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Teaching Point
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Variant thoracic venous drainage and its hazards with catheter for haemodialysis

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Introduction

A 63-year-old man commenced haemodialysis for acute-on-chronic kidney disease following urgent coronary artery bypass grafting on a background history of type 2 diabetes mellitus and hypertension. Following initial treatment with a temporary dialysis catheter placed into the right femoral vein, a dual-lumen permanent catheter (Tesio line) was placed via the left internal jugular vein.

The left internal jugular vein was punctured under ultrasound guidance and the line was inserted without any difficulty. There was a good flow in both lumens. A routine post-insertion chest radiograph was performed (Figure 1).

We reasoned that the usual left-sided internal jugular line goes into the left internal jugular vein, left-sided brachiocephalic vein and then crosses the midline at the upper border of the first right costal cartilage to enter the superior vena cava (SVC) on the right-hand side of the chest radiograph. The tips should lie at the level of the atrialcaval junction and ∼4 cm beyond this into the right atrium. In this case, the line did not cross the midline and looked like a mirror image of a right-sided jugular line. A venogram was requested to confirm the line position (Figure 2). This venogram confirmed that there was a persistent left-sided SVC and the line tips were in this vessel.

Fig. 1. Post-dialysis line insertion. Chest X-ray, postero-anterior view. The line goes into left internal jugular vein and left-sided brachiocephalic vein, but then remains in the left haemithorax on the chest radiograph. The tips of the line lie at a point normally associated with the left ventricle on a chest radiograph.

Fig. 2. Venogram demonstrating the line position and persistent left-sided SVC. Contrast injection showed variant drainage of the neck and arm veins with right and left brachiocephalic veins dividing to drain into a normally placed right SVC and a persistent left-sided SVC which is draining into the right atrium inferiorly. This patient has a persistent left-sided SVC draining into the right atrium, the line tips are in this vessel, giving good flow in both lumens.

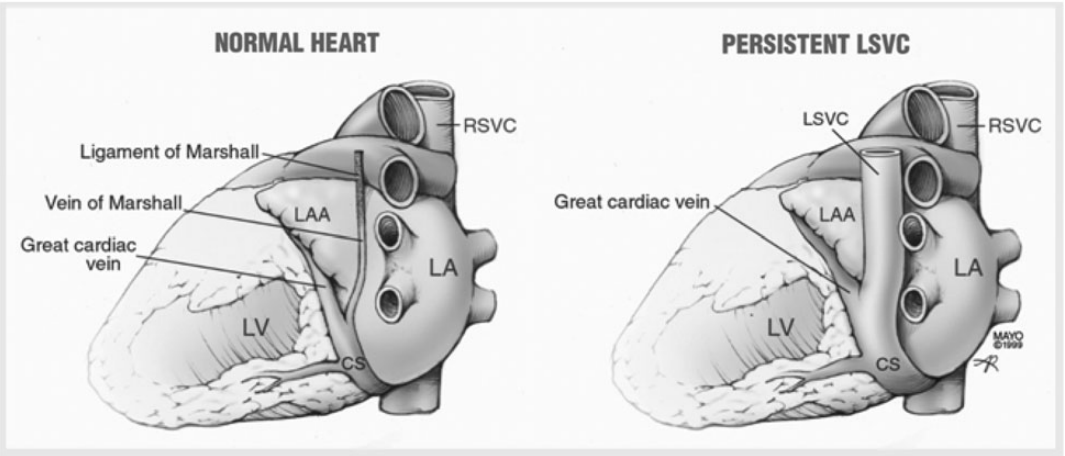

Fig. 3. Anatomical representation of normal thoracic venous drainage on the left and an abnormal rare variant—persistent left-sided superior vena cava draining directly into the coronary sinus on the right (reproduced with permission from: *Indian Pacing Electrophysiol J* 2008; 8: S105–S121).

Discussion

A persistent left-sided SVC is seen in 0.3–0.5% of the normal population and in 3–5% of those with congenital heart disease [1–3]. It is only seen in isolation in 10% of cases since the vast majorities are accompanied by a normal right-sided SVC, termed SVC duplication.

Left-sided SVC forms when the left anterior cardinal vein is not obliterated during normal fetal development. The persistent left-sided SVC passes anterior to the left hilum and lateral to the aortic arch before rejoining the circulatory system. There are a number of possible drainage sites:

(i) Coronary sinus (92%), which is functionally insignificant since the venous return from the head, neck and upper limbs is delivered to the right atrium (Figure 3) [1]. This anomaly is usually asymptomatic and does not require treatment unless accompanied by other cardiac anomalies [2–4].
(ii) Left atrium (8%) results in a right to left shunt which is usually not large enough to cause cyanosis or other symptoms [1, 2].

In the vast majority of cases (82–90%), a normal (but small) right-sided SVC is also present, and a persistent bridging vein (left brachiocephalic vein) is seen in 25–35% of cases [1] (as seen in the venogram (Figure 2).

A persistent left-sided SVC may go unnoticed as a right-sided SVC usually coexists and central venous catheters are most often placed in the right internal jugular vein. However, the presence of a persistent left-sided SVC may have important clinical implications for the nephrologist, especially in the absence of a right-sided SVC.

There may be associated congenital abnormalities of the heart and great vessels which may need further investigation if appropriate.

An introduction of a central venous catheter into a persistent left sided superior vena cava (PLSVC) may be mistaken for a catheter placement in the left internal mammary or superior intercostal veins, mediastinum and pericardium [5]. Therefore, the catheter position and the presence of PLSVC should be confirmed by further imaging such as venography, computed tomography, magnetic resonance imaging or transoesophageal echocardiogram before using the catheter.

Technical difficulties associated with the persistent left-sided SVC may lead to misplacement of the catheter and injury to the vessel wall [6].

There is a greater risk of either the guidewire or the catheter tip entering the coronary sinus during the line insertion because of the altered anatomy (Figure 3), and this may lead to angina, arrhythmia, cardiogenic shock or cardiac arrest [2, 6, 7].

Teaching points

(i) When inserted into the left jugular vein for haemodialysis, a catheter may enter a left-sided vena cava.
(ii) The diagnosis must be suspected when, on a plain chest radiograph, the tip of the catheter projects on the left ventricle image.
(iii) In such a rare case of left-sided SVC, the tip of the catheter may have entered the coronary sinus with a risk of severe cardiac complications.
(iv) Suspicion of a left-sided SVC on a plain thoracic radiograph must lead to performing further imaging, at least a venogram, before using it, to ensure that the catheter does not enter the coronary sinus.

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