirms right atrial drainage, CT scan reveals patency of the left brachiocephalic vein, ECG reveals no arrhythmia and aspirated blood gas analysis confirms venous blood [5].

A repeat, contrast enhanced chest CT was performed that confirmed non-patency of the hypoplastic left brachiocephalic vein (not shown). Thus, we recommended that the catheter be removed to avoid venous congestion of the left upper limb and neck in case of thrombosis of the PLSVC. After removal, a new catheter was inserted on a different site and the patient underwent hemodialysis successfully. No immediate complications related to the first catheter's short stay were observed.

This case demonstrates the significance of being aware of the presence of seemingly benign anatomical variations and their associated complications, since even routine interventions may disrupt physiological mechanisms and cause unforeseen deleterious effects.

When inserting a central venous catheter, reviewing any prior imaging is essential in selecting the most appropriate target vessel, and when no imaging is available, as in our case, investigating and revising as necessary is vital. **R**

Conflict of Interest:
The authors declared no conflicts of interest.

Funding:
This project did not receive any specific funding.

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Key words: persistent left superior vena cava, congenital anomaly

Ready - Made Citation

Belivanis Michail, Samaras Vaios, Roubanis Dimitrios.
A case of aberrant central venous catheter position on chest X-ray: Ectopic placement or benign finding?, *Hell J Radiol 2025*; 10(4): 84-87.