

Persistent Left Superior Vena Cava and Catheter Placement

Question:

I recently placed a 4 French PICC via the left basilic vein on a 65-year-old woman for an 8-week course of antibiotics. Eight years previously, she had undergone a radical mastectomy on the right side making the left arm inaccessible for catheter insertion. The radiologist reported that the catheter was either located in the aorta or the patient had a left superior vena cava (SVC). I have always understood that the superior vena cava was located on the right side of the mediastinum; therefore this report was very confusing. What is a left SVC and how does it occur?

Answer:

I can understand your confusion, however there is a deviation in normal venous anatomy that results in both a left and right SVC or one left-sided SVC. This results from an alteration in the normal embryologic development of the SVC. In patients with known congenital cardiac anomalies, this SVC variation has been reported in 2% to 9% of patients. It may occur in 0.1% to 0.5% of the normal population.

Usually, the left and right innominate (also called the brachiocephalic) veins join to form the SVC in the right side of the mediastinum. The left innominate vein is longer than the right because of the location of the heart. The SVC joins the right atrium with a large volume of blood flow returning from the upper body. During embryologic development, there is a right and left cardinal vein that joins each respective side of the developing heart. As the system matures, the left cardinal vein atrophies while the left innominate vein develops. The right cardinal vein develops into the superior vena cava when the left innominate vein has developed, thus allowing all blood return to flow into the right atrium.

Persistent left SVC is present when the left cardinal vein does not atrophy. Instead it descends in front of the aortic arch and joins the coronary sinus. The coronary sinus is the large vein returning blood from the myocardium to the right atrium. The left SVC could also join the left atrium.

The majority of case reports occur when central venous catheterization is attempted from the left side, resulting in the catheter passing into the left SVC, although there is at least one report with a right sided insertion. Older studies report that approximately 10% of patients with a history of cardiac anomalies do not have a right SVC, however a more recent study reported the absence of a right SVC in 33% of patients. This latest study was conducted in patients having pacemaker or cardioverter-defibrillator implantation without congenital cardiac disease.

This has been reported with all types of central venous catheters including dialysis, nontunneled percutaneous, pulmonary artery, antecubitally inserted catheters, and implanted ports.

On initial assessment of the post-insertion chest xray, the catheter may appear to be in an artery. Inadvertent intra-arterial catheter placement is reported to be as low as 1.9% and as high as 9% and poses serious risk to your patient.¹ Arterial catheter location can be ruled out by observing for pulsatile or high pressure backflow into the catheter lumen and

the color of the blood, transducing the pressure on the catheter lumen, and analyzing blood gases on a sample drawn from the catheter lumen.

The catheter could also be located in other mediastinal veins such as the left internal mammary, left superior intercostal vein and the pericardiophrenic veins. These smaller veins branch off the left innominate vein and would not be acceptable for infusion of solutions with extremes of pH and osmolarity, for monitoring central venous pressure or for long-term infusion therapy.

Contrast injection with fluoroscopy and computer tomography of the chest can determine that a persistent left SVC is present and the presence or absence of a right SVC. Echocardiography can reveal other cardiac anomalies and the typical enlargement of the coronary sinus caused by the larger volume of blood flow. Tip location in the coronary sinus can lead to a higher incidence of cardiac arrhythmias, hypotension, angina and cardiac arrest.

The next decision concerns the safety of allowing the catheter to remain in this location. If a right SVC is present with a larger blood flow, it might be safer to remove the first catheter and insert a new catheter on the right side, depending upon venous access sites and other risk factors for a second catheter insertion. Blood flow into the left atrium produces a higher risk for air or thrombus emboli into the systemic arterial circulation. This decision is based on an assessment of the type and length of therapy needed compared to the flow capacity and direction of the blood flow through the left SVC. Case reports have described use of catheters in a left SVC ranging from a few days to a few months.

All healthcare professionals inserting central venous catheters should know about this possibility and the risk-benefit assessment required for infusion into a persistent left SVC.

1. Azocar R, Narang P, Talmor D, Lisbon A, Kaynar A. Persistent left superior vena cava identified after cannulation of the right subclavian vein. *Anesthesia and Analgesia*. 2002;95:305-307.
2. Josloff R, Kukora J. Central venous catheterization via persistent left superior vena cava. *The American Surgeon*. 1995;61(9):781-783.
3. Biffi M, Boriani G, Frabetti L, Bronzetti G, Branzi A. Left superior vena cava persistence in patients undergoing pacemaker or cardioverter-defibrillator implantation: A 10-year experience. *Chest*. 2001;120(1):139-144.
4. Higgs A, Paris S, Potter F. Discovery of left-sided superior vena cava during central venous catheterization. *British Journal of Anaesthesia*. 1998;81:260-261.

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