

# Double Superior Vena Cava; A Benign Cause of Widened Mediastinum and Implication on Venous Central Access

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## Citation

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## Abstract

Widened mediastinum can be incidentally found in adults. Aortic aneurysm, aortic dissection, aortic unfolding, hilar lymphadenopathy, anthrax inhalation, esophageal rupture, mediastinal mass, mediastinitis, cardiac tamponade, pericardial effusion and thoracic vertebral fractures are the common pathologic causes of widened mediastinum. Rarely, duplication of the superior vena cava has been implicated as a cause of widened mediastinum. This is a benign cause of widened mediastinum compared to others. The prevalence in the general population is 0.3%. It is due to persistent left superior vena cava. Different variants of double superior vena cava have been described. Depending on the venous pattern, this can render some difficulty in the placement of pace maker or left sided peripherally inserted central catheter (PICC) line. We present two cases of widened mediastinum from persistent left superior vena cava. One of them was identified after placement of left sided PICC line in a 42 year old male while the other was an incidental finding.

## INTRODUCTION

A persistent left superior vena cava (PLSVC) can be the cause of a widened mediastinum found in the chest radiograph. Although only occurring in 0.3% of the general population, it is important to know and understand the variations in the venous anatomy of a PLSVC and the pattern of cardiac venous return of the PLSVC prior to insertion of central venous access device. Venous imaging may be necessary in determining whether the persistent superior vena cava drains into the left or right atrium. If the PLSVC drains into the left atrium a left sided PICC or central line should be avoided as to not inadvertently cause systemic emboli. We report 2 cases of PLSVC, of which one was found after PICC placement.

## CASE 1

A 42-year-old male with past medical history significant for Diabetes Mellitus type 1 complicated by a diabetic foot ulcer presented to the emergency department because of nausea, non-bilious vomiting and epigastric pain. Patient was found to be in Diabetic Ketoacidosis and subsequently admitted to the medical intensive care unit for closer monitoring.

Physical examination at the time was significant for a 2cm x 2cm ulcer with purulent drainage on the left foot. Magnetic Resonance Imaging was consistent with osteomyelitis of the proximal and distal phalanges of the left first toe. Patient

required a six-week course of intravenous antibiotics necessitating placement of the peripherally inserted central catheter. After successful placement of the PICC with ultrasound guidance through the left brachial vein, a confirmatory chest-x-ray was performed. The catheter appeared to be tracking along the common carotid artery and descending into the aorta. An immediate chest computed tomography was done, revealing the tip of the central catheter in the region of the coronary sinus via a persistent left superior vena cava, a vascular variant. Persistent left superior vena cava can have a variety of associated cardiac anomalies. An echocardiogram was performed to address this, however no other structural abnormalities were identified. As the diagnosis was well established on an echocardiogram, a saline contrast echocardiography was deemed unnecessary and was not performed.

**Figure 1**

CT Chest showing left sided superior vena cava (Red Arrow)



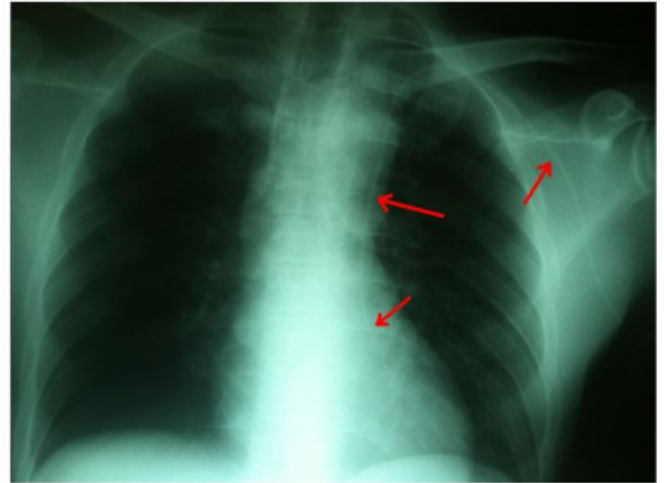
**Figure 2**

CT Chest showing left sided superior vena cava (Red Arrow)



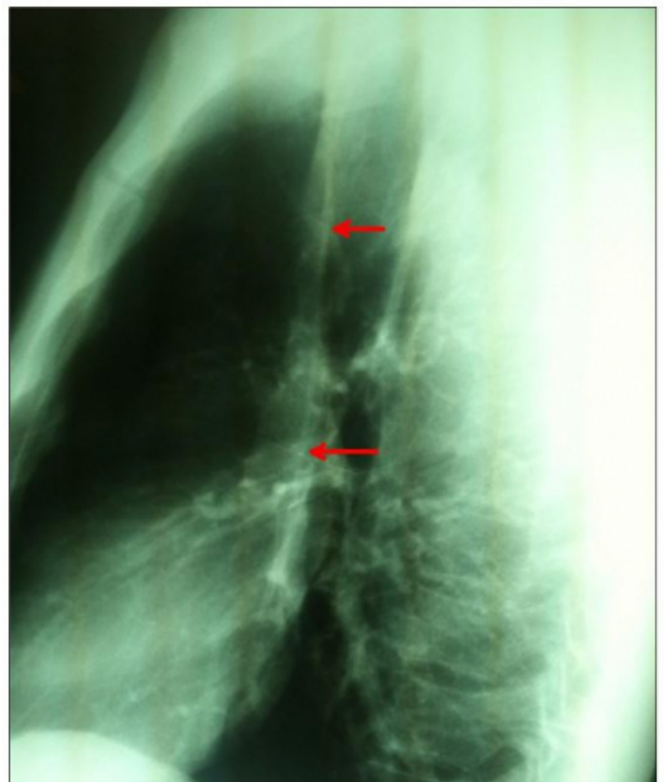
**Figure 3**

Chest-x-ray PA view demonstrating unusual course of peripherally inserted central catheter (arrows) with its distal tip projecting over the upper portion of the cardiac shadow.



**Figure 4**

Chest-x-ray and Lateral demonstrating the left-sided PICC line coursing downwards in a persistent left superior vena cava.



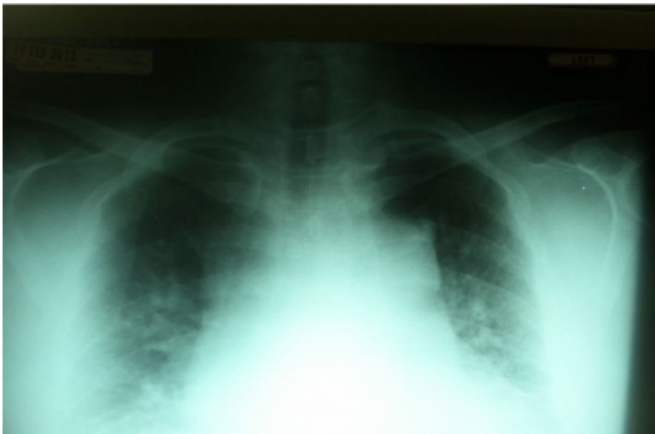
**CASE 2**

We report a case of 57-year-old man with a past medical history of Diabetes Mellitus type 11 and hypertension who

presented to the emergency department because of cough and yellowish sputum of 3 days duration. The patient was evaluated for community-acquired pneumonia. During the investigation, patient underwent a routine chest radiograph, which showed a widened mediastinum and bilateral bronchiectatic changes with no infiltrate or effusion(Figure 5). A further evaluation with computed tomogram of the chest with contrast, showed duplication of the superior vena cava.

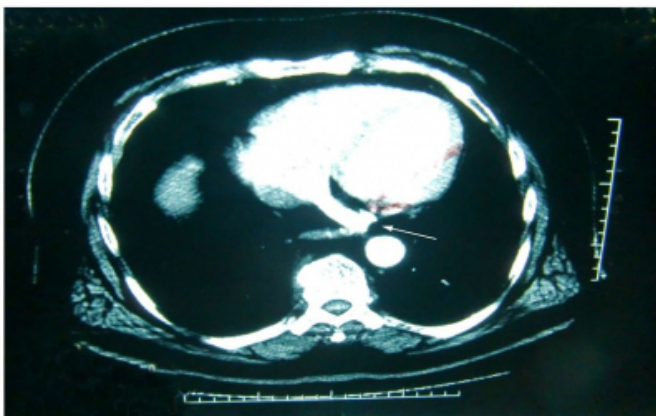
**Figure 5**

Chest Xray PA view showing widened mediastinum



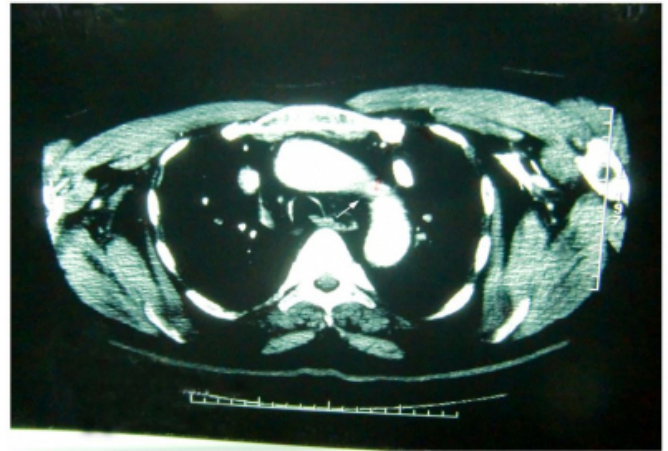
**Figure 6**

CT Chest showing persistent left sided superior vena cava (white Arrow)



**Figure 7**

CT Chest showing persistent left sided superior vena cava (white Arrow)



## DISCUSSION

Widened mediastinum can be incidentally found in adults. Aortic aneurysm, aortic dissection, aortic unfolding, hilar lymphadenopathy, anthrax inhalation (although rare), esophageal rupture, mediastinal mass, mediastinitis, cardiac tamponade, pericardial effusion and thoracic vertebral fractures are some of the causes of widened mediastinum. Rarely, is duplication of the superior vena cava been implicated as a cause of widened mediastinum. This is a benign cause of widened mediastinum compared to others. The prevalence in the general population is 0.3%. It is due to persistent left superior vena cava. Different variants of double superior vena cava have been described. Depending on the venous pattern, this can render some difficulty in the placement of pace maker or left sided PICC line. Whenever a widened mediastinum is identified in clinical practice, diagnosis usually portends a serious cause. Double superior vena cava should be considered as a differential of widened mediastinum.

A persistent left superior vena cava results from the embryological failure of regression of the left anterior cardinal vein. One superior vena cava will be present on each side of the mediastinum with or without a rudimentary left innominate vein as a communication between the two. PLSVC is not often seen. Prevalence in the general population is 0.3% but may reach 12% in patients with congenital heart diseases [1]. Superior vena cava occurs mainly in four variants, single right-sided SVC, double SVC with right and left SVC emptying into the right atrium, double SVC with each emptying into the ipsilateral atria, and single PLSVC emptying into the left atrium. 92% of left

sided SVC's drain into the right atrium (usually via the coronary sinus), with the remainder draining into directly into the left atrium. The left atrium drainage pattern represents a right-to-left shunt. It is usually asymptomatic, however right heart failure, systemic embolization and complex congenital anomalies have been reported. In patients with cerebral abscess, intracardiac and extracardiac shunts have to be suspected, such as intracerebral arteriovenous malformations, atrial septal defect or thoracic venous malformation [2]. In most patients with left SVC, a right SVC is present. Persistent left SVC with absent right SVC occurs in only 0.09% to 0.13% of patients who have congenital heart defects. The most frequently associated extra-cardiac anomaly is esophageal atresia [3]. Our patients have both right and left superior vena cava emptying into the right atrium. Diagnosis can be confirmed with CT of the chest with contrast or transthoracic echocardiography, which reveals a dilated coronary sinus or by use of saline contrast ("bubble study") echocardiography [4].

PLSVC is usually discovered incidentally and the patient will usually have no clinical signs, as was seen in these patients. However, few cases of PLSVC have been incidentally discovered while placement of a peripherally inserted central catheter (PICC) from the left side. NK Shyamkumar and R Brown describe such a case where a patient was found to have a PLSVC upon PICC line placement from the left basilic vein. In this particular patient the left sided superior vena cava (LSVC) drained into the right atrium. The authors cautioned about an anomaly where the LSVC may drain into the left atrium causing systemic embolization [5]. The presence of PLSVC can render access to the right side of the heart challenging via the left subclavian approach, which is a common site of access utilized when placing pacemakers or Swan-Ganz catheters. For this reason caution should be observed when

placing a PICC or central line from the left side of the body in a patient found to have a widened mediastinum on chest radiograph. If the cause of the widened mediastinum is found to be a PLSVC, then it would be imperative to understand the venous anatomy and the pattern of cardiac venous return of the PLSVC prior to placement of the central venous access device. If the PLSVC drains into the left atrium, a left sided PICC or central line should be avoided as to not inadvertently cause the complications described above.

## **CONCLUSION**

Among the other causes of widened mediastinum, persistent left superior vena cava should be considered in asymptomatic adults. Further diagnostic imaging is necessary in such patients to confirm the venous drainage pattern in central venous catheter is indicated.

## **References**

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